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14. ABSTRACT

Year 3 included funding several projects from the third round of proposals. The MSRC supports a total of 24 funded projects, including 5 long-term follow-up studies of MSRC 1.0 projects; 4 secondary data analyses of the MSRC Common Data Elements; 11 intervention studies; 3 assessment studies; and 1 postvention study. The MSRC continues to provide training opportunities to future leaders in the field of military suicide research through a joint MSRC-Army STARRS postdoctoral fellowship program. The Denver staff continues to collaborate with the Florida State University site and seek guidance from its senior advisors and the Military External Advisory Board.

15. SUBJECT TERMS

Funding research projects; pre-doctoral and post-doctoral training; leveraging funds; collaboration with MSRC Cores; quarterly and annual reports; progress meetings

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INTRODUCTION:

The Military Suicide Research Consortium's (MSRC) continued goal is suicide prevention in the military, through research, including on primary, secondary, and tertiary interventions, as well as through information management/scientific communications (disseminating knowledge on military suicide). Specifically, suicidal personnel compromise force readiness, place a strain on the healthcare resources of the military, impact unit morale, and take a large emotional toll on the involved friends, family, and commanders. The stigma associated with being suicidal, which limits the extent to which at-risk individuals are willing to seek help, continues to be present and can be heightened by media focus. MSRC intends to progress in the development of its tools and funding new studies, it is now an established go-to resource for decision-makers to obtain accurate and efficient answers regarding suicidal behavior, with the continued emphasis on the military perspective. MSRC plans to facilitate information management/scientific communications for the Department of Defense (DoD) and to maximize research efforts at understanding and improving suicide risk screening and assessment, interventions, and population-level prevention programs. MSRC and its associates plan to increase their level of involvement and dissemination of information. MSRC continues to receive acknowledgement for its work and its contributions. MSRC has a main goal: expanding knowledge, understanding, and capacity to prevent, treat, and enhance the quality of life of persons in military communities who are affected by suicide-related problems.

KEYWORDS:

Military, suicide, research, dissemination, prevention, intervention, assessment, training

ACCOMPLISHMENTS:

What are the major goals of the project?

(1) Maintain situational readiness, research infrastructure, intellectual capacity, and institutional memory to ensure that the resources exist to meet future military suicide research needs as they change and develop.
(2) Continuing to produce new scientific knowledge about suicidal behavior in the military.
(3) Use high quality research methods and analyses to extend significant findings from studies completed in the first five years of MSRC.
(4) Conduct after-action analyses of null findings from initial MSRC studies to determine whether interventions significantly affected other outcomes (e.g., mechanism variables covered by the Common Data Elements [CDE]).
(5) Capitalize on the CDE (variables collected by all currently funded studies) to encourage rigorous secondary analyses, exploring rival mediators and mechanisms, and moving toward making the data available to the broader research community.
(6) Build on the first five years of research conducted by the MSRC, by continuing to disseminate Consortium knowledge, information, and findings through a variety of methods appropriate for decision makers, practitioners, and others who are accountable for ensuring the mental health of military personnel.
(7) Train future leaders in military suicide research.

What was accomplished under these goals?

Consortium Specific Aim 1: Maintain situational readiness, research infrastructure, intellectual capacity, and institutional memory to ensure that the resources exist to meet future military suicide research needs as they change and develop.

Major Task 1: Implement plan for revised infrastructure

Subtask 2: Consortium Start-up

- The MSRC continues to respond to queries from decision makers and others with speed and efficiency.
- Core B research staff in Denver continue to monitor listservs for military suicide research. Cores A and B continue to respond to media inquiries, data requests, membership requests, general information requests, and funding requests made through the MSRC website portal.

Subtask 3: Attend meetings (annual MSRC, MSRC IPR, MEAB, and DoD IPR) and submit reports (annual and quarterly)

- The MEAB meeting was held on 22 May 2018 at Ft. Detrick. Drs. Joiner and Gutierrez updated the MEAB on the status of currently funded studies, Core D, and post-doctoral activities. There was also a presentation of one proposal: Long-term Follow-up of the Military Continuity Project; Kate Comtois, PhD. LOIs recommended for proposal invitation from the current RFP were also presented. The MEAB agreed with inviting proposals from all but one of the LOIs and approved the Long-term Follow-up proposal.
- The MOMRP Suicide IPR meeting was held on 23-24 May 2018 at Ft. Detrick. Drs. Joiner and Gutierrez presented the status of the MSRC and currently funded studies.
- The MSRC IPR meeting was held on 25 May 2018 in Frederick, MD. PIs presented updates from all funded studies.
- The MEAB meeting to review selected proposals from the third RFP was held on 14-15 November 2018 at Ft. Detrick, MD. Drs. Joiner and Gutierrez were in attendance and 11 investigators were provided the opportunity to present 14 proposals in person. The MEAB recommended funding 7 proposals, 5 with revisions. The MEAB also recommended 6 proposals be revised and submitted for a re-vote and 1 proposal was not recommended for funding.
- The MSRC Annual meeting was held on 16 November 2018 in Frederick, MD. Representatives from Core A, Core B, Core C, Core D, MOMRP, Senior Advisors, and the joint MSRC/STARRS post-docs were in attendance.
- Quarterly reports for Year 3 were submitted to MOMRP on schedule.

Subtask 4: Prepare MEAB and scientific review functions

- Core A released a third targeted RFP on 06 April 2018. Topic areas included help-seeking behavior, community and peer-based interventions, bereavement, messaging to increase effectiveness in D&I, translation of research into practice, and postvention.
- A total of 53 Letters of Intent (LOIs) were received and 28 investigators were invited to submit a full proposal. Five investigators declined the proposal invitation due to unforeseen conflicts.
- Core A worked with the American Association of Suicidology (AAS) to facilitate scientific peer reviews of the proposals.

- Drs. Gutierrez and Joiner recommended 15 proposals for invitation to the 14-15 November 2018 MEAB meeting. Core A provided MOMRP with a complete list of proposals, indicating which were recommended for invitation to the MEAB as well as the proposal abstracts, and independent scientific peer reviews. The MOMRP provided concurrence/non-concurrence with the recommendations.
- Core A provided full proposals and presentations to the MEAB prior to the 14-15 November 2018 meeting.

The following milestones were achieved in Year 3:

- Meetings attended
- Reports submitted
- Review functions defined and in place

Consortium Specific Aim 2: Continuing to produce new scientific knowledge about suicidal behavior in the military.

Major Task 2: Refine & Develop research priorities

Subtask 1: Plan research projects

- Drs. Gutierrez and Joiner continue to participate in monthly Study to Assess Risk & Resilience in Servicemembers – Longitudinal Study (STARRS-LS) PI conference calls.
- Drs. Gutierrez and Joiner continue to refine and develop research priorities with the MSRC MEAB.

Subtask 2: Identify research teams

- The following studies were approved by the MEAB and are currently funded:
  - Dr. Mike Anestis: Project Safe Guard
  - Dr. Jessica Ribeiro: Examining the nature of suicide risk over time using machine learning
  - Dr. Brad Schmidt: Long Term Follow-up for MSRC DARTS Clinical Trial
  - Dr. Joe Franklin: Using Machine Learning to Distinguish among Active Duty, Veteran, and Civilian Suicidality
  - Dr. Jessica Ribeiro: Optimized suicide risk detection and management in military primary care
  - Dr. Brad Schmidt: Building Stronger Allies: Development and Evaluation of a Web Application Targeting Interpersonal Risk Factors for Suicide in Active Duty Service Members
  - Dr. Sarra Nazem: Efficacy of a Computerized Cognitive Behavioral Treatment for Insomnia: Increasing Access to Insomnia Treatment to Decrease Suicide Risk
  - Dr. Alexis May: Couples Crisis Response Planning to Reduce Post-Discharge Suicide Risk
  - Dr. Courtney Bagge: Profiles of Behavioral Warning Signs for Suicide Attempts in the Prediction of Future Suicidality
  - Dr. Lora Johnson: Three Year Follow-up of Study on Suicide Risk Assessments within Suicide-Specific Group Therapy Treatment for Veterans
  - Dr. Andrew Littlefield: Enhancing Identification of Suicide Risk among Military Service Members and Veterans: A Machine Learning Approach to Suicidality
  - Dr. April Smith: Interoceptive Deficits and Suicidality

- Dr. David Vogel: Establishing Measurement Equivalence of MRSC Database Assessments
- Dr. Kate Comtois: Reviewing the Effects of Caring Contacts (RECON): A Long-Term Follow-Up Study from the Military Continuity Project
- Dr. Lily Brown: Suicide Risk and Sleep in Treatment: An Intensive Daily Sampling Study
- Dr. Dan Capron: Behavioral Economics Intervention to Increase Treatment Seeking in the National Guard
- Marjan Holloway: A Brief Peer-Support Cognitive Behavioral Intervention for Military Life Transitions (Mil-iTransition) Following Medical and Physical Evaluation Boards
- Dr. Lisa Brenner: Facilitating Assessment of At-Risk Sailors with Technology (FAAST)
- Dr. April Smith: Characterizing the dynamics of acute suicidal affective disturbance: A between-subjects and intra-individual network approach
- Dr. April Smith: Reconnecting: Improving interoception to reduce suicidal ideation and behavior
- (Contract Pending) Dr. Thomas Joiner: Increasing Connection to Care Among Military Service Members at Elevated Suicide Risk: A Randomized Controlled Trial of a Web-Based Intervention
- Dr. Brian Marx: Decreasing Suicide Risk among Service Members with Posttraumatic Stress
- Dr. Dan Capron: Mobile Interpretation Bias Modification Clinical Trial
- Julie Cerel: Personal and Professional Exposure to Suicide in Military Populations

- Core A is working with recently funded investigators to execute contracts and facilitate IRB and HRPO approvals.

Subtask 3: Consult with funded MSRC applicants to develop D&I plans for their research proposals that are feasible and relevant to military settings and populations

- Core D continues to work with MSRC 2.0 PIs on developing integrated D&I plans for their studies and have a template for implementation as well as clinical effectiveness outcomes PIs can focus on collecting. However, for observational data, Core D expects to make significant changes based on what is learned at the Dissemination Science Institute in May 2019.
- Core D drafted a Dissemination Process Flow working document that provides a visual framework and guide to the dissemination process and efforts. It was reviewed as part of the MSRC Annual Meeting and continues to develop with a new draft being readied for review 11 Apr 2019.
- Core D consulted with applicants regarding their D&I plans for the initial set of submissions. However, it was determined after that that Core D would not be involved in the application process and no further consultation on proposal development has been done.
- Core D has made recommendations with regard to D&I funding opportunities to investigators when we consult with them. However, investigations by Core D have found there are almost no options for D&I funding that are not a full-size grant and MOMRP has indicated that is not the kind of project that is their focus for funding. Core D made connections with DSPO regarding funding opportunities when they had discretionary money for this purpose, but that has not been allocated to them by Congress in the past two years. Core D has investigated the PHCoE PBIN as an option for Crisis Response

Planning and strongly encouraged Dr. Craig Bryan to apply. However, the PBIN has no funds to offer to the PI or others outside of PHCoE so this vehicle does not work for researchers outside of DoD who need a source of funding for their involvement. Dr. Kate Comtois also approached the PBIN with her Caring Contacts intervention and was encouraged to obtain external funding from MOMRP or elsewhere in order to partner with the PBIN for implementation as they do not have budget for such partnerships.

Subtask 4: Determine gaps in implementation science research and methods relevant to military populations

- The 2nd Annual Core D meeting was held on 19 April 2018 in Washington, DC in conjunction with the American Association for Suicidology Conference, during which the team reflected on progress to date and agreed on the vision and priorities the next year, which was better understanding and promotion of dissemination, messaging, and communication of research findings.
- Core D provided consultation to Core A and C on considering D&I in research priorities at the MSRC IPR meeting and provided information to Core C on request.
- Core D has developed a one and a half-day Dissemination Science Institute on 14-15 May 2019 on the Catholic University of America campus in Washington, DC. Experts in the field of dissemination science will present. In addition to didactic instruction, included in Day 1 of the program will be two panel discussions focusing on dissemination priorities for military treatment facilities, one focused on military clinical care leadership, the other on military public health leadership as well as opportunities for question/answer and discussion. Building on the expert presentations from Day 1, Day 2 will be a "Dissemination Development Workshop" that follows an evidence-based format to develop dissemination plans for attendees who volunteer to present their projects or research studies. The workshop will use a structured format led by a facilitator who coordinates collegial feedback from other workshop attendees. One goal of the workshop will be to provide feedback to the presenter. The more important goal is to facilitate discussion of cutting-edge issues related to disseminating and communicating information about military and veteran suicide prevention. To date, 15 MSRC researchers, 29 military personnel and contractors, 7 Veteran focused, and 27 civilian participants have accepted the MSRC invitation to attend.
- At the MSRC Annual meeting, Dr. Bruce Crow presented the Dissemination Process Flow working document that Core D drafted to provide a visual framework and guide to the dissemination process. Based on the discussion, Core D met with Senior Advisor, Dr. Lisa Brenner, and Dr. Adam Walsh from the Defense Suicide Prevention Office to discuss clinical research criteria. Core D and MSRC has had further discussions about how to revise the document to address issues raised at the annual meeting.

Subtask 6: Call for proposals for third round of new studies

- The third targeted RFP was released on 06 April 2018. Ten projects were funded with a budget cap of $1.5M per project. Total funding for the third RFP was $10,402,085. The following research areas were targeted:
  - Help-seeking behavior (e.g., interventions, messaging campaigns, resource portals which encourage and facilitate service members accessing care without prompting from command/clinicians)
  - Community and peer-based interventions, specifically identifying at-risk individuals and what to do when an individual is in crisis (e.g., programs aimed at teaching service members to recognize and respond to risk in others)

- Suicide bereavement (e.g., programs which seek to decrease the negative impacts of suicide losses within a unit on unit members)
- Messaging about interventions to increase effectiveness in dissemination and implementation (e.g., dissemination and implementation interventions to effectively roll-out existing military-specific suicide prevention interventions)
- Translation of research into practice (e.g., studies that evaluate how we can facilitate the effective and consistent adoption of evidence-based therapies; evaluation of military medical records to assess to what degree the treatment offered was evidence-based)
- Postvention addressing or, perhaps primarily focusing on, suicide attempts, not suicide (e.g., develop and evaluate best methods to promote continued unit function at high level, avoid stigmatization of survivors [peers, friends, family], avoid "glorification", etc.)

- AAS completed scientific reviews for 23 proposals and 15 proposals were recommended for presentation to the MEAB meeting on 14-15 November 2018.

The following milestones were achieved in Year 3:

- Research priorities updated (ongoing)
- Research studies funded (ongoing)

Major Task 3: Fund and Oversee Clinical Trials and Research Studies

Subtask 1: Facilitate Success

- Sixteen funded studies have received local IRB approval and thirteen have received HRPO approval and are recruiting subjects or conducting data analyses.
- Several funded studies from the third RFP have begun working on local IRB submissions and two have IRB approval with HRPO review pending.
- Funded investigators have submitted quarterly reports on time.
- Core A held an in-person meeting for funded investigators in Frederick, MD on 25 May 2018. Core A is pleased with the progress being made and problem solving that occurred during the meeting.
- Core A held kick-off meetings via conference calls in February 2019 for newly funded investigators.
- Core A will hold an in-person review meeting for funded investigators on 11 July 2019 in Denver, CO.
- Core C continues to manage the upload and maintenance of the common data elements.

The following milestones were achieved in Year 3:

- Maintain defined schedule of data uploads and meetings.

Consortium Specific Aim 3: Use high quality research methods and analyses to extend significant findings from studies completed in the first five years of MSRC.

Major Task 4: Perform analyses on findings from years 1-5

Subtask 1: Perform analyses on years 1-5 findings to extend first five years of MSRC research activities

- Long-term follow-up studies of five of the MSRC 1.0 projects are in progress.
  - Dr. Jessica Ribeiro: Examining the nature of suicide risk over time using machine learning

- Dr. Brad Schmidt: Long Term Follow-up for MSRC DARTS Clinical Trial
- Dr. Courtney Bagge: Profiles of Behavioral Warning Signs for Suicide Attempts in the Prediction of Future Suicidality
- Dr. Lora Johnson: Three Year Follow-up of Study on Suicide Risk Assessments within Suicide-Specific Group Therapy Treatment for Veterans
- Dr. Kate Comtois: Reviewing the Effects of Caring Contacts (RECON): A Long-Term Follow-Up Study from the Military Continuity Project

Consortium Specific Aim 4: Conduct after-action analyses of null findings from initial MSRC studies to determine whether interventions significantly affected other outcomes (e.g., mechanism variables covered by the Common Data Elements [CDE]).

Major Task 5: Perform after-action analyses

Subtask 1: Conduct after-action analyses on any null findings from years 1-5

- 1.0 PIs were asked to select findings and CDE variables that were not included in their primary study analyses and test them for potential moderator effects. Several of the PIs conducted the requested analyses and did not find anything which added to their primary results. Other PIs were unable to conduct the requested analyses due to insufficient resources now that their study protocols have been closed. We concluded that commitment of additional MSRC resources to this task is not necessary and therefore deem it complete.

The following milestones were achieved in Year 3:

- Analyses completed

Consortium Specific Aim 5: Capitalize on the CDE (variables collected by all currently funded studies) to encourage rigorous secondary analyses.

Major Task 6: Capitalize on CDE Secondary Analyses

Subtask 1: Call for proposals for secondary data analyses of Common Data Elements

- Four secondary data analysis projects are in progress.
  - Dr. Joe Franklin: Using Machine Learning to Distinguish among Active Duty, Veteran, and Civilian Suicidality
  - Dr. Andrew Littlefield: Enhancing Identification of Suicide Risk among Military Service Members and Veterans: A Machine Learning Approach to Suicidality
  - Dr. April Smith: Interoceptive Deficits and Suicidality
  - Dr. David Vogel: Establishing Measurement Equivalence of MRSC Database Assessments

The following milestones were achieved in Year 3:

- Secondary analyses funded

Consortium Specific Aim 6: Disseminate Consortium knowledge, information, and findings.

Major Task 7: Development of D&I Plans

Subtask 1: Review years 1-5 MSRC studies' design and implementation of findings

- Core D continues to hold weekly meetings to organize Core D tasks, review the MSRC study research findings, and prepare for the MSRC D&I Readiness Working Group

reviews and other dissemination of study findings as well as plan for the Dissemination Science Institute.

- Core D provided consultation to nine PIs in preparation for the review by the Working Group and other dissemination. (Anestis, Cerel, Comtois, Holm-Denoma/Witte, Matarazzo, Gutierrez/Joiner, Schmidt).
- The Working Group reviewed two MSRC 1.0 funded intervention studies, four observational studies, and conducted three internal reviews on the observational studies' review process. Final reports are attached for Dr. Comtois' Caring Contacts study and Drs. Gutierrez and Joiner's Gold Standard study. Three previous observational studies reviewed by the Working Group initially (Anestis, Cerel, Holm-Denoma & Witte) were reviewed preliminarily to provide the Working Group with a perspective on what observational data exists to decide how to proceed. Therefore, there were no final reports. As we are developing the actionable finding briefs, we will be returning to these studies to develop these briefs which will replace final reports going forward. The final report for the Dr. Matarazzo's HOME study is still under review and will be available next quarter.
- Core D has held discussions with seven PIs regarding determining actionable findings of their study results (Anestis, Cerel, Comtois, Holm-Denoma/Witte, Matarazzo, Gutierrez, and Joiner).
- Core D has consulted with Cores A and C on developing quality of evidence rating scale for determining the actionable findings of MSRC-funded research.
- Core D has awarded 11 MSRC-funded PIs or their designee (all who applied) travel support to attend the Dissemination Science Institute. In total, 16 PIs will be in attendance (Brenner, Brown, Capron, Gutierrez, Holloway, Johnson, Joiner, Kerbrat (Comtois designee), LaCroix (Holloway designee), Lee-Tauler (Holloway designee), Marx, May, Nazem, Rosek (Bryan designee), Schmidt, and Smith.

Subtask 2: Evaluate MSRC study interventions for readiness for D&I

- Core D has developed a draft template for an action brief in tandem with the Dissemination Flow working document for efficiently and effectively presenting potentially actionable findings from MSRC studies.

Subtask 3: Core D will establish and maintain ongoing relationships and partnerships with agencies and organizations that can support D&I in military and veteran settings with military communities.

- Core D continues to collaborate with the Society for Implementation Research Collaboration (SIRC) – bringing a military perspective to the organization and conference as well as engaging with and linking military partners to the SIRC Policy Network. Core D has started a collaboration with the SIRC Intermediary Network (i.e. trainers, consultants, facilitators of EBPs in large health care and state systems) as well.
- Dr. Bruce Crow attended the VA Implementation Facilitator training in Little Rock, AR 9-11 Oct 2018, that developed from collaboration of Drs. Comtois and Landes from Core D.

The following milestone was achieved in Year 3:

- Infrastructure updated
- Meetings attended
- Establish D&I relationships
- Create clear D&I plans for MSRC funded studies

- Communication of MSRC deliverables

Major Task 8: Organized Dissemination

Subtask 1: Identify and establish connection with implementation science organizations which can support D&I with military populations

- Core D represented the MSRC at an exhibit table at the American Association of Suicidology (AAS) Conference in Washington, D.C. and disseminated Consortium knowledge, information, and findings via brochures, publications, visual media, and "meet & greet" sessions. In coordination with Core B, information about the exhibit was publicized daily via social media (Twitter, the conference app, MSRC website, etc.).
- Core D contacted the study PIs who had exhibited to inquire if there had been any new connections within these two months post conference. The feedback was generally appreciative of Core D's efforts. Some specific outcomes they reported were:
    - *Virtual Hope Box (VHB)*
      PI: Bush
      Per the download metrics for the VHB there was an increase in downloads during the month of April 2018; however, due to the limited analytical tools allowed for security reasons, it is not possible to determine if this is attributable to the exhibit.
    - *Texting a brief intervention to prevent suicidal ideation and behavior*
      PI: Comtois
      Having made a connection at the AAS exhibit, Research Scientist Amanda Kerbrat was able to follow-up and provide information to the JagConnect Suicide Prevention Program at the University of South Alabama to assist them in starting a caring contacts via text message program.
    - *A Study of Suicide Risk Assessments within Suicide-Specific Group Therapy Treatment for Veterans*
      PIs: Johnson, Jobes, O'Conner
      After speaking with a suicide prevention coordinator from the VA in New Hampshire, PI was asked to provide them with articles from the study after the conference.
- Core D collaborated with Core B to start a D&I blog as a pathway for disseminating MSRC research study informational findings, which was inaugurated in October. Core D looks forward to continued work with Core B in organizing the MSRC website to support D&I efforts.
- A revised budget justification and detailed budget were submitted for approval for a Dissemination Science Institute. USAMRAA confirmed that The Dissemination Science Institute is in line (within scope) of the aspects of Major Tasks 7 and 8 in the SOW and that the budget revisions will facilitate the costs for the proposed Dissemination Research Institute. Core D has confirmed presenters, panelists, reserved the venue. Registration is underway.

Subtask 2: Cores B and D will support the MSRC in communication of deliverables

- Cores B and D will support the overall communication of deliverables.
- In October, Core D inaugurated the MSRC blog, "Research in Action" as a pathway for disseminating informational findings from MSRC-funded research, and vehicle for increasing awareness of MSRC by encouraging traffic toward the MSRC website. The first blog summarized research conducted by Julie Cerel, PhD., and was publicized via MSRC's Twitter and Facebook.

- Core D established and debuted the quarterly "MSRC Advances in Suicide Prevention Methodology Webinar Series" to provide a forum for MSRC researchers to share valuable information on research methodologies from MSRC studies, apart from actual study results. On 07 Dec 2018 Jessica Ribeiro, PhD. debuted the series with a presentation on "The Role of Machine Learning in Suicide Science" to an audience of close to 50 attendees representing agencies within DoD and the VA, as well as outside agencies, universities, and non-profit organizations.

Consortium Specific Aim 7: Train future leaders in military suicide research.

Major Task 9: Continue pre-doctoral and postdoctoral training experiences at FSU and Rocky Mountain MIRECC

Subtask 1: Establish career development network

- Under the leadership and guidance of Drs. Gutierrez and Joiner, the MSRC continues to provide training and research opportunities to pre-doctoral students and post-doctoral fellows.

Subtask 2: Establish joint pre-doctoral and postdoctoral training experiences through the MSRC

- The 2018 MSRC Training Day was held in conjunction with the AAS conference on 18 April 2018. The full day training included 36 attendees.
- Core A is working on the 2019 MSRC Training Day in conjunction with the AAS conference. Thirty-four students have been accepted to attend the MSRC Training Day. That number includes the current and recently accepted postdoctoral fellows funded by MSRC.
- Dissertation award final reports were received from Ian Stanley, Jennifer Buchman, Sarah Carter, Melanie Hom, Kenye Law, and Matthew Podlogar.
- MSRC awarded dissertation awards to four graduate students. The awards of $2,000/each are intended to provide support for a doctoral dissertation topic of relevance to the MSRC.
    - Brian Bauer, University of Southern Mississippi: Using Nudges to Mitigate the Effects of Cognitive Biases in Veteran.
    - Joseph Boffa, Florida State University: Mitigating Suicidal Thought Suppression: Development and Evaluation of a Novel Intervention for New-Onset Suicide Risk among Military Personnel and Civilians.
    - Hannah Martinez, Uniformed Services University of the Health Sciences: Individual and Dyadic Characteristics in Intimate Partner Relationships Associated with Suicide in Military Psychiatric Inpatients.
    - Megan Rogers, Florida State University: Evaluation of Real-Time Risk Factors Associated with Suicidal Intent and Behaviors.
- The joint MSRC/STARRS fellows, Drs. Samantha Bernecker and Kelly Zuromski continue to evaluate the impact and cost effectiveness of available intervention and prevention programs in epidemiologically targeted high-risk military population segments.
- The joint MSRC/STARRS fellows, Drs. Carol Chu and Chelsey Wilks started their fellowship on 6 August 2018. They are focusing on learning to apply cost effectiveness analyses to available intervention data, supporting projects initiated in the first year of the fellowship, and determining which specific projects they will take the lead on this training year.

- An in-person meeting with the current MSRC/STARRS post-docs and Harvard-based mentors Drs. Nock and Kessler was held on 4-5 October 2018. Drs. Zuromski, Bernecker, Chu, and Wilks provided an overview of projects they will be working on and planned manuscripts.

Subtask 3: Establish military/veteran oriented D&I postdoctoral training experiences within Core D

- Dr. Bruce Crow continues to be fully engaged in the Dissemination and Implementation of Suicide Prevention Strategies in Military Settings Post-Doctoral Fellowship with Core D.

What opportunities for training and professional development has the project provided?

Please refer to Consortium Specific Aim 7: Train future leaders in military suicide research (above).

How were the results disseminated to communities of interest?

Nothing to Report.

What do you plan to do during the next reporting period to accomplish the goals and objectives?

- Core A will submit quarterly reports on time.
- Core A staff will work with the currently funded PIs to obtain IRB and HRPO approvals.
- The 6th Annual MSRC Research Training Day in conjunction with the American Association of Suicidology Annual Conference is scheduled for 24 April 2019.
- Drs. Gutierrez and Joiner will attend the MOMRP IPR Meeting on 21-22 May 2019 at Fort Detrick.
- Drs. Gutierrez, Joiner, and Comtois will attend the MOMRP MEAB Meeting on 23 May 2019 at Fort Detrick.
- The MSRC IPR meeting for funded investigators is scheduled for 11 July 2019 in Denver, CO. This will be an opportunity for PIs to present on the status of their project. It will also be an opportunity to troubleshoot problems and brainstorm ideas among the PIs and MSRC staff.
- MSRC funded studies will inform the development of tools for military leaders to identify and manage suicidal service members.
- Drs. Gutierrez and Joiner will continue to establish and maintain ongoing relationships and partnerships with STARRS-LS, DSPO, DCoE, and military and veteran communities and organizations.
- Provide ongoing training opportunities for MSRC staff, MSRC trainees, and MSRC investigators.
- The MSRC Annual Meeting will be held in Fall 2019, location and date to be determined.
- Core D will hold the 3nd Annual D&I Core meeting on 26 April 2019.
- Core D will host the Dissemination Science Institute 14-15 May 2019 in Washington, DC.
- Using Core D pilot funding: Core D is in the process of conducting qualitative interviews with Dissemination Science Institute military panelists with regard to how they need

information presented to be effective and useful. Synthesizing this information with the knowledge gained at the Dissemination Science Institute, Core D will use its pilot funding to conduct an evaluation of the existing blog dissemination approach compared to an expanded approach using methods learned at the Institute.

- Core D will continue to develop the Dissemination Flow working document in coordination with Core A, present to the Working Group April 2019 and to the MEAB at the In-Progress Review in May 2019. Examples of MSRC 1.0 research finding action briefs are being developed using this action brief template for feedback from Core A, MOMRP, and the MEAB.
- Core D will further collaborate with SIRC Policy and Intermediary Networks
- Core D will continue to present MSRC research findings at MSRC D&I Readiness Working Group monthly meetings.
- Core D will continue organizing the membership for a Veteran-focused Working Group to parallel the active duty military group

IMPACT:

What was the impact on the development of the principal discipline(s) of the project?

The Consortium has funded twenty-four projects to date. Sixteen funded studies have received local IRB approval and thirteen have received HRPO approval and are recruiting subjects or conducting data analyses. Subawards are in place for studies funded from the third RFP and investigators are working on regulatory submissions and project infrastructure.

What was the impact on other disciplines?

Nothing to report.

What was the impact on technology transfer?

Nothing to report.

What was the impact on society beyond science and technology?

Nothing to report.

CHANGES/PROBLEMS:

Changes in approach and reasons for change

Nothing to report.

Actual or anticipated problems or delays and actions or plans to resolve them

Nothing to report.

Changes that had a significant impact on expenditures

On 15 August 2018 we received a contract modification with a third option increase in funding for each site in the amount of $1,015,214. The additional funds were added to the research program budget at each site.

On 30 September 2018 the Denver site received a contract modification with a fourth increase in funding in the amount of $2,028,574. The additional funds were added to the research program budget.

Significant changes in use or care of human subjects.

Nothing to report.

Significant changes in use or care of vertebrate animals.

N/A

Significant changes in use of biohazards and/or select agents

N/A

PRODUCTS:

Publications, conference papers, and presentations

Publications

Soberay, K. A., Hanson, J. E., Dwyer, M., Plant, E. A., & Gutierrez, P. M. (2018). The relationship between suicidal responses and traumatic brain injury and severe insomnia in active duty, veteran, and civilian populations. *Archives of Suicide Research*, 1-35. https://doi.org/10.1080/13811118.2018.1479322

Stanley, I. H., Buchman-Schmitt, J. M., Chu, C., Rogers, M. L., Gai, A. R., Wagner, R. K., Gutierrez, P. M., & Joiner, T. E. (2018). The Military Suicide Research Consortium common data elements: An examination of measurement invariance across current service members and veterans. *Assessment,* 1-13. http://doi.org/10.1177/1073191118777635

Hom, M. A., Duffy, M. E., Rogers, M. L., Hanson, J., Gutierrez, P. M., & Joiner, T. E. (2018). Examining the link between prior suicidality and subsequent suicidal ideation among high-risk U.S. military service members. *Psychological Medicine,* 1–10. https://doi.org/ 10.1017/S0033291718003124

Nock, M. K., Han, G., Millner, A. J., Gutierrez, P. M., Joiner, T. E., Hwang, I., King, A., Naifeh, J. A., Sampson, N. A., Zaslavsky, A. M., Stein, M. B., Ursano, R. J., & Kessler, R. C. (2018). Patterns and Predictors of Persistence of Suicide Ideation: Results from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). *Journal of Abnormal Psychology,* Vol. 127, No. 7, 650–658. http://dx.doi.org/10.1037/abn0000379

Gutierrez, P. M., Joiner, T., Hanson, J., Stanley, I. H., Silva, C., & Rogers, M. L. (in press). Psychometric properties of four commonly used suicide risk assessment measures: Applicability to military treatment settings. Military Behavioral Health.

Bernecker, S. L., Zuromski, K. L., Gutierrez, P. M., Joiner, T. E., King, A. J., Liu, H., Nock, M. K., Sampson, N. A., Zaslavsky, A. M., Stein, M. B., Ursano, R. J., & Kessler, R. C. (in press). Predicting suicide attempts among soldiers who deny suicidal ideation in the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). Behaviour Research and Therapy.

Gutierrez, P. M., & Hanson, J. E. (2018). Suicide. In E. L. Weiss & C. A. Castro (Eds.), American Military Life in the 21st Century: Social, Cultural, and Economic Issues and Trends (pp. 244-254). Santa Barbara, CA: ABC-CLIO.

Presentations

Comtois, K.A. (2018, August) Military Suicide Research Consortium Dissemination and Implementation Core. Presented to Defense Suicide Prevention Office (DSPO) Suicide Prevention Risk Reduction Committee (SPARRC), Washington, D.C.

Comtois, K.A. (2018, September) Military Suicide Research Consortium Dissemination and Implementation Core. Presented at the Society for Implementation Research Collaboration (SIRC) Strategic Planning meeting, St. Louis, MO.

Gutierrez, P. M., Joiner, T. E., & Hanson, J. E. (2018, September). Evidence-based suicide assessment. Presented at the European Symposium on Suicide & Suicidal Behavior, Ghent, Belgium.

Gutierrez, P. M., Joiner, T. E., & Buchman-Schmitt, J. (2018, August). Predicting suicidal ideation and behaviors with brief assessment protocols. Presented at the Military Health System Research Symposium, Kissimmee, FL.

Joiner, T. E., Gutierrez, P. M., Stanley, I. H., & Hom, M. A. (2018, August). A prospective investigation of factors associated with suicidal ideation severity and new-onset suicide attempts among high-risk U.S. military service members. Presented at the Military Health System Research Symposium, Kissimmee, FL.

Peterson, A, Cifu, D.X., Joiner, T.E., Williams, R.L., Keane, T, Hinds, S.R., Gutierrez, P. M., Kosten, T. R. (2018, August). Leveraging the Synergistic Power of Team Science: Lessons Learned from DoD-Funded Research Consortia. Presented at the Military Health System Research Symposium, Kissimmee, FL.

Stanley, I. H., Rogers, M. L., Hanson, J. E., Gutierrez, P. M., & Joiner, T. E. (2018, November). PTSD symptom clusters and suicidal behaviors among high-risk military service members: A three-month prospective investigation. To be presented at the Association for Behavioral and Cognitive Therapies, Washington, DC.

Gutierrez, P. M., Joiner, T. E., & Hanson, J. E. (2018, September). Evidence-based suicide assessment. Presented at the European Symposium on Suicide & Suicidal Behavior, Ghent, Belgium.

Other Products

Advances in Suicide Prevention Methodology Webinar Series - https://msrc.fsu.edu/webinars

MSRC Blog: Research in Action - https://msrc.fsu.edu/research-in-action

Technologies or techniques

Nothing to report.

Inventions, patent applications, and or licenses

Nothing to report.

Other Products

Nothing to report.

Leveraging

Dr. Gutierrez will provide CAMS-G continuing education training for VISN 9 (Kentucky and Tennessee VA Medical Centers) clinicians.

Dr. Gutierrez continues to serve as a member of the steering committee for the Colorado National Collaborative (CNC). He ensures that MSRC findings and expertise regarding military and veteran suicide prevention inform this state-wide public health approach to suicide prevention. If CNC efforts to reduce Colorado suicide rates 20% by 2024 prove effective, the model will be disseminated nationally.

Dr. Gutierrez serves as a member of the Colorado Team for SAMHSA's Service Members, Veterans, and their Families (SMVF) Technical Assistance Center's Governor's Challenge to facilitate implementation of the 2018-2028 National Strategy for the Prevention of Veteran Suicide. His participation is to ensure that relevant MSRC research findings and expertise inform this effort.

Drs. Joiner and Gutierrez received the 2018 Charles C. Gersoni Military Psychology Award presented at the American Psychological Association (APA) Convention in San Francisco on 10 August 2018.

Drs. Joiner and Gutierrez received the 2018 Outstanding Research Accomplishment Award (Team/Academia) presented at the Military Health System Research Symposium in Kissimmee, FL on 20 August 2018.

Dr. Joiner is the recipient of the American Psychological Foundation's 2018 Alexander Gralnick Research Investigator Prize presented at the American Psychological Association (APA) Convention in San Francisco on 10 August 2018.

Dr. Bruce Crow received the 2018 John C. Flanagan Lifetime Achievement Award from the Society for Military Psychology, Division 19 of the American Psychological Association (APA) Convention in San Francisco on 10 August 2018.

Ian Stanley received a Pilot Innovation Grant from the American Foundation for Suicide Prevention (AFSP) for $30,000. This is related to health seeking in the military, among other populations. PI: Ian Stanley and Co-Is: Melanie Hom and Thomas Joiner. Title: Reducing Help-Seeking Stigma in Young Adults at Elevated Suicide Risk: A Randomized Controlled Trial.

PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS:

What individuals have worked on the project?

Denver VA Medical Center, Denver Research Institute

Peter Gutierrez, PhD
Principal Investigator
75% effort
Contribution to Project: Dr. Gutierrez is responsible for the oversight and management of project staff based at Denver. He works closely with Dr. Joiner on overall Consortium executive management (Core A co-direction) and provides oversight of all Consortium Cores (B, C, D) in collaboration with Dr. Joiner.

Lisa Brenner, PhD
Co-Investigator
3% effort
Contribution to Project: Dr. Brenner has expertise in Traumatic Brain Injury and Suicide. She collaborates with Dr. Gutierrez on MSRC training program issues and research projects.

Kelly Soberay, MA
Project Coordinator
50% effort
Contribution to Project: Ms. Soberay is the Project Coordinator for the Denver site and serves to facilitate the daily management of administrative tasks to include financial management, technical reporting, and management of reports from the research projects.

Karen Gronau, BS
Project Coordinator/IRB Coordinator
100% effort
Contribution to Project: Ms. Gronau is the Project Coordinator/IRB Coordinator for the Denver site and serves to facilitate the daily management of administrative tasks to include financial management, technical reporting, and management of reports from the research projects. She also manages local regulatory issues and assists funded PIs with regulatory approvals.

Jetta Hanson, MA
Research Coordinator
100% effort
Contribution to Project: Ms. Hanson supports the Principal Investigator in day to day operations and managing research studies at the Denver site. She also monitors military and civilian research relevant to the MSRC and fields research requests.

Core D – Dissemination and Implementation (D&I) Core – University of Washington

Kate Comtois, PhD
Director
30% effort
Contribution to Project: Dr. Comtois directs the D&I Core and is responsible for the team's completion of tasks in the Statement of Work (SOW).

Andria Pierson, MEd
Project Manager
92.5% effort (01/01/19-02/28/19); 90% (03/01/19-03/31/19)
Contribution to Project: Ms. Pierson coordinates operation for the D&I Core including management of time line, budget, scheduling, and training events.

Amanda Kerbrat, MS
Research Scientist
20% Effort (01/01/19-02/28/19); 0% (03/01/19-03/31/19)
Contribution to Project: Ms. Kerbrat develops protocols and standard operating procedures to facilitate MSRC investigator's use of evidence-based implementation research strategies.

Justin Um, BA
Assistant to the Director
70% effort (01/01/19-02/28/19); 57.5% (03/01/19-03/31/19)
Contribution to Project: Mr. Um assists the D&I director with day to day operations of the D&I Core, and supports Dr. Comtois, Ms. Kerbrat, and Ms. Pierson in completing all Core tasks on time and on budget

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

No changes.

What other organizations were involved as partners?

Florida State University

SPECIAL REPORTING REQUIREMENTS:

Quad charts are attached in Appendix A12.

APPENDICIES:

A1 VITA

DATE: 3-18-19

NAME: Peter M. Gutierrez

ADDRESS: Rocky Mountain MIRECC
1700 N. Wheeling Street
Aurora, Colorado 80045

PHONE: 303-378-5562

E-MAIL: peter.gutierrez@va.gov

EDUCATION:

Degree	Date	Institution	Location
Ph.D., Clinical Psychology	1997	University of Michigan	Ann Arbor, MI
M.A., Clinical Psychology	1994	University of Michigan	Ann Arbor, MI
B.A., Psychology *Summa Cum Laude*	1991	Winona State University	Winona, MN

AREAS OF SPECIALIZATION AND RESEARCH INTERESTS:

Suicide risk factors, assessment, and interventions. Scale development and psychometric evaluation.

PROFESSIONAL EXPERIENCE:

2008- Clinical/ Research Psychologist, Department of Veterans Affairs, Rocky Mountain Mental Illness Research and Education Clinical Center.

6/9/08- Licensed Clinical Psychologist, Colorado #3203.

7/1/14- Professor, University of Colorado School of Medicine, Department of Psychiatry.

2009-2014 Associate Professor, University of Colorado School of Medicine, Department of Psychiatry.

2008-2009 Visiting Associate Professor, University of Colorado Denver School of Medicine, Department of Psychiatry.

2007-2008 Research Psychologist, Denver VA Medical Center, Mental Illness Research and Education Clinical Center.

2006-2008 Adjoint Associate Professor, University of Colorado Denver School of Medicine, Department of Psychiatry.

2006-2007 Research Consultant, Denver VA Medical Center, Mental Illness Research and Education Clinical Center.

2002-2007 Associate Professor, Northern Illinois University, Department of Psychology.

2002-2006 Assistant Chair, Northern Illinois University, Department of Psychology.

1996-2002 Assistant Professor, Northern Illinois University, Department of Psychology.

PUBLICATIONS (120): http://www.ncbi.nlm.nih.gov/sites/myncbi/1NSkUvt-678QZ/bibliography/48519024/public/?sort=date&direction=ascending

Hom, M. A., Stanley, I. H., Duffy, M. E., Rogers, M. L., Hanson, J. E., Gutierrez, P. M., & Joiner, T. E. (in press). Investigating the reliability of suicide attempt history reporting across five measures: A study of U.S. military service members at risk of suicide. *Journal of Clinical Psychology.*

Gutierrez, P. M., Joiner, T., Hanson, J., Stanley, I. H., Silva, C., & Rogers, M. L. (in press). Psychometric properties of four commonly used suicide risk assessment measures: Applicability to military treatment settings. *Military Behavioral Health*. DOI: 10.1080/21635781.2018.1562390

Chen, J. I., Osman, A., Fredendall, S. L., & Gutierrez, P. M. (in press). An examination of the psychometric properties of the Reasons for Living Inventory within a male veteran clinical sample. *Archives of Suicide Research.*

Bernecker, S. L., Zuromski, K. L., Gutierrez, P. M., Joiner, T. E., King, A. J., Liu, H., Nock, M. K., Sampson, N. A., Zaslavsky, A. M., Stein, M. B., Ursano, R. J., & Kessler, R. C. (in press). Predicting suicide attempts among soldiers who deny suicidal ideation in the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). *Behaviour Research and Therapy*. DOI: 10.1016/j.brat.2018.11.018

Hom, M. A., Duffy, M. E., Rogers, M. L., Hanson, J. E., Gutierrez, P. M., & Joiner, T. E. (in press). Examining the link between prior suicidality and subsequent suicidal ideation among high-risk U.S. military service members. *Psychological Medicine.* DOI: 10.1017/S0033291718003124

Nock, M. K., Han, G., Millner, A. J., Gutierrez, P. M., Joiner, T. E., Hwang, I., King, A., Naifeh, J. A., Sampson, N. A., Zaslavsky, A. M., Stein, M. B., Ursano, R. J., & Kessler, R. C. (in press). Patterns and Predictors of Persistence of Suicide Ideation: Results from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). *Journal of Abnormal Psychology*.

Stanley, I. H., Buchman-Schmitt, J. M., Chu, C., Rogers, M. L., Gai, A. R., Wagner, R. K., Gutierrez, P. M., & Joiner, T. E. (in press). The Military Suicide Research Consortium common data elements: An examination of measurement invariance across current service members and veterans. *Assessment*.

Brown, T. M., Gutierrez, P. M., Grunwald, G. K., DiGuiseppi, C., Valuck, R. J., & Anderson, H. D. (in press). Access to psychotropic medication via prescription is associated with choice of suicide method: A retrospective study of 27,876 suicide attempts. *The Journal of Clinical Psychiatry*.

Bernecker, S. L., Rosellini, A. J., Nock, M. K., Chiu, W. T., Gutierrez, P. M., Hwang, I., Joiner, T. E., Naifeh, J. A., Sampson, N. A., Zaslavsky, A. M., Stein, M. B., Ursano, R. J., & Kessler, R. C. (in press). Improving risk prediction accuracy for new soldiers in the U.S. Army by adding self-report survey data to administrative data. *BMC Psychiatry*.

Stanley, I. H., Hom, M. A., Chu, C., Dougherty, S. P., Gallyer, A. J., Spencer-Thomas, S., Shelef, L., Fruchter, E., Comtois, K. A., Gutierrez, P. M., Sachs-Ericsson, N. J., & Joiner, T. E. (in press). Perceptions of belongingness and social support attenuate PTSD symptom severity among firefighters: A multi-study investigation. *Psychological Services.* DOI: 10.1037/ser0000240

Stanley, I. H., Rogers, M. L., Hanson, J. E., Gutierrez, P. M. & Joiner, T. E. (in press). PTSD symptom clusters and suicidal behaviors among high-risk military service members: A three-month prospective investigation. *Journal of Consulting and Clinical Psychology*.

Chu, C., Hom, M. A., Stanley, I. H., Gai, A., Nock, M. K., Gutierrez, P. M., & Joiner, T. E. (in press). Non-suicidal self-injury and suicidal thoughts and behaviors: A study of the explanatory roles of the interpersonal theory variables among military service members and veterans. *Journal of Clinical and Consulting Psychology.*

Nock, M. K., Millner, A. J., Joiner, T. E., Gutierrez, P. M., Han, G., Hwang, I.…& Kessler, R. C. (in press). Risk Factors for the Transition from Suicide Ideation to Suicide Attempt: Results from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). *Journal of Abnormal Psychology*.

Ringer, F., Soberay, K., Rogers, M., Hagan, C., Chu, C., Schneider, M., Podlogar, M., Witte, T., Holm-Denoma, J., Plant, A., Gutierrez, P., & Joiner, T., (in press). Initial validation of brief measures of suicide risk factors: Common Data Elements used by the Military Suicide Research Consortium. *Psychological Assessment*. http://dx.doi.org/10.1037/pas0000519

Zuromski, K. L., Bernecker, S. L., Gutierrez, P. M., Joiner, T. E., King, A. J., Liu, H., Naifeh, J. A., Nock, M. K., Sampson, N. A., Zaslavsky, A. M., Stein, M. B., Ursano, R. J., & Kessler, R. C. (2019) Assessment of a risk index for suicide attempts among US Army Soldiers with suicidal ideation: Analysis of data from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). *JAMA Network Open*, *2(3),* e190766. doi:10.1001/jamanetworkopen.2019.0766.

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Corona, C. D., Gutierrez, P. M., Wagner, B. M., & Jobes, D. A. (2018). Assessing the reliability of the CAMS rating scale using a generalizability study. *Crisis*. DOI: 10.1027/0227-5910/a000565

Soberay, K., Hanson, J., Dwyer, M., Plant, E., & Gutierrez, P. M. (2018). The Relationship between suicidal responses and traumatic brain injury and severe insomnia in active duty, veteran, and civilian populations. *Archives of Suicide Research*. DOI: 10.1080/13811118.2018.1479322

Huh, D., Jobes, D. A., Comtois, K. A., Kerbrat, A. H., Chalker, S. A., Gutierrez, P. M., & Jennings, K. W. (2018). The Collaborative Assessment and Management of Suicidality (CAMS) versus Enhanced Care as Usual (E-CAU) with suicidal soldiers: Moderator analyses from a randomized controlled trial. *Military Psychology, 30(6),* 495-506. DOI: 10.1080/08995605.2018.1503001

Chiurliza, B., Gutierrez, P. M., Joiner, T., Hanson, J., Ben Yehuda, A., Tatsa-Laur, L., Schneider, M., Stanley, I., & Shelef, L. (2018). Evaluation of suicide risk assessment measures in an Israel Defense Forces military sample. *Military Behavioral Health.* DOI: 10.1080/21635781.2018.1470585

Jobes, D. A., Comtois, K. A., Gutierrez, P. M., Brenner, L.A., Huh, D., Chalker, S. A….& Crow, B. (2017). A Randomized Controlled Trial of the Collaborative Assessment and Management of Suicidality versus Enhanced Care as Usual with Suicidal Soldiers. *Psychiatry: Interpersonal and Biological Processes, 80,* 339–356. DOI: https://doi.org/10.1080/00332747.2017.1354607

Johnson, L. L., O'Connor, S. S., Kaminer, B., Gutierrez, P. M., Carney, E., Groh, B., & Jobes. (2017). Evaluation of structured assessment and mediating factors of suicide focused group therapy for veterans recently discharged from inpatient psychiatry. *Archives of Suicide Research, 0,* 1-19. DOI: 10.1080/13811118.2017.1402722

Gutierrez, P. M., Wortzel, H. S., Forster, J. E., Leitner, R. A., Hostetter, T. A., & Brenner, L. A. (2017). Blister packaging medication increases treatment adherence for psychiatric patients. *Journal of Psychiatric Practice, 23(5),* 320-327. doi: 10.1097/PRA.0000000000000252

Ribeiro, J. D., Gutierrez, P. M., Joiner, T. E., Kessler, R. C., Petukhova, M. V., Sampson, N. A., Stein, M. B., Ursano, R. J., & Nock (2017). Healthcare Contact and Suicide Risk Documentation prior to Suicide Death: Results from the Army Study to Assess Risk. *Journal of Consulting and Clinical Psychology*, *85(4),* 403-408. doi: 10.1037/ccp0000178

Hom, M. A., Stanley, I. H., Gutierrez, P. M., & Joiner, T. E. (2017). Exploring the association between exposure to suicide and suicide risk among military service members and veterans. *Journal of Affective Disorders, 207,* 327-335. doi:10.1016/j.jad.2016.09.043

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Hom, M. A., Chu, C., Schneider, M. E., Lim, I. C., Hirsch, J. K., Gutierrez, P. M., & Joiner, T. E. (2017). Thwarted belongingness as an explanatory link between insomnia and suicidal ideation: Findings from three samples of military service members and veterans. *Journal of Affective Disorders, 209*, 114-123. doi: 10.1016/j.jad.2016.11.032

O'Connor, S. S., Carney, E., Jennings, K. W., Johnson, L. L., Gutierrez, P. M., & Jobes, D. A. (2016). Relative Impact of Risk Factors, Thwarted Belongingness, and Perceived Burdensomeness on Suicidal Ideation in Veteran Service Members. *Journal of Clinical Psychology, 73(10),* 1360-1369. doi:10.1002/jclp.22426

Gutierrez, P. M., Pease, J., Matarazzo, B. B., Monteith, L. L., Hernandez, T., & Osman, A. (2016). Evaluating the psychometric properties of the Interpersonal Needs Questionnaire and the Acquired Capability for Suicide Scale in military veterans. *Psychological Assessment, 28(12),* 1684-1694. doi: 10.1037/pas0000310

Joiner, T., Hom, M., Rogers, M., Chu, C., Stanley, I., Wynn, G., & Gutierrez, P. M. (2016). Staring Down Death: Is Abnormally Slow Blink Rate a Clinically Useful Indicator of Acute Suicide Risk? *Crisis, 37(3),* 212-217. doi: 10.1027/0227-5910/a000367

Gutierrez, P. M., Davidson, C., Friese, A., & Forster, J. (2016). Physical activity, suicide risk factors, and suicidal ideation in a veteran sample. *Suicide and Life-Threatening Behavior, 46(3),* 284-292. doi: 10.1111/sltb.1290

Gutierrez, P. M. (2015). Introduction to the special section: The costs and benefits of working with pooled data. *Military Behavioral Health. e-pub ahead of print.* doi: 10.1080/21635781.2015.1085932

Villate, J., O'Connor, S., Leitner, R., Kerbrat, A., Johnson, L., & Gutierrez, P. M. (2015). Suicide attempt characteristics among veterans and active duty servicemembers: A pooled data analysis. *Military Behavioral Health, 3(4)*, 316-327. doi: 10.1080/21635781.2015.1093981

Tucker, R. P., Crowley, K., Davidson, C. L., & Gutierrez, P. M. (2015). Risk factors, warning signs, and drivers of suicide: What are they, how do they differ, and why does it matter? *Suicide and Life-Threatening Behavior, 45(6)*, 679-689 . doi: 10.1111/sltb.12161

Petrik, M. L., Gutierrez, P. M., Berlin, J. S., & Saunders, S. M. (2015). Barriers and Facilitators of Suicide Risk Assessment in Emergency Departments: A Qualitative Study of Provider Perspectives. *General Hospital Psychiatry, 37(6)*, 581-586. doi: 10.1016/j.genhosppsych.2015.06.018

Anestis, M. D., Joiner, T., Hanson, J. E., & Gutierrez, P. M. (2015). Response to commentary on the modal suicide decedent did not consume alcohol just prior to the time of death: An analysis with implications for understanding suicidal behavior. *Journal of Abnormal Psychology, 124(2),* 460-461. doi: 10.1037/abn0000062

Bodell, L., Forney, K. J., Keel, P., Gutierrez, P., & Joiner, T. E. (2014). Consequences of Making Weight: A Review of Eating Disorder Symptoms and Diagnoses in the United States Military. *Clinical Psychology: Science and Practice, 21(4),* 398-409. PMID: 25642105

Anestis, M. D., Soberay, K. A., Hernández, T. D., Joiner, T. E., & Gutierrez, P. M. (2014). Reconsidering the link between impulsivity and suicidal behavior. *Personality and Social Psychology Review, 18 (4),* 366-386. doi: 10.1177/1088868314535988

Anestis, M. D., Joiner, T., Hanson, J. E., & Gutierrez, P. M. (2014). The modal suicide decedent did not consume alcohol just prior to the time of death: An analysis with implications for understanding suicidal behavior. *Journal of Abnormal Psychology, 123(4),* 835-840. doi: 10.1037/a0037480

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Rings, J. A., Forster, J., E., & Gutierrez, P. M. (2014). Exploring Prolonged Grief Disorder and its Relationship to Suicidal Ideation among Veterans. *Military Behavioral Health, 2(3)*, 283-292. DOI: 10.1080/21635781.2014.963758

Ribeiro, J.D., Bender, T. W., Buchman, J. M., Nock, M. K., Rudd, M. D., Bryan, C.J., Lim, I. C., Baker, M. T., Knight, C., Gutierrez, P. M., & Joiner, T. E. Jr. (2014). An investigation of the interactive effects of the acquired capability for suicide and acute agitation on suicidality in a military sample. *Depression and Anxiety, 00,* 1-7. DOI: 10.1002/da.22240

Matarazzo, B. B., Barnes, S. M., Pease, J. L., Russell, L. M., Hanson, J. E., Soberay, K. A., & Gutierrez, P. M. (2014). Suicide risk among lesbian, gay, bisexual, and transgender military personnel and veterans: What does the literature tell us? *Suicide and Life-Threatening Behavior, 44(2),* 200-217. Doi: 10.1111/sltb.12073

Osman, A., Lamis, D. A., Freedenthal, S., Gutierrez, P. M., & McNaughton-Cassill, M. (2014). The Multidimensional Scale of perceived Social Support: Analyses of internal reliability, measurement invariance, and correlates across genders. *Journal of Personality Assessment, 96(1)*, 103-112. doi: 10.1080/00223891.2013.838170

Gutierrez, P. M., Brenner, L. A., Rings, J. A., Devore, M. D., Kelly, P. J., Staves, P. J., Kelly, C. M., & Kaplan, M. S. (2013). A qualitative description of female veterans' deployment-related experiences and potential suicide risk factors. *Journal of Clinical Psychology, 69(3),* 923-935. doi: 10.1002/jclp.21997

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BOOK/CHAPTERS (9):

Gutierrez, P. M., & Hanson, J. E. (2018). Suicide. In E. L. Weiss & C. A. Castro (Eds.), *American Military Life in the 21st Century: Social, Cultural, and Economic Issues and Trends* (pp. 244-254). Santa Barbara, CA: ABC-CLIO.

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PAPER PRESENTATIONS (87):

Hom, M. A., Stanley, I. H., Duffy, M. E., Rogers, M. L., Hanson, J. E., Gutierrez, P. M., & Joiner T. E. (2019, April). *Investigating patterns in the reporting of suicide attempt history across measures: A study of high-risk U.S. military service members.* Paper to be presented at the 52nd Annual Meeting of the American Association of Suicidology, Denver, CO.

Gutierrez, P. M., Joiner, T. E., & Hanson, J. E. (2018, September). Evidence-based suicide assessment. Presented at the European Symposium on Suicide & Suicidal Behavior, Ghent, Belgium.

Gutierrez, P. M., Joiner, T. E., & Buchman-Schmitt, J. (2018, August). Predicting suicidal ideation and behaviors with brief assessment protocols. Presented at the Military Health System Research Symposium, Kissimmee, FL.

Joiner, T. E., Gutierrez, P. M., Stanley, I. H., & Hom, M. A. (2018, August). A prospective investigation of factors associated with suicidal ideation severity and new-onset suicide attempts among high-risk U.S. military service members. Presented at the Military Health System Research Symposium, Kissimmee, FL.

Gutierrez, P. M., Hanson, J., & Joiner, T. (2018, April). Suicide assessment for military service members: And maybe everyone else? Presented at the 51st Annual Conference of the American Association of Suicidology, Washington, DC.

Poindexter, E., King, C. A., & Gutierrez, P. M. (2018, April). Psychotherapy strategies to target perceived burden on others and suicide risk. Presented at the 51st Annual Conference of the American Association of Suicidology, Washington, DC.

Comtois, K. A., Carter, G., Gutierrez, P. M., & Jobes, D. A. (2018, April). Suicide risk assessment: Should we do it? Why should we do it? What should we do? Presented at the 51st Annual Conference of the American Association of Suicidology, Washington, DC.

Gutierrez, P. M. & Joiner, T. (2017, November). The Military Suicide Research Consortium common data elements: Psychometric support, clinical, and research utility. Presented at the International Academy of Suicide Research meeting, Las Vegas, NV.

Joiner, T. & Gutierrez, P. M. (2017, November). The Military Suicide Research Consortium Common Data Elements: An examination of measurement invariance across enlisted service members, younger veterans, and older veterans. Presented at the International Academy of Suicide Research meeting, Las Vegas, NV.

Joiner, T. & Gutierrez, P. M. (2017, August). The Military Suicide Research Consortium common data elements: Measurement invariance across enlisted service members, younger veterans, and older veterans. Presented at the Military Health System Research Symposium, Kissimmee, FL.

Berman, L., McIntosh, J., Campbell, F., King, C., Jobes, D., Eastgard, S., Mazza, J., Gutierrez, P., Schmitz, B., & Miller D. (2017, April). AAS past presidents panel: Perspectives on the field and AAS at 50 years. Presented at the 50th Annual Conference of the American Association of Suicidology, Phoenix, AZ.

Fiske, A., Gutierrez, P., Nadorff, M., Muehlenkamp, J., & Anestis, M. (2017, April). An illustration of how student mentorship has progressed: Important research questions over the 50 years of Suicidology. Presented at the 50th Annual Conference of the American Association of Suicidology, Phoenix, AZ.

Drapeau, C. W., Muehlenkamp, J. J., Quinn-Lee, L., Cross, W., Quinnett, P. G., & Gutierrez, P. M. (2017, April). Innovating gatekeeper trainings: Incorporating per educators, postvention and cultural competencies, active learning strategies, and novel evaluative methods. Presented at the 50th Annual Conference of the American Association of Suicidology, Phoenix, AZ.

Chen, J. I., Gutierrez, P. M., Bahraini, N. (2017, April). Facilitators and barriers to use of standardized suicide risk assessment tools among veteran-serving clinicians. Presented at the 50th Annual Conference of the American Association of Suicidology, Phoenix, AZ.

Corona, C. D., Gutierrez, P. M., Wagner, B. M., & Jobes, D. A. (2017, April). Assessing the reliability of the CAMS rating scale using a generalizability study. Presented at the 50th Annual Conference of the American Association of Suicidology, Phoenix, AZ.

Gutierrez, P. M., & Joiner, T. (2017, April). The Military Suicide Research Consortium (MSRC): Overview, accomplishments and recommendations for implementation in other nations. Presented at the NATO HFM-275 Symposium on Military Suicide Prevention, Riga, Latvia.

Gutierrez, P. M., & Shelef, L. (2017, March). Predictive validity of suicide-specific measures. Presented at the 2017 Shoresh Conference on Military Medicine, Rockville, MD.

Gutierrez, P. M., & Joiner, T. (2016, August). The Military Suicide Research Consortium Common Data Elements: Psychometric Support, Clinical, and Research Utility. Presented at the Military Health System Research Symposium, Kissimmee, FL.

Gutierrez, P. M. (2016, April). The Interpersonal Needs Questionnaire and Acquired Capability for Suicide Scale: Valid and Reliable Measures for use with Veterans. In M. VanSickle (Chair), *Measures*. Presented at the 49th Annual Conference of the American Association of Suicidology, Chicago, IL.

O'Connor, S. S., Jobes, D. A., Gutierrez, P. M., Johnson, L. L., Jennings, K. A., & Carney, E. (2016, April). Applying Mediational and Qualitative Methods to Advance our Understanding of Suicidal ideation in Distinct Clinical Populations. Presented at the 49th Annual American Association of Suicidology conference, Chicago, IL.

Gutierrez, P. M., Pease, J., Matarazzo, B., Monteith, L., & Hernandez, T. How well do the Interpersonal Needs Questionnaire and the Acquired Capability for Suicide Scales work for military veterans? Presented at the IASR/AFSP International Summit on Suicide Research, New York, NY, October 14, 2015.

Villatte, J. L., O'Connor, S., Leitner, R., Kerbrat, A. H., Johnson, L. A., & Gutierrez, P. M. Differences in Risk Factors and Characteristics of Suicide Attempts between Active Duty Military Personnel and Veterans. Presented at the IASR/AFSP International Summit on Suicide Research, New York, NY, October 12, 2015.

Gutierrez, P. M., & Joiner, T. The Military Suicide Research Consortium: Clinical trials reducing suicide risk and increasing resilience. Presented at the Military Health Systems Research Symposium, Fort Lauderdale, FL, August 19, 2015.

Gutierrez, P. M. Advances in understanding suicide in the US military. Presented at the International Association for Suicide Prevention conference, Montreal, QC, Canada, June 18, 2015.

Cornette, M., Wintersteen, M., Gutierrez, P. M., Reidenberg, D., & McKeon, R. Youth warning signs for suicide: Results of a national expert consensus panel. Presented at the American Association of Suicidology annual conference, Atlanta, GA, April 17, 2015.

Crowley, K. J., Tucker, R., Davidson, C., & Gutierrez, P. M. Connecting over what "drives" suicide: Defining suicide-specific drivers and their utility for clinical risk. Presented at the American Association of Suicidology annual conference, Atlanta, GA, April 17, 2015.

Anestis, M., Bradley, B., Cornette, M., Denneson, L., & Gutierrez, P. M. On the front lines of military suicidology. Presented at the American Association of Suicidology annual conference, Atlanta, GA, April 17, 2015.

Crowley, K. J., Ballard, E., Tucker, R., Davidson, C., May, A. E., Klonsky, E. D., & Gutierrez, P. M. Improving imminent risk assessment: Conceptual and empirical considerations. Presented at the American Association of Suicidology annual conference, Atlanta, GA, April 16, 2015.

Gutierrez, P. M., & Shelef, L. (2015, March). Predictive Validity of Suicide-specific Measures. Shoresh military medicine conference, Ramat Gan, Israel.

Gutierrez, P. M., & Joiner, T. (2015, March). Military Suicide Research Consortium Treatment Studies. Shoresh military medicine conference, Ramat Gan, Israel.

Gutierrez, P. M. Veteran suicide risk assessment. Grand Rounds presentation at the University of Mississippi Medical Center, Department of Psychiatry and Human Behavior, Jackson, MS, September 5, 2014.

Gutierrez, P. M. Veteran suicide risk assessment. Presented at the American Psychological Association convention, Washington, DC, August 8, 2014.

Gutierrez, P. M. Is alcohol use really a direct risk factor for suicide? Presented at the Show Me You Care About Suicide Prevention Conference, Jefferson City, MO, July 15, 2014.

Gutierrez, P. M. Providing for our youngest Veterans: Similarities and Differences in College Student and Veteran Suicide Prevention Efforts. Presented at the Preventing Suicide Among Youth and Young Adults conference, Springfield, IL, April 25, 2014.

Chesin, M. S., Hughes, J., Andover, P., & Gutierrez, P. M. Developing and testing three novel adjunctive psychosocial interventions to prevent suicide and non-suicidal self-injury: An overview of the interventions, lessons learned, and preliminary outcomes. Presented at the American Association of Suicidology conference, Los Angeles, CA, April 10, 2014.

O'Connor, S. S., Villatte, J., & Gutierrez, P. M. Differences in characteristics of suicide attempts between active duty military personnel and veterans. Presented at the American Association of Suicidology conference, Los Angeles, CA, April 11, 2014.

Gutierrez, P.M. Toward a gold standard for suicide risk assessment for military personnel. Presented at the International Association for Suicide Prevention Congress, Oslo, Norway, September 27, 2013.

Gutierrez, P. M., Joiner, T., Blatt, A., & Castro, C. United States military suicide prevention research: Navigating challenges and capitalizing on opportunities. Presented at the International Academy of Suicide Research World Congress on Suicide, Montreal, Quebec, Canada, June 12, 2013.

Goodman, M., Gutierrez, P. M., Bossarte, R., Rasmusson, A. M., Brenner, L., & Stanley. B. Research updates and new directions for suicide prevention in the Veterans Administration. Discussant for symposium presented at the American Psychiatric Association annual meeting, San Francisco, CA, May 19, 2013.

Gutierrez, P. M. Alcohol and suicide: A deadly cocktail or misinterpretation of data? Plenary address presented at the American Association of Suicidology conference, Austin, TX, April 26, 2013.

Gutierrez, P. M., Joiner, T., & Castro, C. Preventing suicide in the United States military: Research challenges and opportunities. Presented at the 14th European Symposium of Suicide & Suicidal Behavior, Tel Aviv-Jaffa, Israel, September 5, 2012.

Gutierrez, P. M., Castro, C., Fitek, D. J., Holloway, M., & Jobes, D. A. Status of DoD funded suicide research. Presented at the Annual DoD/VA Suicide Prevention Conference, Washington, DC, June 20, 2012.

Matarazzo, B., Gutierrez, P. M., & Silverman, M. M. The Self-Directed Violence Classification System: What it is and why it matters. Presented at the Annual DoD/VA Suicide Prevention Conference, Washington, DC, June 20, 2012.

Gutierrez, P. M., Fitek, D. J., Joiner, T., Holloway, M., Jobes, D., & Rudd, M. D. Status of Department of Defense funded suicide research. Featured Panel presentation at the American Association of Suicidology conference, Baltimore, MD, April 20, 2012.

Gutierrez, P. M. Navigating IRBs as a suicide researcher. Presented at the American Association of Suicidology conference, Baltimore, MD, April 19, 2012.

Kemp, J., Thompson, C., Brown, G. K., Brenner, L. A., & Gutierrez, P. M. VA continuum of care for suicidal Veterans. Panel presentation at the American Association of Suicidology conference, Portland, OR, April 16, 2011.

Gutierrez, P. M., & Lineberry, T. United States Army Medical Research and Materiel Command United States military suicide research: Activities and opportunities. Panel presentation at the American Association of Suicidology conference, Portland, OR, April 14, 2011.

Bahraini, N., Gutierrez, P. M., Brenner, L. A., Hedegaard, H., & Huggins, J. The Colorado Violent Death Reporting System (COVDRS): Exploring factors associated with suicide in VA and non-VA services utilizing Veterans. Presented at the American Association of Suicidology conference, Portland, OR, April 14, 2011.

Marshall, J., Gutierrez, P. M., Lineberry, T., & Jobes, D. United States Army Medical Research and Material Command United States military suicide research activities: Activities and opportunities. Panel presentation at the DOD/VA Annual Suicide Prevention Conference, Boston, MA, March 15, 2011.

Gutierrez, P. M., Bahraini, N., Basham, C. M., Brenner, L. A., Hedegaard, H., Denneson, L. M., & Dobscha, S. K. Lessons learned about veteran suicide from the Colorado and Oregon Violent Death Reporting Systems. Presented at the American Association of Suicidology conference, Orlando, FL, April 22, 2010.

Gutierrez, P. M. Blister packaging medication to increase treatment adherence and clinical response: Impact on suicide related morbidity and mortality. Presented at the 2010 DoD/VA Suicide Prevention Conference, Washington, DC, January 12, 2010.

Gutierrez, P. M. Theater of War. Plenary Panel member at the 2010 DoD/VA Suicide Prevention Conference, Washington, DC, January 12, 2010.

Bahraini, N., Gutierrez, P. M., Brenner, L. A., Hedegaard, H., Chase, M., & Shupe, A. The Colorado violent death reporting system: Exploring factors associated with suicide in VA and non-VA services utilizing veterans. Presented at the Centers for Disease Control and Prevention's NVDRS Reverse Site Visit, Denver, CO, May 14, 2009.

Leach, R. L., Breshears, R. E., Brenner, L. A., Homaifar, B. Y., Gutierrez, P. M., Gorgens, K. M., & Harwood, J. E. F. The utility of the Personality Assessment Inventory for predicting violence in veterans with traumatic brain injury. Presented at the Rehabilitation Psychology Conference, Jacksonville, FL, February 27, 2009.

Gutierrez, P. M. Collaborative assessment and management of suicide (CAMS): A feasibility study. DoD/VA Annual Suicide Prevention Conference, San Antonio, TX, January 13, 2009.

Gutierrez, P. M., Brenner, L. A., Homaifar, B. Y., & Olson-Madden, J. H. VA VISN 19 MIRECC research and clinical efforts at suicide prevention. Symposium presented at the American Psychological Association convention, Boston, MA, August 15, 2008.

Brausch, A. M., & Gutierrez, P. M. Body image and disordered eating in adolescent suicidality. Presented at the American Association of Suicidology conference, Boston, MA, April 17, 2008.

Gutierrez, P. M. Redefining diversity: The chronically suicidal veteran as one example. Presidential address at the American Association of Suicidology conference, Boston, MA, April 17, 2008.

Breshears, R. E., Brenner, L. A., & Gutierrez P. M. Predictive validity of the Personality Assessment Inventory in veterans with traumatic brain injury. Presented at the Rehabilitation Psychology Conference, Tucson, AZ, March 13, 2008.

King, C. A., Gutierrez, P. M., & Jobes, D. A. Looking back – looking ahead: American suicidology at mid-life. Plenary panel presentation at the American Association of Suicidology conference, New Orleans, LA, April 12, 2007.

Mazza, J. J., Reynolds, W. M., & Gutierrez, P. M. Screening for youth suicidal behavior revisited. Panel presentation at the American Association of Suicidology conference, New Orleans, LA, April 12, 2007.

Schumacher, M., Quinnett, P., & Gutierrez, P. M. QPRT suicide risk assessment and management course utility. Panel presentation at the American Association of Suicidology conference, New Orleans, LA, April 12, 2007.

Gutierrez, P. M. Change is good: What the past 40 years tell us about the future. Presidential address at the American Association of Suicidology conference, New Orleans, LA, April 12, 2007.

Gutierrez, P. M. Suicide in the young adult population. Presented at the Department of Veterans Affairs Employee Education System's Evidence-Based Interventions for Suicidal Persons conference, Denver, CO, February 8, 2007.

Rudd, M. D., Berman, L., Silverman, M. M., Gutierrez, P. M., & Schumacher, M. Warning signs for suicide: Theory, research, and clinical applications. Panel presented at the American Association of Suicidology conference, Seattle, WA, April 30, 2006.

Freedenthal, S. L., & Gutierrez, P. M. Adolescents' disclosures of suicidality: Who knows? Presented at the American Association of Suicidology conference, Seattle, WA, April 30, 2006.

Gutierrez, P. M. Shneidman Award Presentation – An integrated approach to assessing risk and protective factors for adolescent suicide. Presented at the American Association of Suicidology conference, Broomfield, CO, April 15, 2005.

Schumacher, M., & Gutierrez, P. M. Bipolar spectrum traits and suicide risk. Presented at the American Association of Suicidology conference, Broomfield, CO, April 15, 2005.

Gutierrez, P. M., & Osman, A. Prediction of adolescent suicide reattempts. Presented at the Kansas Conference in Clinical Child and Adolescent Psychology, Lawrence, KS, October 22, 2004.

Gutierrez, P. M., & Konick, L. C. Evaluation of school-based suicide prevention programs. Presented at the Suicide Prevention: Advancing the Illinois Strategic Plan conference, Springfield, IL, September 23, 2004.

Williams, J. E., Osman, A., Barrios, F., Kopper, B. A., & Gutierrez, P. M. Reliability and validity of the Inventory for Suicide Ideation – 30. Presented at the American Psychological Society conference, Chicago, IL, May 28, 2004.

Hovey, J. D., Freedenthal, S., Gutierrez, P. M., & Fernquist, R. Career development strategies in suicide research #1: Working with a mentor. Panel presented at the American Association of Suicidology conference, Miami, FL, April 15, 2004.

Conwell, Y., Silverman, M., Gutierrez, P. M., Konick, L. C., & Muehlenkamp, J. J. Career development strategies in suicide research #3: Publishing your findings. Workshop presented at the American Association of Suicidology conference, Miami, FL, April 16, 2004.

Konick, L. C., & Gutierrez, P. M. Suicide risk in college students: A test of a model. Presented at the 2004 American Association of Suicidology conference, Miami, FL, April 16, 2004.

Brausch, A. M., & Gutierrez, P. M. Does this magazine make me look fat? Media's impact on body image, depression, and eating. Presented at the Midwestern Psychological Association Conference, Chicago, IL, May 1, 2004.

Muehlenkamp, J. J., Swanson, J., & Gutierrez, P. M. Differences between self-injury and suicide on measures of depression and suicidal ideation. Presented at the Midwestern Psychological Association annual meeting, Chicago, IL, May 9, 2003.

Kaplan, M., Schultz, D., Gutierrez, P. M., Sanddal, N., & Fernquist, N. Suicide research: Working with a mentor. Panel presentation at the American Association of Suicidology annual conference, Santa Fe, NM, April 24, 2003.

Konick, L. C., & Gutierrez, P. M. Is spirituality a moderator of risk for suicide? Presented at the American Association of Suicidology annual conference, Santa Fe, NM, April 25, 2003.

Watkins, R. L., & Gutierrez, P. M. Exposure to peer suicide in college students. Presented at the American Association of Suicidology annual conference, Santa Fe, NM, April 25, 2003.

Gutierrez, P. M., Osman, A., Watkins, R. L., Konick, L. C., Muehlenkamp, J. J., & Brausch, A. M. Development and validation of the Suicide Resilience Inventory - 25 (SRI-25) in clinical and nonclinical samples. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October 19, 2002.

Konick, L. C., Brausch, A. M., Gutierrez, P. M., & Pawlowski, C. CBT in depressed kids: What factors moderate treatment effectiveness? Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October 19, 2002.

Hovey, J. D., Gutierrez, P. M., & Jha, A. Measuring cultural risk factors in suicide research. Panel presented at the American Association of Suicidology annual conference, Atlanta, GA, April 19, 2001.

Gutierrez, P. M., Osman, A., Barrios, F. X., & Kopper, B. A. The Self-Harm Behavior Questionnaire. Presented at the American Association of Suicidology annual conference, Atlanta, GA, April 21, 2001.

Gutierrez, P. M., Collura, D., & Watkins, R. A case for regular suicide risk screening in high schools. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October 14, 2000.

Osman, A., Gutierrez, P. M., Kopper, B. A., Barrios, F. X., Breitenstein, J. L., & Silich, N. Validity and utility of the Adolescent Psychopathology Scale (APS) with adolescent psychiatric inpatients. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October 13, 2000.

Kopper, B. A., Gutierrez, P. M., Osman, A., & Barrios, F. X. Helping kids stay alive: The Reasons for Living Inventory - Adolescents. Presented at Western Psychological Association Annual Convention, Portland, OR, April 14, 2000.

Gutierrez, P. M., Rodriguez, P. J., & Foat, N. K. A model of late adolescent suicidality. Presented at the American Association of Suicidology annual conference, Houston, TX, April 15, 1999.

Gutierrez, P. M., Osman, A., Kopper, B. A., & Barrios, F. X. Quality of risk assessment with common measures. Presented at the American Association of Suicidology annual conference, Bethesda, MD, April 18, 1998.

POSTER PRESENTATIONS (64):

Stanley, I. H., Rogers, M. L., Hanson, J. E., Gutierrez, P. M., & Joiner, T. E. (2018, November). PTSD symptom clusters and suicidal behaviors among high-risk military service members: A three-month prospective investigation. To be presented at the Association for Behavioral and Cognitive Therapies, Washington, DC.

Peterson, A., Cifu, D. X., Joiner, T. E., Williams, R. L., Keane, T., Hinds, S. R., Gutierrez, P. M., & Kosten, T. R. (2018, August). Leveraging the synergistic power of team science: Lessons learned from DoD-funded research consortia. Presented at the Military Health System Research Symposium, Kissimmee, FL.

Soberay, K. A., Hanson, J. E., & Gutierrez, P. M. (2017, July). Military suicide research presence and impact in policy documents captured by altmetrics. Presented at the VA/DOD Suicide Prevention conference, Denver, CO.

Soberay, K. A., Plant, E. A., Hanson, J. E., & Gutierrez, P. M. (2017, July). Traumatic brain injury, severe insomnia, and suicidal behaviors in active duty military. Presented at the VA/DOD Suicide Prevention conference, Denver, CO.

Lavigne, J. E., Walsh, P., Zhou, M., & Gutierrez P. (2017, July). Cost-utility of blister packaging versus dispensing as usual all medications for veterans with post-traumatic stress disorder, major affective disorder, bipolar affective disorder, and/or schizophrenia: Results from a pragmatic randomized trial. Presented at the VA/DOD Suicide Prevention conference, Denver, CO.

Lavine, J. E., Zhou, M., & Gutierrez, P. (2017, May). Cost-utility of blister versus bulk packaging all medications for veterans with post-traumatic stress disorder, bipolar affective disorder, major affective disorder or schizophrenia: Results of a pragmatic randomized trial. Presented at the 22nd annual meeting of the International Society for Pharmacoeconomics and Outcomes Research, Boston, MA.

Acosta, M., Osman, A., Gutierrez, P. M., Bagge, C. L., Freedenthal, S., Wong, J. L, & Pirani, S. (2016, May). *The Multidimensional Revenge Attitudes Inventory: Validation of Scores on a New Measure of Revenge.* Presented at the meeting of the Association for Psychological Science, Chicago, IL.

Hanson, J. E., Soberay, K., Dwyer, M., Gutierrez, P. M., & Plant, A. (2016, April). Understanding the Relationship of TBI, Severe Insomnia, and Suicidal Behaviors in Active Duty, Veteran, and Civilian Populations. Presented at the 49th Annual Conference of the American Association of Suicidology, Chicago, IL.

Soberay, K., Dwyer, M., Hanson, J. E., Spinks, J., Soberay, A., & Gutierrez, P. M. (2016, April). The Dissemination of Military Research Understood through Altmetrics. Presented at the 49th Annual Conference of the American Association of Suicidology, Chicago, IL.

Gutierrez, P. M., Brenner, L., Wortzel, H., Forster, J., & Leitner, R. Lessons learned about suicide prevention and patient safety from a medication packaging intervention. Presented at the IASR/AFSP International Summit on Suicide Research, New York, NY, October 13, 2015.

Morris, B., O'Connor, S., Johnson, L. L., Jobes, D. A., Gutierrez, P. M., & Kaminer, B. B. Examining group differences between suicidal veterans classified as wish to live, ambivalent, or wish to die using the suicide index score. Presented at the American Association of Suicidology conference, Los Angeles, CA, April 11, 2014.

Davidson, C. L., Babson, K. A., Hostetter, T. A., Crowley, K. J., Forster, J. F., Gutierrez, P. M.. *Exploring the relationship between physical activity and suicide risk among Veterans in the Behavioral Risk Factor Surveillance System Questionnaire.* Poster presented at the Suicide and Self-Injury Special Interest Group at the annual Association of Behavioral and Cognitive Therapies Conference, Nashville, TN, November 22, 2013.

Soberay, K., Dwyer, M., Hanson, J., Ribeiro, J., Gronau, K., Gutierrez, P. M., & Maner, J. Exploring the MSRC common data elements: The relationship between TBI, severe insomnia, and suicidal behaviors in military populations. Presented at the American Psychological Association conference, Honolulu, HI, August 1, 2013.

Pease, J., Soberay, K., Dwyer, M., Gronau, K., & Gutierrez, P. M. Thwarted belonging makes a modest contribution to suicidal ideation after controlling for universalism and relationships. Presented at the American Psychological Association conference, Honolulu, HI, August 1, 2013.

Leitner, R., Gutierrez, P. M., Brenner, L., Wortzel, H., Forster, J. E., & Huggins, J. Psychometric properties of the Self-harm Behavior Questionnaire in Veterans. Presented at the American Psychological Association conference, Honolulu, HI, July 31, 2013.

Dwyer, M. M., Soberay, K., Hanson, J., & Gutierrez, P. M. Military suicide research consortium (MSRC). Presented at the American Association of Suicidology conference, Austin, TX, April 26, 2013.

Rings, J. A., Gutierrez, P. M., Harwood, J. E. F., & Leitner, R. Examining prolonged grief symptomatology and its relationship to self-directed violence among Veterans. Presented at the Veterans Affairs Mental Health Conference. Baltimore, MD, August 23, 2011.

Rings, J. A., Gutierrez, P. M., & Harwood, J. E. F. Prolonged grief disorder and its relationship to self-directed violence among Veterans: Preliminary findings. Presented at the Departments of Defense and Veterans Affairs Suicide Prevention Conference. Boston, MA, March 15, 2011.

Huggins, J., Homaifar, B.Y., Skopp, N.A., Reger, M., Gahm, G., Gutierrez, P., & Brenner, L.A. Suicide prevention through the transformation of data into information. Presented at the Departments of Defense and Veterans Affairs Suicide Prevention Conference. Boston, MA, March 15, 2011.

Betthauser, L. M., Allen, E., Brenner, L. A., & Gutierrez, P. M. Centrality of intimate relationships on failed belongingness and perceived burdensomeness in returning combat Veterans. Presented at the International Association for Relationship Research, Lawrence, KS, November 2009.

Bahraini, N., Gutierrez, P. M., Brenner, L. A., Huggins, J., Hedegaard, H., Shupe, A., & Chase, M. The Colorado violent death reporting system: Exploring factors associated with suicide in VA and non-VA services utilizing veterans. Presented at the American Psychological Association conference, Toronto, Ontario Canada, August 6, 2009.

Brausch, A. M., & Gutierrez, P. M. Psychosocial factors related to non-suicidal self-injury in adolescents. Presented at the American Association of Suicidology annual conference, San Francisco, CA, April 17, 2009.

Ballard, E. D., Jobes, D., Brenner, L., Gutierrez, P. M., Nagamoto, H., Kemp, J., et al. Qualitative suicide status form responses of suicidal veterans. Presented at the American Association of Suicidology conference, Boston, MA, April 18, 2008.

Bahraini, N., Gutierrez, P. M., Brenner, L. A., Staves, P., Cornette, M., & Betthauser, L. Pain tolerance and links to increased suicide risk. Presented at the American Association of Suicidology conference, Boston, MA, April 18, 2008.

Cornette, M. M., DeBoard, R. L., Clark, D. C., Holloway, R. H., Brenner, L., Gutierrez, P. M., & Joiner, T. E. Examination of an interpersonal-behavioural model of suicide: Toward greater specificity in suicide risk prediction. Presented at the International Association for Suicide Prevention conference, Dublin, Ireland, August 31, 2007.

Brenner, L. A., Gutierrez, P. M., Cornette, M., Staves, P. J., & Betthauser, L. M. Veterans' experiences of habituation to painful stimuli, perceived burdensomeness and failed belongingness. Presented at the American Psychological Association conference, San Francisco, CA, August 19, 2007.

Fang, Q., Choma, K., Salvatore, A., Mack, T., Bailey, J., & Gutierrez, P. M. Validation of the Pain Distress Inventory using an adolescent inpatient sample. Presented at the Kansas Conference in Clinical Child and Adolescent Psychology, Lawrence, KS, October 19, 2006.

Brausch, A. M., & Gutierrez, P. M. Adolescent gender differences in reasons for living. Poster presented at the American Association of Suicidology conference, Seattle, WA, April 30, 2006.

Swanson, J. D., & Gutierrez, P. M. Gender, social support, and student suicidality. Poster presented at the American Association of Suicidology conference, Seattle, WA, April 30, 2006.

Kopper, B. A., Osman, A., Gutierrez, P. M., Williams, J. E., & Barrios, F. X. Suicide Resilience Inventory-25: Validation with normal and adolescent psychiatric inpatients. Poster presented at the 2005 APA conference, Washington, DC.

Kopper, B. A., Osman, A., Barrios, F. X., Gutierrez, P. M., & Williams, J. E. The Beck Depression Inventory-II with nonclinical and inpatient adolescents. Poster presented at the 2005 APA conference, Washington, DC.

Brausch, A. M., & Gutierrez, P. M. Ethnic differences in body image, affect, and eating behaviors and the impact of media exposure. Presented at the Association for the Advancement of Behavior Therapy conference, New Orleans, LA, November 11, 2004.

Muehlenkamp, J. J., & Gutierrez, P. M. Validation of the Self-Harm Behavior Questionnaire in adolescents. Presented at the Association for the Advancement of Behavior Therapy conference, New Orleans, LA, November 11, 2004.

Linden, S., Osman, A., Barrios, F. X., Kopper, B. A., Williams, J. E., & Gutierrez, P. M. Structure of the Adolescent Psychopathology Scale (APS) clinical subscales in psychiatric inpatients. Presented at the Association for the Advancement of Behavior Therapy conference, New Orleans, LA, November 11, 2004.

Osman, A., Williams, J. E., Barrios, F. X., Kopper, B. A., Gutierrez, P. M., Linden, S. C., & Carlson, N. Development of cutoff scores for the Beck scales in adolescent psychiatric inpatients. Presented at the Kansas Conference in Clinical Child and Adolescent Psychology, Lawrence, KS, October 21, 2004.

Osman, A., Barrios, F. X., Gutierrez, P. M., Kopper, B. A., Williams, J. E., Carlson, N., & Koser, K. Reliability and validity of the Multidimensional Anxiety Scale for Children and the Children's Depression Inventory. Presented at the Kansas Conference in Clinical Child and Adolescent Psychology, Lawrence, KS, October 21, 2004.

Osman, A., Gutierrez, P. M., Barrios, F. X., Kopper, B. A., Linden, S. C., Carlson, N., & Koser, K. The Reynolds Adolescent Depression Scale 2: Reliability and validity. Presented at the Kansas Conference in Clinical Child and Adolescent Psychology, Lawrence, KS, October 21, 2004.

Muehlenkamp, J. J., & Gutierrez, P. M. Are self-injurious behaviors and suicide attempts different points on the same continuum? Presented at the Suicide Prevention: Advancing the Illinois Strategic Plan conference, Springfield, IL, September 23, 2004.

Brausch, A. M., Swanson, J., & Gutierrez, P. M. Parent marital status, depression and suicide. Presented at the American Association of Suicidology conference, Miami, FL, April 16, 2004.

Konick, L. C., Gutierrez, P. M., Muehlenkamp, J. J., Watkins, R. L., Ward, K. E., & Haase, K. Development of the Spiritual Attitudes and Beliefs Inventory: Phase II. Presented at the Midwestern Psychological Association annual meeting, Chicago, IL, May 8, 2003.

Konick, L. C., Gutierrez, P. M., & Watkins, R. L. Adult Suicidal Ideation Questionnaire psychometrics. Presented at the American Association of Suicidology annual conference, Santa Fe, NM, April 25, 2003.

Gutierrez, P. M., & Muehlenkamp, J. J. Understanding differences between self-injurious behavior and suicide attempts in high school students. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October, 18, 2002.

Gutierrez, P. M., Osman, A., Brausch, A. M., Muehlenkamp, J. J., Watkins, R. L., & Konick, L. C. Reliability and validity of the Beck scales in the assessment of suicide-related behaviors in adolescent psychiatric inpatients. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October, 18, 2002.

Gutierrez, P. M., Osman, A., Watkins, R. L., & Muehlenkamp, J. J. Potential racial differences in adolescent suicide risk. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October, 18, 2002.

Osman, A., Gutierrez, P. M., Kopper, B, A., Barrios, F. X., Boyle, T., & Duncan, A. The Inventory of Suicide Orientation - 30: Further validation with adolescent inpatients. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October, 18, 2002.

Osman, A., Linden, S., Gutierrez, P. M., Barrios, F. X., Kopper, B. A., & Forman, K. Validity of the Adolescent Psychopathology Content Scales (APS) in Pediatric Medical Institute for Children (PMIC) inpatients. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October, 18, 2002.

Konick, L. C., Wrangham, J. J., Gutierrez, P. M., Blacker, D., Watkins, R. L., Aalders, G., Giannerini, J., Miller, M. J., Rapp, J. M., Shayne, L. E., & Ward, K. E. Development of the Spiritual Attitudes and Beliefs Inventory (SABI). Presented at the annual meeting of the Midwestern Psychological Association, Chicago, IL, May 2, 2002.

Gutierrez, P. M., Wrangham, J., Konick, L., Osman, A., & Barrios, F. X. Does ethnicity influence adolescent suicide risk? Presented at the American Association of Suicidology annual conference, Bethesda, MD, April 12, 2002.

Wrangham, J., Gutierrez, P. M., Osman, A., & Barrios, F. X. Validation of the PANSI with minority young adults. Presented at the American Association of Suicidology annual conference, Bethesda, MD, April 12, 2002.

Konick, L. C., Brandt, L. A., & Gutierrez, P. M. School-based suicide prevention programs: A meta-analysis. Presented at the American Association of Suicidology annual conference, Bethesda, MD, April 12, 2002.

Gutierrez, P. M., Osman, A., Kopper, B. A., & Barrios, F. X. Use of the Multi-Attitude Suicide Tendency Scale with minority individuals. Presented at the meeting of the Midwestern Psychological Association, Chicago, IL, May 4, 2001.

Valentiner, D., Gutierrez, P. M., Deacon, B., & Blacker, D. Factor structure and incremental validity of the Anxiety Sensitivity Index for Children in an adolescent sample. Presented at the annual meeting of the Society for Research in Child Development, Minneapolis, MN, April 21, 2001.

Gutierrez, P.M., Rodriguez, P. J., & Garcia, P. Minority suicide risk. Presented at the American Association of Suicidology annual conference, Los Angeles, CA, April 13, 2000.

Kopper, B. A., Gutierrez, P. M., Osman, A., Barrios, F. X., Baker, M. T., & Haraburda, C. M. Reasons for Living Inventory for Young Adults: Psychometric properties. Presented for Division 17 - Counseling Psychology - at the annual convention of the American Psychological Association, Washington, DC, August 5, 2000.

Kopper, B. A., Gutierrez, P. M., Osman, A., Barrios, F. X., & Bagge, C. L. Assessment of suicidal ideation in college students. Presented for Division 17 - Counseling Psychology - at the annual convention of the American Psychological Association, Washington, DC, August 5, 2000.

Gutierrez, P. M., Rubin, E. C., & Blacker, D. A preliminary investigation of the role of suicide exposure and attitudes about death on adolescent suicidal ideation. Presented at the Midwestern Psychological Association annual conference, Chicago, IL, May 4, 2000.

Martin, H., & Gutierrez, P. M. The role of mediating factors on the long-term relationship between early parental death and later depression and anxiety. Presented at the Midwestern Psychological Association Annual Conference, Chicago, IL, May 4, 2000.

Kopper, B. A., Osman, A., Gilpin, A. R., Panak, W. F., Barrios, F. X., Gutierrez, P. M., & Chiros, C. E. The Multi-Attitude Suicide Tendency Scale: Further validation with adolescent psychiatric inpatients. Presented at the annual convention of the American Psychological Association, Boston, MA August 22, 1999.

Kopper, B. A., Osman, A., Linehan, M. M., Barrios, F. X., Gutierrez, P. M., & Bagge, C. L. Validation of the Adult Suicide Ideation Questionnaire and the Reasons for Living Inventory in an adult psychiatric inpatient sample. Presented at the annual convention of the American Psychological Association, Boston, MA August 22, 1999.

Osman, A., Bagge, C. L., Barrios, F. X., Gutierrez, P. M., & Kopper, B. A. Receiver operating characteristic curve analyses of the Beck Depression Inventory - II in adolescent psychiatric inpatients. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October 9, 1998.

Osman, A., Bagge, C. L., Gutierrez, P. M., Kopper, B. A., & Barrios, F. X. Validation of the Reasons for Living Inventory for Adolescents (RFL-A) in a clinical sample. Presented at the Kansas Conference in Clinical Child Psychology, Lawrence, KS, October 9, 1998.

Kopper, B. A., Osman, A., Hoffman, J., Gutierrez, P. M., & Barrios, F. X. Reliability and validity of the BDI-II with inpatient psychiatric adolescents. Presented at Division 12 - Clinical Psychology - at the annual convention of the American Psychological Association, San Francisco, CA, August 16, 1998.

Gutierrez, P. M., & Hagstrom, A. H. Uses for the Multi-Attitude Suicide Tendency Scale. Presented at the American Association of Suicidology annual conference, Bethesda, MD, April 17, 1998.

Gutierrez, P., & Williams, J. Children's understanding of death. Presented at the Midwestern Psychological Association annual meeting, Chicago, IL, May, 3, 1991.

GRANTS:

Current

3/19-3/21 Military Suicide Research Consortium; Co-Principal Investigator (Joiner Co-PI); **$789,962** for *Increasing Connection to Care Among Military Service Members at Elevated Suicide Risk: A Randomized Controlled Trial of a Web-Based Intervention.*

1/18-6/19 Military Suicide Research Consortium; Co-Investigator (Johnson, PI); **$148,982** for *Three Year Follow-up of Study on Suicide Risk Assessments within Suicide-Specific Group Therapy Treatment for Veterans*.

3/16-3/21 Department of Defense, Military Operational Medicine Research Program, grant; Principal Investigator: jointly with Thomas Joiner, Ph.D., Florida State University; **$17,894,035.00** [additional **$2,105,965.00** for option period years 3-5] for *Military Suicide Research Consortium: Extension to New Opportunities and Challenges*.

Completed

1/16-5/17 Department of Defense, Defense Suicide Prevention Office; Military Advisory Board Member for *Community Partners in Suicide Prevention.* A grant given to the American Association of Suicidology, Principal Investigator Craig Bryan, PsyD.

3/11-3/17 Department of Defense, Military Operational Medicine Research Program, grant; Co-Investigator; **$3,400,000** for *A Randomized Clinical Trial of the Collaborative Assessment and Management of Suicidality vs. Enhanced Care as Usual for Suicidal Soldiers.*

7/12-9/16 Military Suicide Research Consortium; Principal Investigator; **$2,381,228** for *Toward a Gold Standard for Suicide Risk Assessment for Military Personnel.*

9/10-9/16 Department of Defense, Military Operational Medicine Research Program, grant; Principal Investigator: jointly with Thomas Joiner, Ph.D., Florida State University; **$15,000,000 (additional $15,000,000 going to FSU)** for *Military Suicide Research Consortium.*

10/12-9/15 Department of Veterans Affairs National Center for Patient Safety; Advisory Board member (PI Monica Matthieu, Ph.D., LCSW); **$569,222** for *Patient Safety Center of Inquiry for Suicide Prevention*.

3/11-2/13 Department of Defense, Military Operational Medicine Research Program, grant; Consultant (PI Steven Vannoy, Ph.D., MPH); **$1,354,386** for *Development and Validation of a Theory Based Screening Process for Suicide Risk.*

9/09-9/14 Department of Defense, Military Operational Medicine Research Program, grant; Principal Investigator; **$1,173,408** for *Blister Packaging Medication to Increase Treatment Adherence and Clinical Response: Impact on Suicide-related Morbidity and Mortality.*

5/09-5/10 Colorado TBI Trust Fund Education grant; **$8427** to support the hosting of a conference of national experts in suicide safety planning and TBI rehabilitation.

5/08-5/09 Colorado TBI Trust Fund Education grant; **$5,000** to support the hosting of a conference of national experts in assessment of TBI and suicide risk and the role of executive dysfunction in linking the two problems.

HONORS AND AWARDS:

2018 Military Health System Research Symposium (MHSRS) Outstanding Research Accomplishment (Team/Academia) Award, jointly with Thomas Joiner, PhD.

2018 Charles C. Gersoni Military Psychology Award, jointly with Thomas Joiner, PhD, American Psychological Association, Division 19, Society for Military Psychology.

2014 Roger J. Tierney Award for Service, American Association of Suicidology.

2005 Shneidman Award for Significant Contributions to Suicide Research, American Association of Suicidology

2003 Outstanding Young Alumni, Winona State University

PROFESSIONAL SERVICE:

2018 Centers for Disease Control and Prevention, National Center for Injury Prevention and Control Extramural Research Program Office, Special Emphasis Panel Member, Research Grants for the Primary or Secondary Prevention of Opioid Overdose (RFA-CE-18-006)

9/17-present Member U.S. Air Force Suicide Prevention Solutions Working Group (AF SPSWG)

1/16-present Member Colorado Steering Team, Colorado-National Collaborative for Suicide Prevention, Colorado Office of Suicide Prevention, Colorado Office of Public Health and Environment

10/15-6/18 University of Colorado School of Medicine Faculty Promotions Committee

2015 Centers for Disease Control and Prevention, National Center for Injury Prevention and Control Extramural Research Program Office, Special

	Emphasis Panel Member, Evaluating Innovative and Promising Strategies to Prevent Suicide among Middle-Aged Men (RFA-CE-15-004)
6/14-8/14	Expert Adviser for the Royal Australian & New Zealand College of Psychiatrists Clinical Practice Guidelines Project on Deliberate Self-harm, Prof. Gregory Carter, Chair
1/12-10/15	Department of Psychiatry Faculty Promotions Committee
1/12-present	Editorial Board Member, *Archives of Suicide Research*, Barbara Stanley, Ph.D., Editor-in-Chief
4/09-present	Associate Editor, *Suicide and Life-Threatening Behavior*, Thomas Joiner, Ph.D., Editor-in-Chief.
4/09-4/11	Past-president, Board position, of the American Association of Suicidology.
3/09-12/09	U. S. Army Suicide Reduction and Prevention Research Strategic Planning Workgroup, Soldier Identification and Case Management Expert Lead.
5/07-10/08	Member of the International Advisory Board for the Australian National Study of Self Injury (ANESSI), Professor Graham Martin, Director.
4/07-4/09	President of the American Association of Suicidology.
3/06-3/07	Reviewer for National Registry of Evidence-based Programs and Practices, Substance Abuse and Mental Health Services Administration.
4/05-4/07	President-Elect of the American Association of Suicidology.
2/04-4/09	Consulting Editor and Editorial Board member, *Suicide and Life-Threatening Behavior*, Morton M. Silverman, M.D., Editor-in-Chief.
11/02-6/06	Member, Illinois Suicide Prevention Strategic Planning Task Force, Illinois Department of Public Health.
3/02-1/06	Member, American Association of Suicidology Institutional Review Board.
4/00-4/03	Director, Research Division, American Association of Suicidology.
4/99-present	Ad hoc reviewer for *Psychiatry Research; Journal of Personality Assessment; American Journal of Public Health; Internal Journal of Circumpolar Health; Death Studies; Social Problems; Journal of Adolescent Research; Child Abuse and Neglect; British Journal of Clinical Psychology; Journal of Clinical and Consulting Psychology; Journal of Abnormal Psychology; International Journal of Psychology; Archives of Suicide Research; American Journal of Orthopsychiatry; Journal of Mental Health Counseling; Crisis.*

1998-2002 Member, North Central Association Outcomes Endorsement Team for Auburn High School, Rockford, IL.

7/98-4/00 Chair, Publications Committee, American Association of Suicidology.

1998-2006 Director, Adolescent Risk Project, Auburn High School, Rockford, IL. Combined research and suicide risk screening project.

1997-2006 Faculty Associate of the Center for Latino and Latin-American Studies at Northern Illinois University.

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS:

12/15-present Society for Implementation Research Collaboration, Founding Member

2010-present International Academy for Suicide Research, Fellow

2007-present Colorado Psychological Association

2003-2010 International Academy for Suicide Research, Associate Member

1999-present APA Div. 12, Section VII, Clinical Emergencies and Crises

1998-2010 APA Div. 53, Society of Clinical Child and Adolescent Psychology

1997-2007 Midwestern Psychological Association

1996-present American Association of Suicidology

A2. Efficacy of a Computerized Cognitive Behavioral Treatment for Insomnia: Increasing Access to Insomnia Treatment to Decrease Suicide Risk
PI: Sarra Nazem, PhD

Summary of Progress: In the fourth quarter of the second year, we completed recruiting and enrolling participants for the study, reaching our targeted goal (n = 250) within the revised schedule. We also surpassed our randomization goal (n = 226) this quarter (n = 231). We have maintained contact with BeHealth Solutions (now Pear Therapeutics) in order to troubleshoot and solve the issues that have arisen for participants using the study website. We have now collected post-intervention assessment data from 182 participants (n = 170 post-intervention assessments needed based on a priori power analyses) as well as 6-month follow-up assessment data from 48 participants.

Regulatory:

Initial IRB approval date: October 3, 2017

Initial HRPO approval date: December 8, 2017

Continuing Review Approval Date: September 6, 2018

HRPO Continuing Review Acknowledgement: November 21, 2018

Recruitment:

Total projected enrollment: 226 (randomized)

Recruitment start date: March 26, 2018

Projected quarterly enrollment: 24

Subjects assessed for eligibility this quarter: 56

Number excluded: 37
Did not meet inclusion/exclusion criteria: 34
Declined to participate: 0
Other: 3

Subjects enrolled this quarter: 24

Subjects withdrawn this quarter: 13
Reason(s): 8 participants failed to complete pre-randomization requirements (10 sleep diaries+baseline assessment). 7 were lost to contact and 1 requested to be withdrawn during a reminder call. 5 participants were withdrawn after randomization. 4 requested to be withdrawn, with 3 citing unrelated life stressors and a lack of time, and 1 citing discontent with the assigned program. The remaining 1 participant died, cause unrelated to the study, and was withdrawn once study team became aware of death.

Completed follow-up visits?

Post-intervention: 182
6-month: 49
1-year: 0

Dropped/Discontinued at follow-up? 1

No contact: 0
Withdrawn from study: Participant died 12/19/18, cause unrelated to the study. Study team became aware of death this quarter and withdrew ppt. from study.
No longer eligible: 0
Other: 0

Progress in relation to the statement of work tasks and objectives:

Task	Timeline	Progress
Major Task 1: Study Start Up	Months 1-6	Elements completed: study protocol refined, regulatory documents approved, staff hired & trained, web-based platform/database infrastructure finalized.
Major Task 2: Randomized Controlled Trial	Months 6-22	Continued recruitment, screening, enrollment, randomization, and collection of baseline and post-intervention data.
Major Task 3: Follow-up Data	Months 14-34	Continued 6-Month follow-up assessments this quarter.
Major Task 4: Final Reports	Months 35-36	N/A
Major Task 5: Ongoing Regulatory Compliance	Ongoing	Continuing review approved and acknowledged by HRPO.

Major findings, results, and/or significance for this project during this quarter: We were able to successfully recruit and enroll the final 24 participants this quarter and finish baseline data collection with a total of 231 participants randomized. Of the 231 participants who completed baseline assessment data, post-intervention assessment data has been collected for 182, and 6-month follow-up assessment data has been collected for 49.

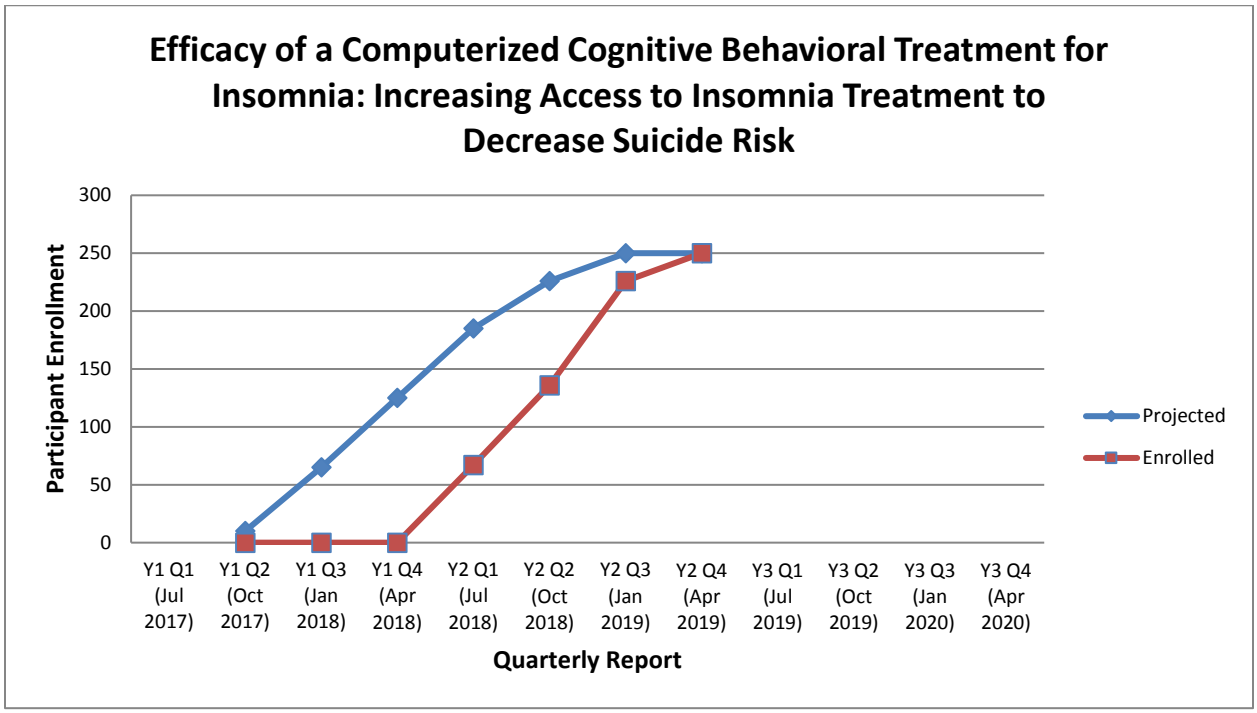
Goals for the next quarter: In the next quarter, we will finish collection of post-intervention assessments and continue collection of post-intervention sleep diaries, and 6-month follow-up assessments.

Problems, challenges and plans to address them: Although behind initial SOW planned enrollment, the team reached the targeted enrollment of 250 participants in early 2019 due to the successful recruitment approach employed over the previous four quarters.

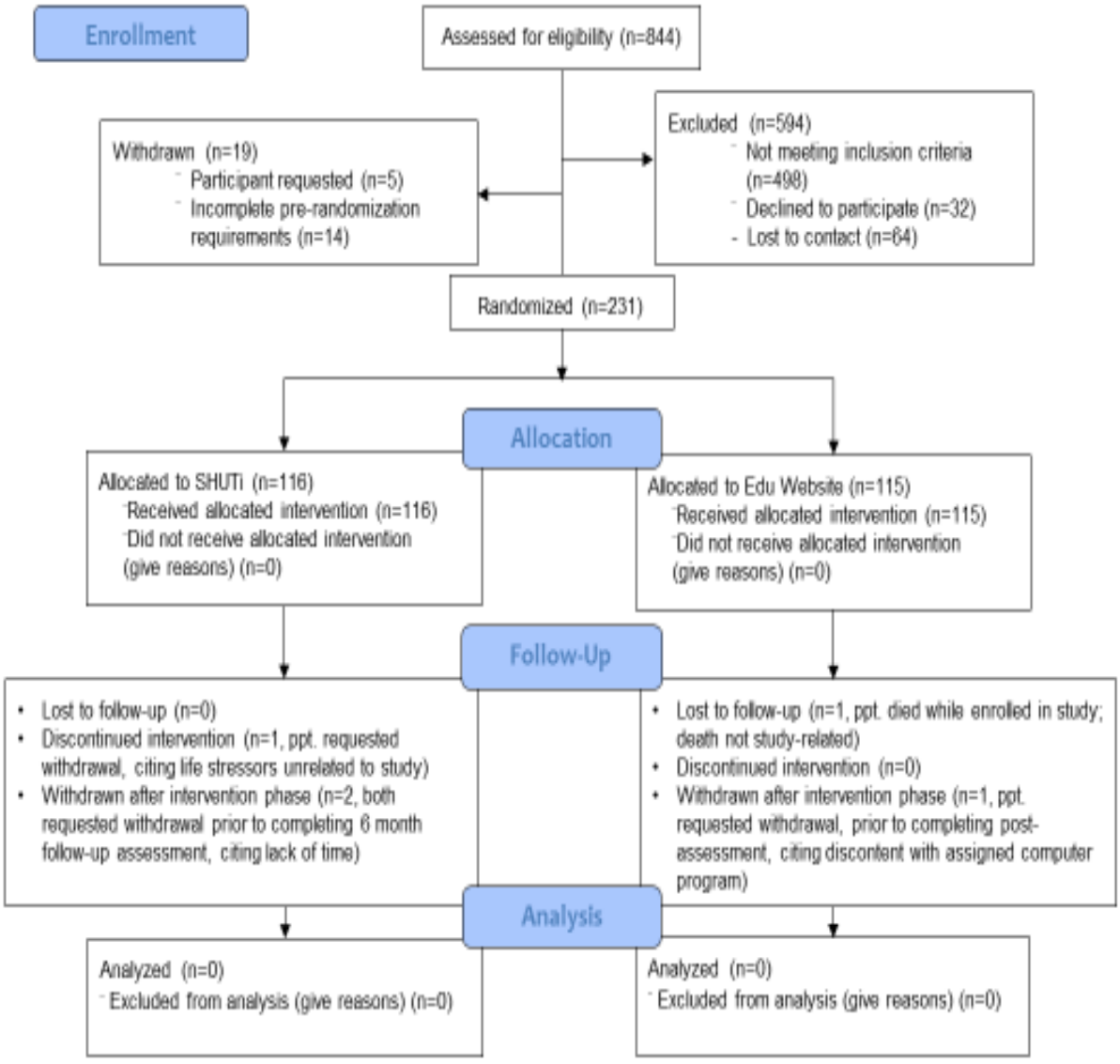
Publications, Presentations, and Media Requests: Nazem, S. (2019, February). The role of insomnia in suicide prevention. Presented at GRECC, MIRECC, COIN Joint Grand Rounds, Aurora, CO.

Recruitment and Retention

Enrollment – Randomization Attrition: 7.6%



CONSORT Diagram



A3. Interoceptive deficits and suicidality
PI: April Smith, PhD

Summary of Progress: Study progress over this quarter includes finalizing all planned analyses for Aims 1 and 2. Specifically, for Aim 1, we finalized the multigroup confirmatory factor analysis between controls, ideators, and attempters. This then allowed us to compare these groups on the interoceptive deficit latent variable. Groups differed in the expected direction (control < ideators < attempters). Further, as expected with Aim 2, the interoceptive deficit latent variable associates with ideation, NSSI, and frequency of attempts over and above other risk factors. Additionally, we finalized coding of the lethality of all the attempts and thus were able to test whether the interoceptive deficit latent variable associated with the lethality of the suicide attempts, which it did, as predicted. Additionally, we began preparing a paper detailing these results for publication and a presentation of the results that will be given at the upcoming American Association of Suicidology conference on 04/26/19.

Regulatory:

Initial IRB approval date: Miami University Exempt Determination on December 5, 2017.

Initial HRPO approval date: Determined this is Research Not Involving Human Subjects Determination on January 4, 2018. No further requirement for review by HRPO.

Recruitment: N/A

Progress in relation to the statement of work tasks and objectives:

Task	Timeline	Progress
Submit Human Subjects Exempt IRB application to Miami University IRB and address any requested IRB application revisions	Months 1-3	Complete
Submit application to Human Research Protection Office	Months 1-3	Complete
Create syntax to classify participants into relevant suicide groups	Months 3-5	Complete
Classification and inter-rater reliability of suicide attempt lethality	Months 3-13	Complete
Complete measurement model for interoceptive deficits latent variable to determine which indicators should be retained.	Months 5-7	Complete
Complete confirmatory factor analysis on latent interoceptive deficits variable; complete multi-	Months 7-10	These analyses are complete. Groups differed in the expected direction on

group confirmatory factor analysis to identify group differences		interoceptive deficits (control < ideators < attempters).
Use structural equation modeling to test whether the interoceptive deficits latent variable associates with self-injurious thoughts and behaviors.	Months 8-14	These analyses are complete. Models identifying how the latent interoceptive deficits variable associates with suicidal ideation, nonsuicidal self-injury, lifetime suicide attempts, and attempt lethality are complete.
Complete multi-group confirmatory factor analysis to identify group differences between service members and civilians.	Months 11-13	This aim was not able to be completed as the civilian database is missing key comparison variables.
Disseminate study findings	Months 13-18	We continue our work on this. Our AAS conference submission detailing this work was accepted for presentation. We have begun writing up the results for publication.

Major findings, results, and/or significance for this project during this quarter: We finalized the project results and drafted them for publication. An excerpt of those results read as follows:

We next proceeded to testing differences in latent means for a partially invariant model. The Control group served as the reference group and thus its factor mean was fixed to zero. The means model demonstrated good fit. Further, the Ideator factor mean (mean = 1.38) was significantly different than the Control group ($p < .01$), as was the Attempter factor mean (mean = 1.85, $p < .01$).

To determine whether interoceptive deficits were associated with suicidal ideation and behavior over and above other established risk factors, hopelessness, age, and gender were modeled as covariates. Results revealed that the interoceptive deficits latent variable was associated with suicidal ideation ($\beta = .42$, SE = .03, $p < .001$), NSSI ($\beta = .41$, SE = .03, OR = 2.85, $p < .001$), suicide attempts, ($\beta = .28$, SE = .03, OR = 1.86, $p < .001$), and attempt lethality ($\beta = .23$, SE = .03, $p < .001$) over and above these other covariates.

Taken together, our Aim 1 results indicate that interoceptive deficits meaningfully differentiate people with various degrees of lifetime suicidal thoughts and behaviors and our Aim 2 results indicate that interoceptive deficits are strongly and positively associated with lifetime suicidal thoughts and behaviors.

Goals for the next quarter: Goals for the next quarter include writing up the results for publication and presenting the findings at the American Association for Suicidology Conference in April 2019.

Problems, challenges and plans to address them: N/A

Publications, Presentations, and Media Requests: N/A

A4. Three Year Follow-up of Study on Suicide Risk Assessments within Suicide-Specific Group Therapy Treatment for Veterans
PI: Lora Johnson, PhD

Summary of Progress: 29 (of the planned 30) follow-up interviews have been completed. 1 participant is willing to complete the 30th interview. We are waiting for his signed consent form to arrive by mail before we can conduct the telephone interview. All (134) chart extractions have been single entered, 29 remain to be double entered. We anticipate double entry will be done in the next three weeks.

Regulatory:

Initial IRB approval date: December 20, 2017

Initial HRPO approval date: June 4, 2018

Continuing review approval date: November 20, 2018

HRPO continuing review acknowledgement: December 14, 2018

Recruitment:

Total projected enrollment: 30; 134 chart extractions

Recruitment start date: June 18, 2018

Projected quarterly enrollment: we will complete the final 1 interview and 29 2nd data extractions.

Subjects assessed for eligibility this quarter: 134 interviews

Number excluded: 13
- Did not meet inclusion/exclusion criteria: 12
- Declined to participate: 1

Subjects enrolled this quarter: 7 interviews

Progress in relation to the statement of work tasks and objectives:

Task	Timeline	Progress
Refine eligibility criteria, exclusion criteria, screening protocol	Months 1-3	Complete
Finalize consent form & human subjects protocol	Months 1-3	Complete
Finalize semi-structured assessment	Months 1-3	Complete
Coordinate with Sites for IRB protocol submission and approval	Months 1-3	Complete
Obtain HRPO approval	Months 1-3	Complete
Training of all staff doing chart extractions	Months 3-5	Complete

Data extraction from charts	Months 6-14	29 second extractions remain
Conduct 30 interviews	Months 6-12	1 interview remains. Subject has agreed to participate but cannot be interviewed until his consent forms arrive via mail.

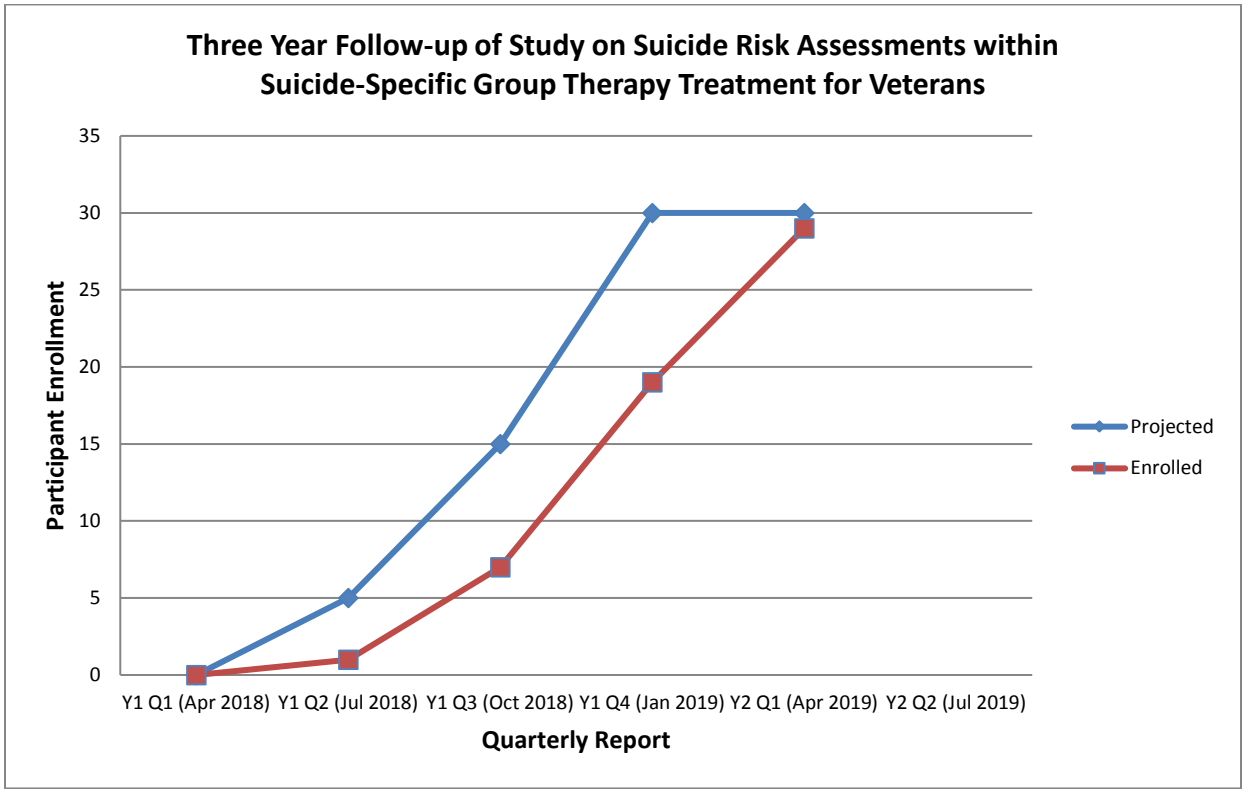
Major findings, results, and/or significance for this project during this quarter: N/A

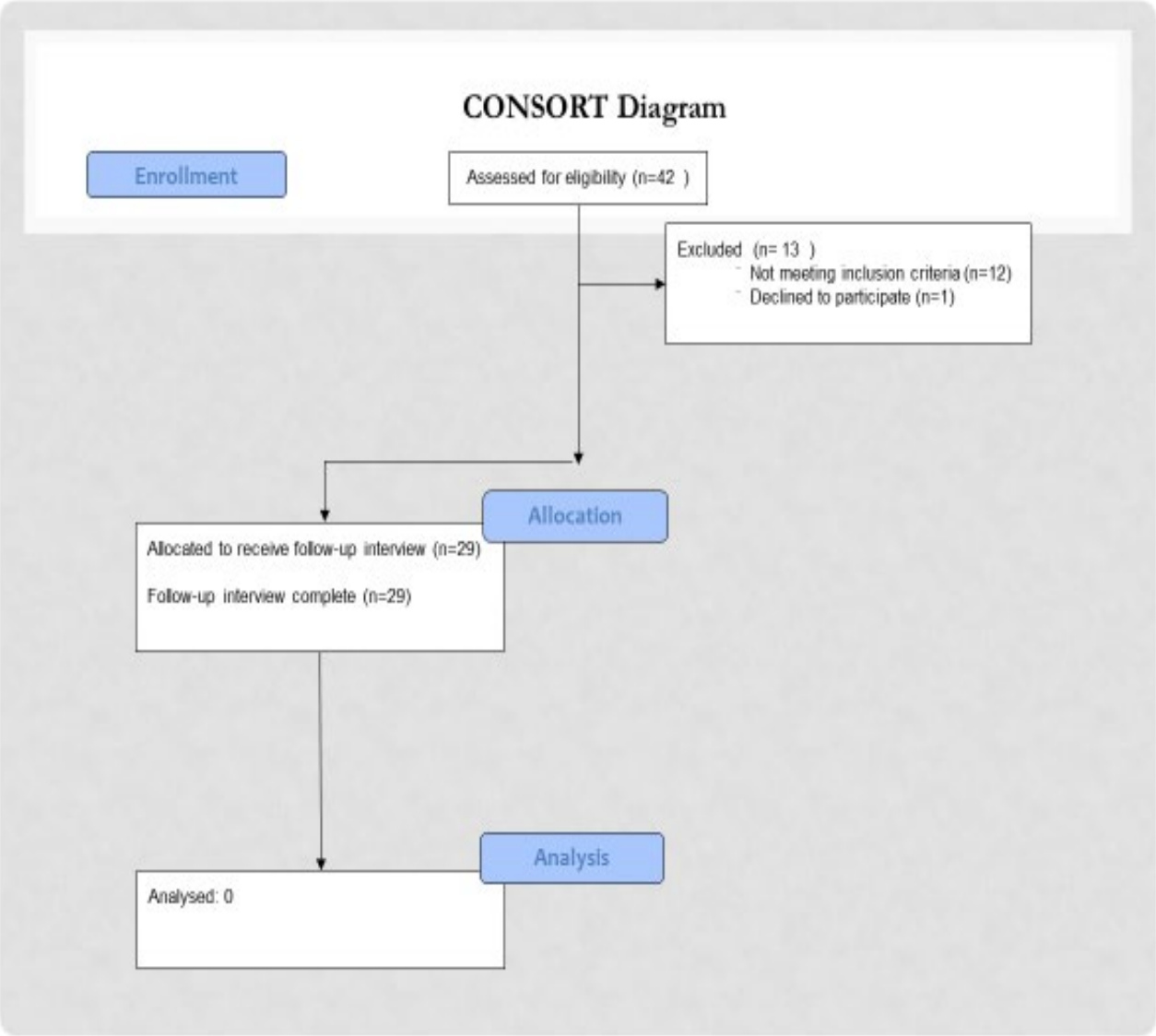
Goals for the next quarter: Complete data collection. The goal is to complete chart extractions and subject interviews, clean data, and run analyses in the next quarter.

Problems, challenges and plans to address them: N/A

Publications, Presentations, and Media Requests: N/A

Recruitment and Retention




CONSORT Diagram
Enrollment
Assessed for eligibility (n=42)
Excluded (n= 13)
Not meeting inclusion criteria (n=12)
Declined to participate (n=1)
Allocation
Allocated to receive follow-up interview (n=29)
Follow-up interview complete (n=29)
Analysis
Analysed: 0

A5. Establishing Measurement Equivalence of MSRC Database Assessments Across Demographic Groups
David Vogel, PhD

Summary of Progress: We are finalizing analyses of the measures and should have the proposed analyses completed by the end of April.

Regulatory:

Initial IRB approval date: Iowa State University Exempt Determination on January 25, 2018.

Initial HRPO approval date: Determined this is Research Not Involving Human Subjects Determination on February 26, 2018. No further requirement for review by HRPO.

Recruitment: N/A

Progress in relation to the statement of work tasks and objectives:

Task	Timeline	Progress
Refine data analytic plan, Coordinate University IRB and HRPO review, Finalize IRB protocol submission	Months 1-6	Complete
Perform MEI analyses, share output and finding with all investigators and with MSRC	Months 7-12	The analyses have been completed. Creating report to share findings.
Perform latent mean invariance and brief screening validity analyses, share output and finding with all investigators and with MSRC.	Months 13-15	Majority of analyses have been completed. Final analyses will be completed by the end of April.

Major findings, results, and/or significance for this project during this quarter: We have completed most of the proposed analyses. We have an accepted presentation at the American Psychological Association Annual Conference in August to report the results regarding the Posttraumatic Stress Checklist for Military Personnel. We are also submitting an abstract to the International Summit on Suicide Research to present on our validity analyses of the brief suicidal screeners.

Goals for the next quarter: Over the next quarter, we will complete the final set of analyses for the final report. As noted above, we also be working on disseminating and sharing the findings.

Problems, challenges and plans to address them: N/A

Publications, Presentations, and Media Requests: N/A

A6. Profiles of Behavioral Warning Signs for Suicide Attempts in the Prediction of Future Suicidality
PI: Courtney Bagge, PhD

Summary of Progress: The current study aims to prospectively examine whether specific behavioral warning signs (BWS), assessed at the time of hospitalization due to a recent suicide attempt, can predict post-discharge serious suicidal ideation and behavior. Knowledge about how specific patterns of BWS are associated with future suicidality would ultimately facilitate the selection of individualized treatment targets during hospitalization, inform discharge decisions regarding safety, forward evidence-based referrals, and optimize suicide prevention efforts for post hospitalization. We have completed Task 1 (Build Infrastructure for the Project) and Task 2 (Recruit and Consent Participants; Collect and Enter Data) is in progress.

Regulatory:

Initial IRB Approval Date: March 26, 2018

Initial HRPO Approval Date: May 15, 2018

Continuing Review Approval Date: March 21, 2019

HRPO Continuing Review Acknowledgment: submitted

Recruitment:

Total projected enrollment: 144

Recruitment start date: June 18, 2018

Projected quarterly enrollment: 27

Subjects assessed for eligibility this quarter: 32

Number excluded: 8
- Did not meet inclusion/exclusion criteria: 0
- Declined to participate: 6
- Other: 2

Subjects enrolled this quarter: 24

Subjects withdrawn this quarter: 0

Progress in relation to the statement of work tasks and objectives:

Task	Timeline	Progress
Build infrastructure for project.	Months 1-3 (Complete)	The project has been approved by the local IRB and HRPO. We have hired and trained a project assessor

		and the creation of databases is complete.
Recruit and consents participants; collect and enter data.	Months 4-16	We have fully completed 126 participants and 2 participants are in progress (this is 88% of what was is expected).

Major findings, results, and/or significance for this project during this quarter: N/A

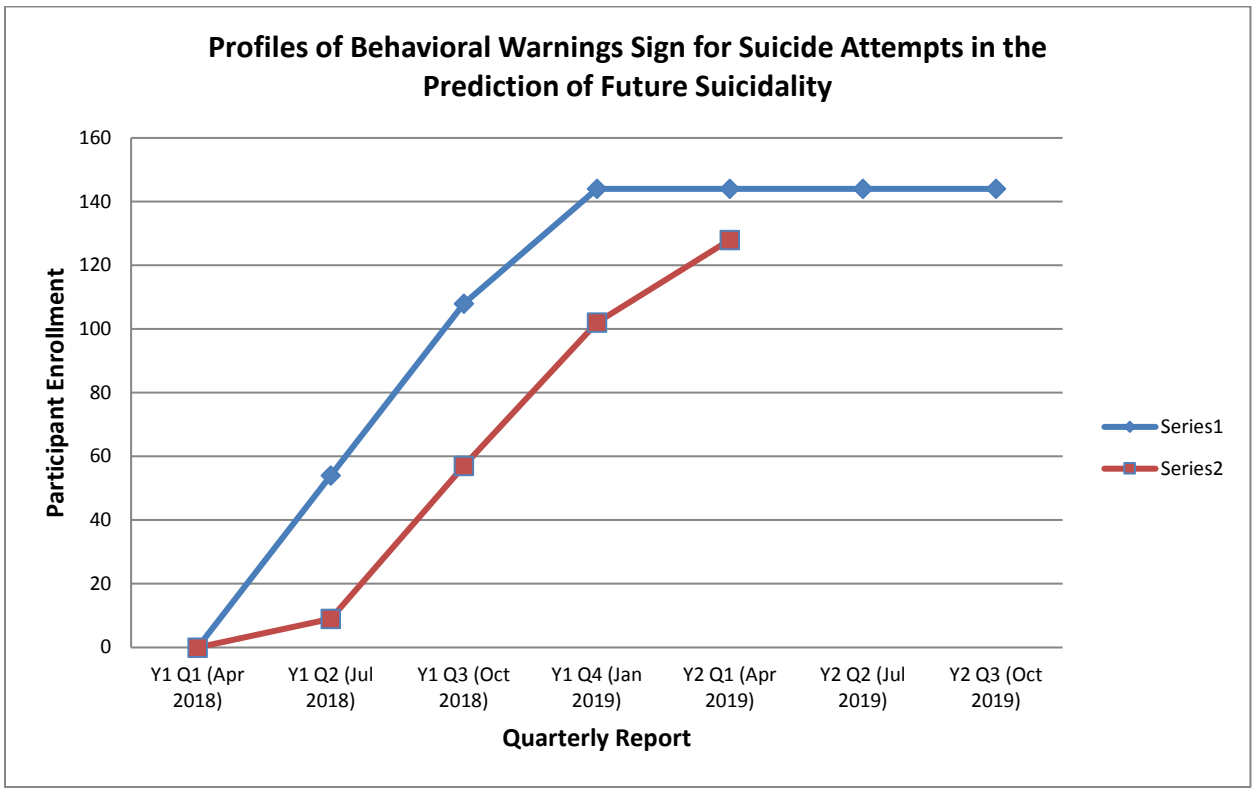
Goals for the next quarter: Continue to recruit and consent participants and double-enter data.

Problems, challenges and plans to address them: We submitted and obtained a no-cost extension in order to complete data collection and study milestones.

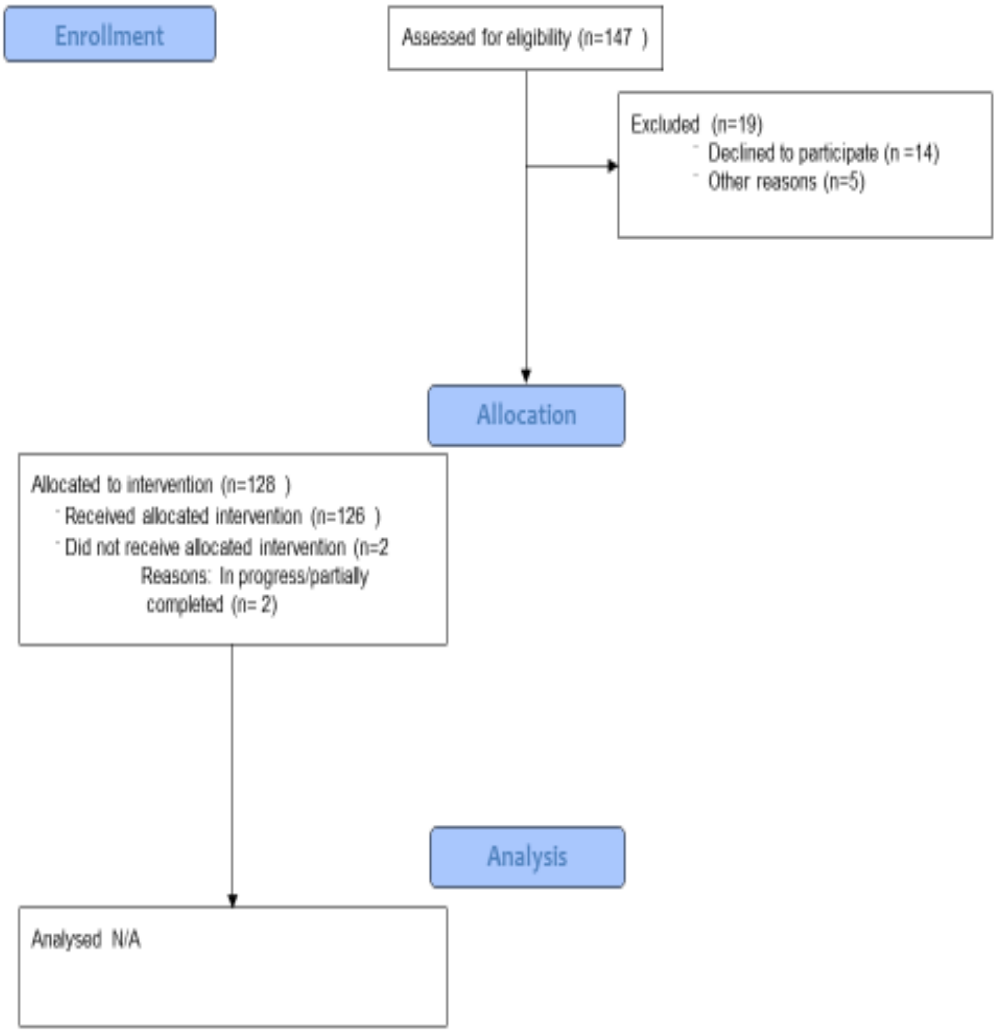
Publications, Presentations, and Media Requests: N/A

Leveraging: A volunteer is providing 12 hours a week to track participants.

Recruitment and Retention



CONSORT Diagram



A7. Couples Crisis Response Planning to Reduce Post-Discharge Suicide Risk
PI: Alexis May, PhD

Summary of Progress: The study's objectives are to determine the needs of service members and their partners for suicide prevention interventions and test the effect of the C-CRP, a targeted single-session couples intervention on suicide ideation among post-9/11 military service members and veterans. This Quarter, we continued to pursue achieving regulatory approval. A pre-review was completed by HRPO in January and University of Utah IRB approval was achieved on 1-APR-19. Materials were submitted to HRPO for approval on 04-APRIL-2019. In the meantime, training of study staff continued and meeting with study consultant Dr. Van Miller was conducted.

Regulatory:

Initial IRB approval date: April 01, 2019

Initial HRPO approval date: pending

Recruitment:

Total Projected Enrollment: 50 couples

Recruitment Start Date: Pending

Projected Quarterly Enrollment: 25 couples

Progress in relation to the statement of work tasks and objectives:

Task	Timeline	Progress
1. Obtain IRB approvals	Months 1-6	Efforts continue to gain regulatory approval. University of Utah IRB approval achieved 04/01/19. HRPO review in process.
2. Hire and train research staff	Months 3-9	All staff have been hired and training is well underway.
3. Begin and complete Phase 1 data collection	Months 1-9	This is delayed until regulatory approval is achieved. Materials and ads are prepared, and the database constructed.
4. Finalize CCRP protocol	Months 7-10	The protocol has been finalized.
5. Begin Phase 2 Data Collection	Months 11-30	This is delayed until regulatory approval is achieved. Materials are prepared.

Major findings, results, and/or significance for this project during this quarter: N/A

Goals for the next quarter: During the next Quarter (Months 14-16 of the project) we will continue to pursue regulatory approval. We will continue training staff members and research associates. As soon as we achieve HRPO approval we will begin enrolling participants in both the online and RCT portions of the study.

Problems, challenges and plans to address them: We plan to continue to address regulatory hurdles. We also plan to be in close and frequent contact with MSRC and CDMRP regarding progress and any additional delays or barriers.

Publications, Presentations and Media Request: N/A

A8. Enhancing Identification of Suicide Risk among Military Service Members and Veterans: A Machine Learning Approach to Suicidality
PI: Andrew Littlefield, PhD

Summary of Progress: The project is currently on track to meet all milestones within the time line specified within the statement of work's tasks and objectives. The research team is prepared to move to the next steps on the project. The research team has been in frequent contact in terms of both emails and conference calls regarding project milestones.

Regulatory:

Initial IRB approval date: Texas Tech University Exempt Determination on January 25, 2018; Harvard University Determination of Not Human Subjects Research on January 26, 2018; University of Rochester Determination of Not Human Subjects Research on February 6, 2018; University of Mississippi Medical Center Determination of Not Human Subjects Research on February 7, 2018.

Initial HRPO approval date: Determined this is Research Not Involving Human Subjects Determination on March 20, 2018. No further requirement for review by HRPO.

Recruitment: N/A

Progress in relation to the statement of work tasks and objectives:

Task	Timeline	Progress
IRB/HRPO Approvals	Months 1-6	Complete
Data cleaning and examining variable distributions.	Months 7-8	All sites have obtained data. With MSRC approval, a shared secure folder with relevant datasets has been established to increase efficiency of data sharing. Data cleaning, examining distributions of variables, and creating dependent variables has been completed.
Determine optimal number of latent classes to retain for mixture analysis	Months 9-10	These analyses are finalized.
Conduct exploratory factor analyses on available measures to create psychometrically enhanced measures of independent variables	Months 9-10	These analyses are finalized.
Coordinate with data analysis team to review main analytic plan	Month 11	The research team has been coordinating frequently and are ready to begin implementing the primary analytic plan.

Major findings, results, and/or significance for this project during this quarter: The research team has begun preliminary analyses though there are no major findings, etc. to report.

Goals for the next quarter: The project goals for the next quarter are to begin developing machine learning algorithms within each of the subdatasets for each outcome and using refined measures of study constructs derived from exploratory factor analysis. We are on scheduled to complete all study goals on time per the statement of work.

Problems, challenges and plans to address them: N/A

Publications, Presentations, and Media Requests: N/A

MSRC 1.0 Readiness Working Group Final Report
MCRS 1.0 Intervention: Caring Contacts via Text Message (Caring Contacts)
MCRS 1.0 Funded Study: Military Continuity Project (MCP): Evaluating the Efficacy of Caring Text Messages to Prevent Suicidal Behavior in Active Duty Suicidal Marines and Soldiers
PI: Katherine Anne (Kate) Comtois, PhD, MPH
Review Date: 08 NOV 2018 and 13 DEC 2018

Grant Summary
Randomized controlled trial with Soldiers and Marines with suicidality comparing a year of Caring Contacts via text messages + usual care vs. usual care alone to prevent suicide attempts, suicidal ideation, and hospitalizations.

Results
In this randomized controlled trial of 658 Soldiers and Marines, augmenting standard care with Caring Contacts did not reduce current suicidal ideation or suicide risk events at 12 month follow-up. However, Caring Contacts reduced the odds of having any suicidal ideation by 44% (80% vs. 88%) and making a suicide attempt by 48% (9% vs. 15%).

Executive Summary of Working Group Feedback
The study PI provided an intervention summary report that was made available to the MSRC Readiness Working Group (WG) prior to the scheduled review. The following summary presents WG feedback derived from meeting minutes taken by D&I Core staff during the WG review meeting discussion.

During the discussion, WG members acknowledged that study participants generally found the intervention helpful (study findings showed 84% of participants would recommend the intervention), and agreed that there was a clinically significant reduction in the odds of making a suicide attempt (SA) throughout follow-up (48%). Questions were posed as to what immediate next steps might be taken and whether or not there was the need for a replication study. Members were reluctant to suggest a full replication, but thought a replication study powered for participants with SA would be useful to confirm the study findings. An alternative option would be to conduct a hybrid effectiveness-implementation study that would allow for replication of effectiveness findings while also moving the field forward by focusing on implementation outcomes as well (e.g., how to get Caring Contacts into practice). WG members felt that current infrastructure across DoD and resources to support the implementation of the intervention would be barriers to uptake of this intervention by providers. Specifically, the primary concern was the labor-intensive resource requirement for continual message monitoring. The possibility of using already established resources such as the 24-hour Military Crisis Line, or those resources within the US Navy SAIL Suicide Prevention Program were considered as possible solutions. The need for weighing the modest effect against the amount of effort required for implementing Caring Contacts was discussed, and a cost-effectiveness analysis for implementation within military settings was recommended. It was noted that the scale of implementation could impact the cost effectiveness (e.g., implementing on a large scale with centralized coordination may result in better cost effectiveness).

<u>Specific Recommendations</u>
Primary DoD Applications
- None suggested.

Potential Pathways for Dissemination of the Intervention within the Military
- Groups with training capacity and adequate resources to implement the intervention with fidelity.
- May be piggybacked on an existing case management or long-term follow-up programs, perhaps within the Department of Veteran Affairs*

**Please see section "Other Research Currently Being Conducted" below*

Recommendations to Facilitate Military Dissemination and Implementation within the Military

- Potentially could incorporate information about Caring Contacts within the Center for Deployment Psychology workshops for DoD providers. This initiative would require additional resources for evaluation, but could be a vehicle for disseminating information to providers and obtaining feedback.

Potential Funding Sources for Future Research for this Intervention

- None suggested.

Contacts for Potential Future Research Funding or Intervention Dissemination & Implementation

- None suggested.

<u>Other Research Currently Being Conducted</u>

Other research on Caring Contacts is currently underway. A very large scale VA trial is examining sending Caring Contacts to all active duty service members upon separation from the military to assist in their transition and connection to VA. Also in VA, an implementation study is being conducted to determine how to adapt and implement Caring Contacts for a VA emergency department setting. NIMH has funded two clinical trials of Caring Contacts with American Indian and Alaska Native communities – one rural and one urban. These studies demonstrate a national interest and momentum for the intervention, especially in the Department of Veterans Affairs.

MSRC 1.0 Readiness Working Group Report

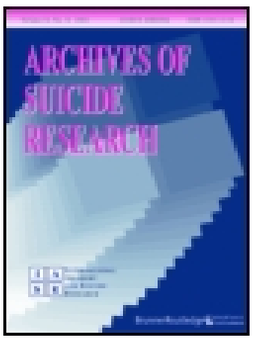
Research Finding Reviewed: Validity and reliability of 4 suicide risk assessments within an active duty sample
PIs: Peter Gutierrez PhD and Thomas Joiner, PhD
Review Date: 10 JAN 2019

Grant Summary
Title: Toward a Gold Standard for Suicide Risk Assessment for Military Personnel
Observational study comparing current psychometrically sound suicide risk assessment measures to determine which tool or combination optimally assesses the likelihood of suicide-related risk and behavior in a three month period. The measures were the C-SSRS, SHBQ, SBQ-R, and BSS. A total of 1,044 suicidal military service members completed baseline, 72.6% completed three-month follow-up.

Research Findings Discussed
Four commonly utilized suicide risk assessment measures: Columbia-Suicide Severity Rating Scale (C-SSRS). Self-Harm Behavior Questionnaire (SHBQ), Suicidal Behaviors Questionnaire-Revised (SBQ-R), and Beck Scale for Suicide Ideation (BSS), were found to be valid and reliable when used with active duty U.S. service members at risk for suicide with the exception of predictive validity, which has not been evaluated. Small differences in the psychometric properties were found across measures but overall performance was acceptable.

Executive Summary of Working Group Feedback
The Working Group did not recommend the implementation of these measures for two reasons: 1. Implementation of risk assessment in the military by DHA is being organized according to the VA/DoD Clinical Practice Guidelines, so new assessments would have to be recommend by or coordinated with these guidelines and 2. Pending further analyses that are planned to examine the predictive validity.

Further implementation research is warranted once the predictive validity has been established in order to determine the most effective way to implement these risk assessment tools.



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The Relationship between Suicidal Responses and Traumatic Brain Injury and Severe Insomnia in Active Duty, Veteran, and Civilian Populations

Kelly A. Soberay, Jetta E. Hanson, Megan Dwyer, E. Ashby Plant & Peter M. Gutierrez

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The Relationship between Suicidal Responses and Traumatic Brain Injury and Severe Insomnia in Active Duty, Veteran, and Civilian Populations

Kelly A. Soberay, Jetta E. Hanson, Megan Dwyer, E. Ashby Plant, and Peter M. Gutierrez

This study examined how a positive traumatic brain injury (TBI) screening and insomnia severity relate to suicidal outcomes across active duty, veteran, and civilian samples. Data were used from 3,993 participants from 19 studies. We conducted a series of analyses by group to identify which significantly differed on the variables of interest. TBI and insomnia each had independent relationships with outcomes over and above the impact of the other factor. Veterans presented as clinically worse across the outcomes. However, the relationship between insomnia and suicidal responses was stronger for active duty military compared to veterans. Continued research on TBIs and insomnia severity across groups will improve quality of care for those at risk of suicide.

Keywords insomnia, military, suicide, traumatic brain injury, veteran

INTRODUCTION

Suicide is one of the most complex problems plaguing families, researchers, and clinicians worldwide. In the United States, it is the tenth leading cause of death in civilians (Centers for Disease Control and Prevention [CDC], 2016), the second leading cause of death among military personnel (Armed Forces Health Surveillance Center, 2014; Ramchand, Acosta, Burns, Jaycox, & Pernin, 2011), and the second leading cause of death among veterans (Weiner et al., 2011). The military suicide rate had been historically lower than the civilian rate until 2009, and it has since

been steadily increasing (Alexander et al., 2014; Hoge & Castro, 2012; Luxton, June & Fairall, 2012). Similarly, suicides among U.S. veterans continue to climb, with an estimated 20 veteran deaths by suicide daily (U.S. Department of Veterans Affairs, 2016) and the male veteran suicide rate up to twice the rate of their civilian counterparts (Kemp & Bossarte, 2013). Research has identified several psychological, physical, and cognitive risk factors associated with an increased risk of suicide (e.g., Bryan & Clemans, 2013; Pigeon, Britton, Ilgen, Chapman, & Conner, 2012a; Pigeon, Pinquart, & Conner, 2012b). Among these are traumatic brain injuries and insomnia, which are more prevalent in active duty and veteran than civilian populations (e.g., Brenner, Ignacio, & Blow, 2011; Hoge, Robbins, & Grant 2008).

Traumatic brain injury (TBI) is associated with a higher risk of suicide in civilian (Fazel et al., 2014; Teasdale & Engberg, 2001), active duty military (Bryan & Clemans, 2013), and veteran populations (Brenner et al., 2011). These findings are especially relevant given that TBI has been labeled as one of the signature injuries of the Iraq and Afghanistan wars due to its high incidence rate (Hoge et al., 2008; Tanielian et al., 2008). The number of service members from the current conflicts who reported a TBI while on deployment ranges from approximately 15%–23% (Hoge et al., 2008; Terrio et al., 2009). In a study of U.S. military service members referred to a TBI clinic in Iraq, Bryan and Clemans (2013) found the number of TBIs that a service member experienced was significantly associated with suicidal thoughts and behaviors after controlling for clinical symptom severity. Research on both civilian (Teasdale & Engberg, 2001) and veteran populations (Brenner et al., 2011) indicates that suicide risk persists across TBI severity levels (mild, moderate, severe), again controlling for psychiatric diagnoses. Regardless of military or civilian status, individuals with a TBI are at an increased risk for suicide. However, identifying what psychological, physical, and cognitive factors may compound suicide risk is important.

Similar to suicide and TBI, insomnia is a public health concern linked to many physical and mental health conditions (Morin et al., 2006; Ohayon, 2002; Rosekind & Gregory, 2010). Suicide risk is one of the many mental health related concerns that has been associated with insomnia severity (Bernert et al., 2015; Bernert & Joiner, 2007; McCall et al., 2010; McCall & Black, 2013; Pigeon et al., 2012b). There is a unique opportunity for clinicians who identify insomnia severity as it is a modifiable risk factor that often lacks the stigma associated with suicide risk. There has been extensive research into insomnia in military, veteran, and civilian populations. A large cross-sectional study of 8,098 adults reported that shorter duration of sleep is associated with increased suicidal ideation and attempts, independent of comorbid mental disorders (Goodwin & Marusic, 2008). Furthermore, there is evidence that the occurrence of insomnia has steadily increased during the same timeframe as the increase in suicide risk in military populations (Armed Forces Health Surveillance Center, 2010; McCarthy et al., 2009), although this finding does not mean there is necessarily a causal link between the two. The literature concurs that insomnia severity is a risk factor for suicide among military personnel. Luxton and colleagues (2011) conducted a cross-sectional study of soldiers who had recently returned from combat. They

reported that sleep durations of 6 hours or less were associated with increased suicide risk. Similarly, Ribeiro and colleagues (2012) examined insomnia severity and how it related to current and future suicide ideation in a sample of active duty soldiers. Even when controlling for depression, posttraumatic stress disorder (PTSD), anxiety, substance abuse, and hopelessness, insomnia severity had a direct association with current and future suicide ideation. In addition, a chart review study conducted at the Department of Veteran Affairs revealed that veterans with documented sleep complaints died by suicide sooner than those without such complaints (Pigeon et al., 2012a). Suicide prevention efforts that target sleep disturbances have the potential to not only help individuals with current mental health disorders, but also lessen the likelihood of developing anxiety, mood, or substance use related disorders.

Independently, both a history of TBI and insomnia severity are suicide risk factors. In addition, sleep disturbances are a common sequalae following a TBI, impacting between 30% and 70% of individuals post-TBI (Ouellet & Morin, 2006; Viola-Saltzman & Watson, 2012). There is evidence to support that mild TBIs affect sleep disturbances in active duty military and civilian populations (Lew et al., 2010; Ouellet & Morin, 2006). Research supports that insomnia is a multifactorial problem similar to suicide risk and that a TBI may significantly impact both outcomes (Bramoweth & Germain, 2013). Therefore, it would be valuable to examine the impact of both TBI and insomnia simultaneously to identify the independent relationship of each one to suicidal outcomes, and to examine possible interaction effects. However, this goal is complicated by the fact that insomnia is also a common sequela of at TBI.

Although a significant amount of research has independently examined the link between TBI and insomnia and suicidal outcomes, only one study explored the relationships of TBI, insomnia severity, and suicidality within a military population. In 2013, Bryan and colleagues administered a battery of mental health assessments, including the Insomnia Severity Scale (ISI) and the Suicidal Behaviors Questionnaire-Revised (SBQ-R), to 158 military personnel referred to an outpatient TBI clinic. The authors noted that participants with mild TBI reported significantly more severe depression, PTSD, insomnia, and suicidal symptoms (Bryan et al., 2013). However, a limitation to this study was its focus on risk factors as a whole, with limited attention to insomnia specifically. In addition, a single study does not provide adequate information about the roles of TBI and insomnia on suicidal behaviors. To our knowledge, no research has reported the effects of TBI and insomnia using the same measures across active duty, veteran, and civilian samples. Our study aims to fill this gap by exploring the independent relationship between a positive TBI screening and insomnia severity with risk for suicide across active duty, veteran, and civilian samples.

METHODS

Procedure and Participants

Participants were recruited as described per the study protocol from 19 studies funded by the Military Suicide Research Consortium (MSRC). Additional information on the MSRC funded study protocols is available (see Ringer et al., 2018). Methods, recruitment settings, study design, and measure administration varied between each study. Four of the

nineteen studies recruited participants who were not experiencing some level of psychological distress past or present, defined specifically by study. The four studies consisted of 30.2% of the participants, accounting for approximately 4.4% of the veteran group, 15.7% of the active duty group, and 10.1% of the civilian group. However, all participants completed the same battery of self-report measures known as the MSRC Common Data Elements (CDEs). A total of 3,993 active duty military, veteran, and civilian participants were included for this study. Studies enrolling civilian participants included questions on military history in their demographic forms to appropriately categorize participants as civilians (those with no military experience) or veterans. Participants were predominately male (70.0%), with 29.5% reporting as female, 0.2% as transgender, and 0.3% not reporting their gender. Racial distribution was 66.0% White/Caucasian, 19.9% Black/African American, 2.1% Asian, 0.9% Native American/Native Alaskan, 0.2% Pacific Islander, 2.0% Multiracial, 8.1% "Other", and 0.8% did not report their racial background. Descriptive statistics for the basic demographics for the sample as a whole and broken down by military experience can be found in Table 1. Active Duty participants comprised 42.2% ($n = 1{,}684$) of the study sample, with 24.0% civilians ($n = 959$), and 33.8% veterans ($n = 1{,}350$) also participating. Approximately 49% of the active duty participants reported previous deployment history, whereas only 25% of the veteran participants reported the same. However, not all of the studies collected deployment history, so that information was missing for 39% of the veteran participants and 6% of the active duty participants. Veterans from all eras were enrolled; however, studies varied on reporting era within their demographic forms and therefore not included. See Table 2 for military branch and experience.

Approval was required for all study protocols by the lead organization's institutional review board (IRB) and the Department of Defense's Human Research Protection Office (HRPO). Protocols and inclusion/exclusion criteria for participants varied across the funded studies. National Guard participants recruited within this research were activated at the time of enrollment and therefore were included within the active duty military subgroup.

Measures

All MSRC funded studies include the MSRC CDEs (Ringer et al., 2018). The MSRC CDEs were designed to broadly assess suicide-related behavior and empirically established suicide risk factors. The items within the CDEs were selected by a panel of expert suicidologists. The MSRC CDEs consist of 57 items, including 47 from existing validated measures and 10 created specifically for this measure. Initial evidence on the MSRC CDEs supports its use as a psychometrically valid, brief measure of suicide risk (Ringer et al., 2018). The following measures within the MSRC CDEs were examined for this study.

Traumatic Brain Injury-4 (TBI-4). The TBI-4 is a four-item TBI screening tool (Brenner et al., 2013). The four questions assess possible accidents or injuries that may have resulted in a traumatic brain injury. Ongoing research is being conducted to establish the concurrent validity and clinical utility of the TBI-4 questions (Brenner et al., 2013; Olson-Madden et al., 2014; Schneider et al., 2016). Previous research has examined the

TABLE 1. **Demographic Information as a Function of Military Service**

N **(%)** **Age**		**Active duty (*n* = 1,684)**	**Veteran (*n* = 1,350)**	**Civilian (*n* = 959)**
Mean Age (SD)	34.55 (14.37)	$25.97\ (7.08)_a$	$46.37\ (14.07)_b$	$32.90(12.80)_c$
Gender				
Male	2795 (70.0%)	$1318\ (78.3\%)_a$	$1144\ (84.7\%)_b$	$333\ (34.7\%)_c$
Female	1179 (29.5%)	$351\ (20.8\%)_a$	$203\ (15.0\%)_b$	$625\ (65.2\%)_c$
Transgender	9 (0.2%)	$8\ (0.5\%)_a$	$1\ (0.1\%)_a$	
Missing	10 (0.3%)	$7\ (0.4\%)_a$	$2\ (0.1\%)_a$	$1\ (0.1\%)_a$
Race				
White/Caucasian	2637 (66.0%)	$1038\ (61.6\%)_a$	$930\ (68.9\%)_b$	$669\ (69.8\%)_b$
Black/ African American	795 (19.9%)	$343\ (20.4\%)_a$	$257\ (19.0\%)_a$	$195\ (20.3\%)_a$
Native American/Alaskan	36 (0.9%)	$13\ (0.8\%)_a$	$19\ (1.4\%)_{ab}$	$4\ (0.4\%)_{ac}$
Asian	82 (2.1%)	$48\ (2.9\%)_a$	$21\ (1.6\%)_b$	$13\ (1.4\%)_b$
Pacific Islander	8 (0.2%)		8 (0.6%)	
Multiracial	80 (2.0%)	$1\ (0.1\%)_a$	$46\ (3.4\%)_b$	$33\ (3.4\%)_b$
Other	322 (8.1%)	$231\ (13.7\%)_a$	$49\ (3.6\%)_b$	$42\ (4.4\%)_b$
Missing	33 (0.8%)	$10\ (0.6\%)_a$	$20\ (1.5\%)_b$	$3\ (0.3\%)_a$
Ethnicity (Hispanic or Not)				
Hispanic	356 (8.9%)	$187\ (11.1\%)_a$	$101\ (7.5\%)_b$	$68\ (7.1\%)_b$
Non-Hispanic	3321 (83.2%)	$1303\ (77.4\%)_a$	$1164\ (86.2\%)_b$	$854\ (89.1\%)_b$
Other	59 (1.5%)	$59\ (3.5\%)_a$		
Missing	257 (6.4%)	$135\ (8.0\%)_a$	$85\ (6.3\%)_a$	$37\ (3.9\%)_b$
Relationship Status				
Married	1264 (31.7%)	$586\ (34.8\%)_a$	$262\ (19.4\%)_b$	$416\ (43.4\%)_c$
Single	1598 (40.0%)	$863\ (51.2\%)_a$	$370\ (27.4\%)_b$	$365\ (38.1\%)_c$
Cohabitating	39 (1.0%)		$19\ (1.4\%)_a$	$20\ (2.1\%)_a$
Widowed	51 (1.3%)	$1\ (0.1\%)_a$	$32\ (2.4\%)_b$	$18\ (1.9\%)_b$
Divorced/ Separated	792 (19.8%)	$221\ (13.1\%)_a$	$435\ (32.2\%)_b$	$136\ (14.2\%)_a$
Other	9 (0.2%)		9 (0.7%)	
Missing	240 (6.0%)	$13\ (0.8\%)_a$	$223\ (16.5\%)_b$	$4\ (0.4\%)_a$

Note. Age means between columns without common subscripts differ at $p < .05$. Percentages were rounded to the first decimal place.

specificity and sensitivity of using only an affirmative response to question 2 of the TBI-4 compared to an affirmative response to any of the four questions. Brenner and colleagues (2013) reported that specificity on all four items was 0.56 and sensitivity was 0.74; whereas with question 2, specificity increased to 0.77 and sensitivity was lower at 0.58. Our analyses included a TBI positive screen if a participant responded affirmative that any of the possible accidents or injuries had occurred. If

TABLE 2. **Military History**

	Active duty (n = 1,684)	Veterans (n = 1,350)
Military Branch		
Army–Active Duty	457 (27.1%)	504 (37.3%)
Army Reserves	1 (.1%)	12 (.9%)
Army National Guard	568 (33.7%)	49 (3.6%)
Air Force Active Duty	31 (1.8%)	130 (9.6%)
Air Force Reserves	2 (.1%)	2 (.1%)
Air Force National Guard	3 (.2%)	7 (.5%)
Navy Active Duty	456 (27.1%)	226 (16.7%)
Navy Reserves	2 (.1%)	8 (.6%)
Marine Corps–Active Duty	117 (6.9%)	158 (11.7%)
Marine Corps Reserves		5 (.4%)
Coast Guard–Active Duty	10 (.6%)	10 (.7%)
Coast Guard Reserves	2 (.1%)	
Unspecified/Other	27 (1.6%)	11 (.8%)

they responded "no" to all the items, they received a negative screen for TBI.

Insomnia Severity Index (ISI). The ISI is a 7-item measure that examines current sleep difficulties (i.e., last 2 weeks) and its effects on daily functioning (Bastien, Vallières, & Morin, 2001). The MSRC CDEs included an abbreviated 5-item version of the 7-item ISI to measure insomnia severity. Participants rated common insomnia symptoms (e.g., difficulty staying asleep) on a 5-point Likert scale (0–4) measuring severity, satisfaction, and interference with higher scores indicating greater insomnia. Previous research indicates that the full ISI exhibits good psychometric properties, including high internal consistency and validity (Bastien, Vallières, & Morin, 2001; Morin et al., 2011). A recent examination of the 5-item ISI used within the MSRC CDEs found that internal consistency of the MSRC CDEs version was also good (Cronbach's $\alpha = 0.87$; Ringer et al., 2018). In this study, the ISI severity subscale demonstrated good internal consistency (Cronbach's $\alpha = 0.86$).

Suicidal Behaviors Questionnaire-Revised (SBQ-R). The SBQ-R is a 4-item measure of lifetime suicide ideation, plans, and attempts, recent frequency of suicidal ideation, communication of suicidal intent, and self-determined likelihood of future suicidal behavior (Osman et al., 2001). The 4 items are assessed on Likert scales of varying lengths. Previous studies have demonstrated the SBQ-R to be valid and reliable across a range of populations with good internal consistency (Osman et al., 2001). The full measure of the SBQ-R was included in the CDEs, and it exhibited good internal consistency within this sample (Cronbach's $\alpha = 0.81$). However, in the present study, the individual items from the SBQ-R were analyzed separately.

Data Analysis

Data were analyzed using SPSS version 22. We conducted a series of

TABLE 3. **Analysis of Variance and Descriptive Statistics for Variables by Military Service**

Variable	Military service *F p*	Active duty ($n = 1,684$) *M*	*SD*	Veteran ($n = 1,350$) *M*	*SD*	Civilian ($n = 959$) *M*	*SD*
TBI screen	195.41 < .001	$.43_a$	.50	$.76_b$	.43	$.48_a$	.50
Insomnia severity	82.64 < .001	1.69_a	1.14	2.17_b	.97	1.82_c	.95
Suicidal behavior	58.29 < .001	2.25_a	1.17	2.71_b	1.18	2.54_c	1.23
Suicidal thoughts	56.72 < .001	2.51_a	1.55	2.89_b	1.60	2.21_c	1.47
Suicidal communication	19.36 < .001	1.47_a	.66	1.63_b	.79	1.50_a	.74
Suicidal likelihood	89.05 < .001	1.50_a	1.30	1.92_b	1.75	1.07_c	1.50

Note. Means between columns without common subscripts differ at $p < .05$ according to a Tukey's Post Hoc HSD test. The TBI screen was scored 0 (*negative*) or 1 (*positive*). Insomnia severity was scored on a 0 (*none*) to 4 (*very severe*) scale. Suicidal behavior was scored on a 1–4 scale, suicidal thoughts on a 1–5 scale, suicidal communication on a 1–3-point scale, and suicidal likelihood on a 0–6-point scale with higher scores indicating a more intense suicidal response in each case.

between-subject 3 group (military service: active duty vs. veteran vs. civilian) Analyses of Variance (ANOVAs) on the TBI screen, insomnia severity, as well as the items from the SBQ-R assessing frequency of current thoughts (coded as suicidal thoughts), lifetime history of suicidal behavior (coded as suicidal behavior), communication of suicidal intent (coded as suicidal communication), and future likelihood (coded as suicidal likelihood). We followed up significant main effects with Tukey tests to identify which of the military service groups significantly differed from each other.

Following the ANOVAs, we conducted a series of regression analyses to explore whether screening positive for a TBI and insomnia severity predicted suicidal thoughts, behavior, communication, and likelihood and whether the effect of these factors varied as a function of military service. Given the relationship typically found between TBI and insomnia (Ouellet & Morin, 2006; Viola-Saltzman & Watson, 2012), it was not surprising that a positive screen for TBI was correlated with insomnia severity in the present sample ($r = .25$, $p < .001$). However, there is no suitable way to independently assess the impact of insomnia versus insomnia as a sequela of TBI. Dummy codes were created with currently active duty as the comparison group. We regressed suicidal behavior, thoughts, communication, and likelihood on the TBI screen dichotomous variable, centered insomnia severity scores, the two dummy codes for military service, and the 2-way interactions between the dummy codes and TBI screening, the dummy codes and insomnia severity, and insomnia severity and TBI screening.

RESULTS

As a first step in examining our results, we compared participants across our key measures who were currently active duty military (active duty) to those who were veterans of military service (veteran) and those who had never served in the military (civilian). All descriptives and statistics

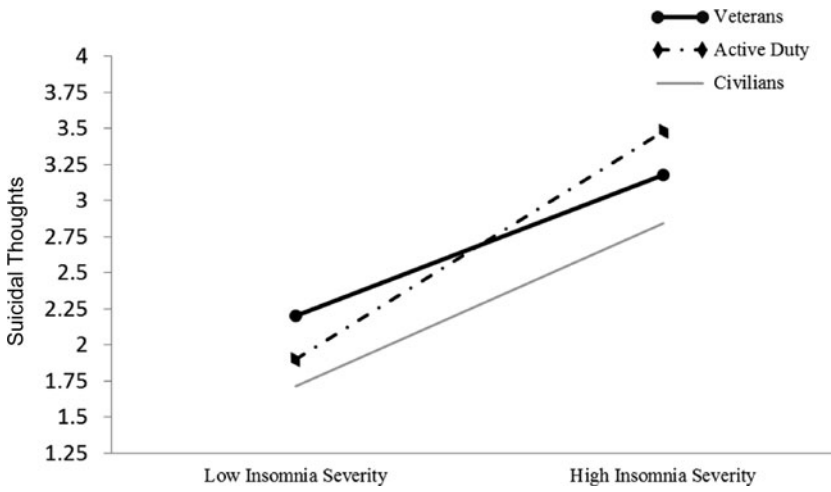

FIGURE 1. *Suicidal Thoughts as a function of Insomnia Severity (+ or -1 SD) and Military status (Veterans vs. Active Duty and Civilian vs. Active Duty).*

from these ANOVAs can be found in Table 3.

For each of our variables, there was a main effect of military service. Generally, the veterans scored higher across the variables than the other groups. On average, the veterans were more likely to screen positive on the TBI screen than both the active duty and civilian groups. The active duty and civilian groups, however, did not significantly differ on the TBI screen. Examination of the insomnia measure revealed that the veterans reported the highest levels of insomnia severity. The civilians reported the next highest level of insomnia severity, and participants who were currently active duty reported the lowest levels of insomnia severity.

The veterans reported higher levels on all variables of the suicidal measures (i.e., suicidal behavior, thoughts, communication, and likelihood) compared to the civilian and active duty participants. For suicidal thoughts and likelihood, the active duty participants reported higher rates than the civilians. In contrast, for suicidal behavior, the civilians reported higher levels than the active duty participants. Finally, for suicidal communication, the active duty and civilian participants did not differ from each other.

We next conducted a series of regression analyses to examine whether the TBI screen and insomnia severity predicted suicidal thoughts, behavior, communication, and likelihood and whether their effects varied as a function of military service.

The analysis of suicidal thoughts revealed main effects of a positive TBI screen ($B = .18$, $p = .01$, semi-partial $r = .04$, 95% CI [0.04, 0.32]) and insomnia severity ($B = .79$, $p < .001$, semi-partial $r = .29$, 95% CI [.72, .86]). Participants who screened positive for TBI and who reported greater issues with insomnia tended to report a higher frequency of suicidal thoughts. The main effect of insomnia severity was qualified by two 2-way interactions with the military service dummy codes. There was a 2-way interaction between insomnia severity and comparing active duty to veterans ($B = -.30$,

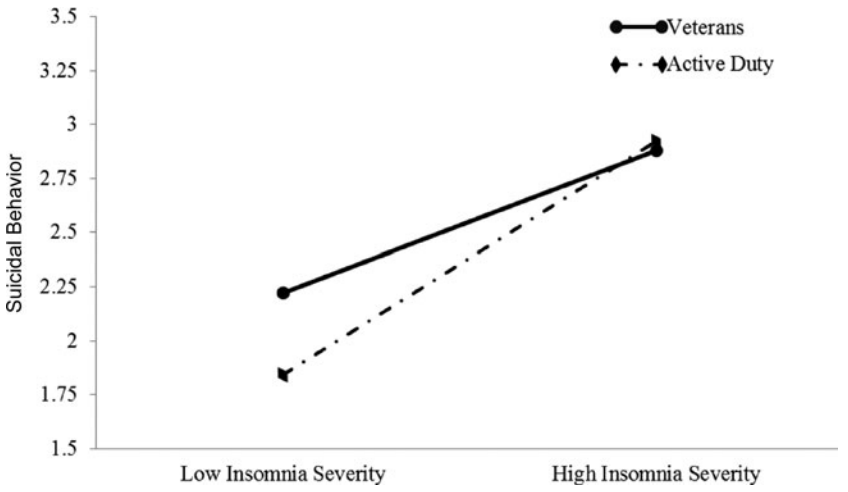

FIGURE 2. *Suicidal Behavior as a function of Insomnia Severity (+ or - 1 SD) and Veterans vs. Active Duty Participants.*

$p < .001$, semi-partial $r = -.08$, 95% CI [−.41, −.19]) and insomnia severity and comparing active duty to civilians ($B = -.22$, $p < .001$, semi-partial $r = -.05$, 95% CI [−.34, −.11]; Figure 1). Examination of these two interactions revealed that the impact of insomnia severity on suicidal thoughts was stronger for participants who were currently active duty ($\beta = .51$, $p < .001$) compared to those who were veterans ($\beta = .31$, $p < .001$) or civilians ($\beta = .36$, $p < .001$).

The analysis of suicidal behavior also revealed main effects of a positive TBI screen ($B = .21$, $p < .001$, semi-partial $r = .06$, 95% CI [0.11, 0.32]) and insomnia severity ($B = .54$, $p < .001$, semi-partial $r = .26$, 95% CI [.49, .60]). Participants who screened positive for TBI and who reported greater issues with insomnia tended to report a higher instance of previous suicidal behavior. The main effect of insomnia severity was qualified by a 2-way interaction between insomnia and comparing participants who were currently active duty to veterans ($B = -.21$, $p < .001$, semi-partial $r = -.07$, 95% CI [−.29, −.12]; Figure 2). Examination of this interaction revealed that the impact of insomnia severity on suicidal behavior was stronger for participants who were currently active duty ($\beta = .45$, $p < .001$) compared to those who were veterans ($\beta = .28$, $p < .001$).

Similar to suicidal thoughts and behavior, the analysis of suicidal communication revealed main effects of a positive TBI screen ($B = .09$, $p = .014$, semi-partial $r = .04$, 95% CI [0.02, 0.16]) and insomnia severity ($B = .20$, $p < .001$, semi-partial $r = .16$, 95% CI [.17, .24]). A positive TBI screen and insomnia severity were both positively related to suicidal communication. The main effect of insomnia severity was qualified by a 2-way interaction between insomnia and comparing participants who were currently active duty to veterans ($B = -.07$, $p = .008$, semi-partial $r = -.04$, 95% CI [−.13, −.02]). Like the analysis for suicidal

behavior, the impact of insomnia severity on suicidal communication was stronger for participants who were currently active duty ($\beta = .28$, $p < .001$) than it was for veterans ($\beta = .18$, $p < .001$).

The analysis for suicidal likelihood revealed a main effect of insomnia severity ($B = .11$, $p < .001$, semi-partial $r = .15$, 95% CI [.31, .46]), such that people with higher levels of insomnia reported a higher likelihood of future suicidal behavior. The analysis also revealed two 2-way interactions between a positive TBI screen and comparing active duty to veterans ($B = .36$, $p = .002$, semi-partial $r = .05$, 95% CI [.13, .60]) and a positive TBI screen and comparing active duty to civilians ($B = .27$, $p < .024$, semi-partial $r = .03$, 95% CI [.04, .51]). Examination of these two interactions revealed that whereas the relationship between a positive TBI screen and suicidal likelihood was nonsignificant for participants who were currently active duty ($\beta = .04$, $p = .14$), TBI was positively related to suicidal likelihood for veterans ($\beta = .15$, $p < .001$) and civilians ($\beta = .12$, $p < .001$).

In summary, insomnia severity was associated with more suicidal responses across all outcomes. However, the relationship with suicidal behavior, thoughts, and communication was stronger for currently active duty participants than veterans (and stronger for currently active duty than civilians for suicidal thoughts). A positive TBI screen had a similar and significantly negative relationship with suicidal behavior, thoughts, and communication; whereas, the relationship with suicidal likelihood was only significant for the veterans and civilians. In general, insomnia severity seemed particularly problematic for people who were currently active duty, whereas TBI was somewhat less problematic for them (regarding suicidal likelihood).

DISCUSSION

Although previous research has established that traumatic brain injury and insomnia severity are each separately associated with increased suicide risk (e.g., Bernert et al., 2015; Brenner et al., 2011; Teasdale & Engberg, 2001), to our knowledge, no single study has examined their simultaneous impact across active duty, veteran, and civilian populations. Our study is consistent with the current literature, demonstrating that a positive TBI screen and insomnia severity increase risk of suicidal outcomes, such as suicidal thoughts, behaviors, communication of intent, and likelihood for a future attempt. Furthermore, our findings demonstrate that TBI and insomnia each have independent relationships with these suicidal outcomes over and above the impact of the other factor. Additionally, our study shows the relative impact of these factors across the three populations and how the different groups compare on these predictors and suicidal outcome measures. Overall, our study found that veterans presented as clinically worse across the suicidal outcomes than the active duty military and civilian groups, leading to possible recommendations for improving future treatment. For example, research indicates that Item 3 of the Patient Health Questionnaire-9 (PHQ-9) may be an effective screening tool to determine likelihood for sleep disturbances in veterans (MacGregor et al., 2012). The PHQ-9 is a popular screening measure that would allow the Department of Defense, Department of Veterans Affairs, and general Primary Care Providers (PCPs) to easily screen for sleep without unnecessary burden. Should an individual screen positively for a sleep disturbance on the PHQ-9, the ISI severity scale used in this study

would allow providers to better address sleep hygiene and further determine best treatment options. Cognitive Behavioral Therapy for Insomnia (CBT-I) has been packaged and validated for individual therapy, group therapy, web-based applications, and telehealth (Holmqvist, Vincent, & Walsh, 2014; Koffel, Koffel, & Gehrman, 2015; Talbot et al., 2014). Additional research on phone applications such as SHUTi and CBT-I Coach would further insomnia treatment reach and accessibility (Kuhn et al., 2016), especially for active duty military and rural veterans and civilians.

The prevalence of TBIs from the recent conflicts in Iraq and Afghanistan helped elevate its medical understanding and assessment (Risling, 2010), both in the military and civilian settings. The integration of a TBI screening within military protocol is becoming standard practice, specifically for those redeploying, and is used in determining if post-injury sequelae resolved over time (Terrio et al., 2009). Despite TBIs being one of the signature wounds for the current conflicts, according to our research, the active duty and civilian groups did not differ significantly in reporting a positive TBI screening with about 45% of each group screening positive. The lack of difference between these two groups may be due to reporting positive TBI screening rates as opposed to documented diagnoses. In a recent study of soldiers who served in Iraq, 22.8% had a clinician confirmed TBI history with an additional 9.7% who reported other injuries that may have been identified by a TBI screening (Terrio et al., 2009). Civilian literature acknowledges that little is known about actual TBI rates as many individuals do not receive care after a potential TBI or are not officially given a TBI diagnosis even when examined (Langlois, Rutland-Brown, & Wald, 2006). This similarity across the two populations may be due to the number of National Guard included in the active duty group; however, approximately 62% had been deployed. In addition, Hoge et al., (2008) found that service members reported experiencing training related TBIs, supporting the inclusion of activated National Guard in this study. Another consideration may be that TBI diagnosis could be delayed while on deployment, and engagement in risky behaviors by active duty personnel and veterans typically occur after any post-deployment health screening (Regasa et al., 2016), lowering self-reports of TBI in an activated military sample. According to our results, veterans were more likely to screen positive for TBIs than the general civilian and active duty groups, which may be attributed to their age and increased likelihood to engage in risky behaviors and having been exposed to multiple TBIs prior to participating in research. Our study did not account for the number of potential TBIs a person experienced, which may impact the suicidal outcomes by group. Additionally, the data did not contain sufficient detail to determine the severity of TBI participants had experienced, and this may also have impacted group differences.

Active duty military presented with the lowest levels of insomnia among our participants, which is surprising given the association between irregular sleeping conditions and active duty service. However, with approximately 34% of our sample including National Guard personnel who were activated due to training operations, this likely impacted the reportedly low levels of current insomnia within the larger sample. When isolating deployed active duty military, insomnia may be more severe. Although active duty military

reported the lowest levels of insomnia, the individuals with highest levels of insomnia experienced increased rates of suicidal outcomes compared to the veteran and civilian populations. That is, the relationship between insomnia severity and suicidal behavior, thoughts, and communication was particularly strong among our active military participants. This finding supports the premise that high insomnia severity can exacerbate current suicidal thoughts and behavior and may be an indication that without sleep, a person's ability to problem solve and develop coping strategies that are not suicidal in nature, diminish substantially (Walter Reed Army Institute of Research, 2007). Further, they suggest that such effects may be particularly problematic for people who are currently serving in the military. Military guidelines on sleep maintenance suggest that it is as necessary as food and water, but with rapid deployments and continuous high tempo training, sleep deprivation is common. Persistent insomnia, sometimes referred to in the military as a "sleep debt," meaning continually losing sleep over time, may manifest as degradation in work performance. This can result in slower thinking or confusion, an increase in mistakes, decline in planning ability and complex mental operations, inaccuracy in hitting the correct target, loss of self-awareness, and vulnerability to depression and anxiety (Walter Reed Army Institute of Research, 2007). Attention to these insomnia-related warning signs and ensuring that those suffering get necessary rest may reduce the risk of suicidal thoughts and behaviors. The magnitude of the relationship between insomnia severity and suicidal outcomes among active duty military is notable and highlights the importance of insomnia interventions, such as CBT-I, light therapy, or medications (Smith et al., 2002), for this population.

Gehrman and colleagues (2013) found that pre-deployment sleep duration and insomnia symptoms were significantly associated with increased risk for PTSD, depression, and anxiety post-deployment. In a retrospective chart review of veterans, reported sleep disturbance and insomnia were found to be more prevalent among those who died by suicide (Pigeon et al., 2012a). Addressing sleep deprivation and insomnia in readiness training for military personnel pre-deployment could have long-term effects for post-deployment and quality of life as a veteran. Civilian transition programs could also benefit from addressing the risks of sleep deprivation and insomnia; as such prevention and intervention approaches would lessen not only suicide risk, but also other psychiatric disorders. Attending to insomnia severity as a suicide risk factor is particularly important because it is modifiable and less stigmatized than other risk factors across all populations. This is particularly true for active duty populations because acknowledging the presence of suicidal thoughts and behaviors can have additional consequences, such as being discharged from service or limiting access to firearms. However, civilians should not be overlooked as the present findings indicate that insomnia severity is a concern across all three groups. Therefore, military, veteran, and non-military clinicians and their patients would benefit from attending to and addressing the warning signs of insomnia.

Although there are unique repercussions for active duty military who report suicidal thoughts compared to other populations, our study found that suicidal thoughts and reported likelihood of a future attempt were higher among this

group compared to civilians. The interpersonal psychological theory of suicide (Joiner, 2005) may account for active duty and veteran's increased expectation that he or she may die by suicide. The theory posits that through painful and provocative events, an individual may develop fearlessness toward death. Active duty and veteran populations are more likely to be exposed to death than civilian populations (Bryan & Cukrowicz, 2011) and therefore, may be less fearful toward death. Such fearlessness may increase the likelihood that they will consider suicide as a viable option for resolving problems. The associations between insomnia and TBI with future likelihood to attempt suicide may be a result of the individual's increased acquired capability for suicide (Joiner, 2005) because insomnia severity and TBIs are related to other painful and provocative experiences, such as accidents and engagement in risky behaviors (Catrett & Gaultney, 2009; Olson-Madden et al., 2012). Additionally, the cognitive and executive functioning sequelae of insomnia and TBI may exacerbate maladaptive coping and problem-solving skills, which in turn could contribute to the individuals' increased likelihood to die by suicide.

Conversely, the civilian sample reported higher suicidal behavior than the active duty sample. Research continues to support that death by suicide is more prevalent among men, whereas nonfatal suicidal behavior is higher among women (Nock et al., 2008). The civilian population is more equally distributed among men and women than the active duty sample, which may account for this difference. In addition, in the present sample 65% of the civilians were women, whereas only 21% of the active duty and 15% of the veterans were women. These gender differences in the three groups may have contributed to this finding. However, past attempts are one of the best predictors of future attempts and should not be ignored, regardless of gender.

Like the other suicide outcomes, communication of suicidal intent was heightened among individuals across groups that had a positive TBI screen and increased insomnia severity. The relationship between insomnia severity and communicating suicidal intent was stronger among the active duty sample than the veteran sample. The current research on individuals communicating thoughts or plans to die by suicide is often directed to those who make these expressions through social media (Luxton, June & Fairall, 2012). However, previous work using psychological autopsies has found that over two-thirds (69%) of suicide decedents communicated suicidal ideation, with 41% specifically stating an intent to die by suicide (Robins et al., 1959). Although the active military participants in our study were not as likely to report communicating suicidal intent as the other samples, it is possible to capitalize on the opportunities for communication available for active duty military. Decreasing stigma and encouraging communication may help individuals get the help they need to cope with suicidal thoughts. For example, active duty military regularly have access to chaplains, noncommissioned officer (NCO) mentorship, nearby peers and friends within their units, and a designated teammate primarily for training and accountability. Capitalizing on these resources is essential to the prevention of suicide among active duty military. Educating chaplains, NCO mentors, and fellow peers about the warning signs and risks associated with TBI and insomnia on suicidal outcomes may help to encourage these people to broach topics of

emotional distress among military personnel in need. Such efforts may enhance the likelihood that people with suicidal thoughts will communicate these thoughts with others and increase the potential for intervention. Training chaplains, NCO mentors, and peers on how to respond when suicidal thoughts, behaviors, and intent are expressed would be paramount in this effort. Exploring how to replicate similar access to support, outside of traditional mental health services should be considered for veteran and civilian populations as well.

Private and public health care providers need to be aware of the independent influences of TBI and insomnia on suicidal outcomes and consider the unique complications as well as the resources, from the Veterans Health Administration (VHA), DoD, and various military organizations, available to patients with a military history. Therefore, it is essential that all patients are assessed for military status, especially given that not all veterans seek care from military treatment facilities or the VHA system. Although the literature supports that there is no single risk factor that is sufficient to predict future suicidal behavior or death by suicide, there is evidence indicating that screening for and addressing TBI and insomnia severity can prevent psychological and physical sequelae, including suicide risk. For clinicians and leadership, it is important to distinguish between who is the highest risk population (Ursano et al., 2015), which supports the need for exploring these risk factors among active duty, veterans, and civilians. Although veterans tended to score higher at a mean level on these risk factors than active military or civilians, the relationship between insomnia and suicidal responses tended to be stronger for active military compared to veterans (and in one case compared to civilians). Thus, veterans and active military personnel each face a type of heightened risk.

LIMITATIONS

There are several limitations to consider when interpreting these results. The measures within the MSRC CDEs had varying reporting time intervals. For example, the ISI measures insomnia severity within the past 2 weeks, whereas the TBI-4 screening tool assesses likelihood of a TBI in the individual's lifetime, and the timing of the SBQ-R varies by the question. In addition, other measure limitations include that the ISI is not defined in clinical terms for insomnia and the TBI-4 screening tool limits the interpretation of a positive TBI screening compared to a confirmed TBI diagnosis (with related information regarding severity) on the suicidal outcomes. Also of note, the inclusion and exclusion criteria for the MSRC-funded studies varied by each study's aims and hypotheses. In most studies, participants who were experiencing psychological distress were actively recruited. Therefore, this sample may present with more clinical symptoms than the average active duty, veteran, and civilian population and may limit generalizability.

Generalizability also may be limited due to the distribution among branches within our active duty sample. The Army is slightly underrepresented in the active duty sample and substantially underrepresented in the veteran sample, whereas the Navy is significantly overrepresented in the active duty sample. In addition, the Air Force is significantly underrepresented in both the active duty and veteran samples. Representativeness was also likely impacted

by the geographic locations the studies recruited participants.

Finally, our study relied on use of self-report measures, which could provide potentially misleading results and reporting bias. This may be particularly true for the active duty participants, where the consequences of reporting suicidal thoughts and behaviors may have implications for their military career in addition to being heavily stigmatized within the military culture. Although the interpretation of these results must factor in the situational and contextual variables in which they occurred, the use of self-report measures has been shown to be superior to clinician gathered data in suicide research (Harkavy-Friedman & Asnis, 1989; Kaplan et al., 1994; Kendall, Cantwell, & Kazdin, 1989).

FUTURE RESEARCH

The relationship between insomnia and TBI has been established in the literature. However, there is evidence to suggest that TBI patients with insomnia tend to overestimate sleep disturbance in subjective measures compared to objective measures (Ouellet & Morin, 2006). Additional research to explore the co-occurrence of TBI and insomnia, with the inclusion of subjective and objective measures, on suicidal outcomes is warranted.

The prevention and intervention of suicide is an arduous challenge for all involved. There are evidence-based interventions for individuals with TBI and insomnia that continue to support this effort; however, there is a gap between the translation of these interventions and their adoption into best practices (Callender et al., 2017). Continued efforts examining the effectiveness of these interventions for reducing suicide risk are essential, as is the dissemination and implementation of practical guidelines and interventions for military, veteran, and civilian populations. Further exploration of insomnia and/or TBI-related insomnia would also strengthen the ability of military personnel, clinicians, and individuals to intervene appropriately. Cost effective approaches are also critical to this initiative. Screening service members for insomnia prior to and after deployment would assist with early detection and intervention before the prognosis worsens (Callahan, 2010). Veterans and civilians would also benefit from TBI and insomnia screenings, with short and empirically supported screening measures available such as the TBI-4, ISI-Severity Subscale, and PHQ-9. This process requires financial resources and time as well as agreed upon screening tools. However, the need for mentally and physically resilient service members is critical to the military's mission and its success, as well as an important opportunity for all populations. Encouraging and normalizing self-awareness and reporting of such difficulties will benefit active duty military, veterans, and civilians.

Our study would be further enhanced by examining the effects of traumatic brain injury and insomnia severity on suicidal thoughts and behaviors by disaggregating the sample by military branch and era. Research is often limited by the inclusion of only one branch or combining all branches together. Each service has unique challenges and therefore unique risk factors that may contribute to psychological sequelae resulting from TBI and insomnia severity that can be explored. Additional research would provide guidance for risk and resiliency training purposes, as well as check points for potential warning signs of interference with daily living.

In addition, future research could include an examination of TBI and insomnia prevention and intervention efforts'

contribution to the reduction of negative long-term health effects and general improvement in quality of life. An example of a long-term health effect specific to TBIs is chronic traumatic encephalopathy (CTE). Much of the CTE research is sports injury related and the link between CTE and suicide risk in football players and veterans still remains inconclusive (Iverson, 2016; Miller, 2012; Wortzel, Shura, & Brenner, 2013). Nevertheless, individuals with repetitive mild TBIs or a moderate to severe TBI often experience devastating and enduring changes in all aspects of life, including employment, and family and social relationships.

Lastly, although the value of peers and access to chaplains is known, the impact of replicating similar access to care for veteran, civilian, and reserve and National Guard populations is unclear. Continued research on TBIs and insomnia severity across populations will help address the gaps in access to care and quality of care that influence individuals' risk for suicide (Brancu, Straits-Tröster, & Kudler, 2011; Burnam et al., 2008).

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Article

The Military Suicide Research Consortium Common Data Elements: An Examination of Measurement Invariance Across Current Service Members and Veterans

Assessment
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Abstract

Suicide rates within the U.S. military are elevated, necessitating greater efforts to identify those at increased risk. This study utilized a multigroup confirmatory factor analysis to examine measurement invariance of the Military Suicide Research Consortium Common Data Elements (CDEs) across current service members (n = 2,015), younger veterans (<35 years; n = 377), and older veterans (≥35 years; n = 1,001). Strong factorial invariance was supported with adequate model fit observed for current service members, younger veterans, and older veterans. The structures of all models were generally comparable with few exceptions. The Military Suicide Research Consortium CDEs demonstrate at least adequate model fit for current military service members and veterans, regardless of age. Thus, the CDEs can be validly used across military and veteran populations. Given similar latent structures, research findings in one group may inform clinical and policy decision making for the other.

Keywords

Military Suicide Research Consortium, MSRC, Common Data Elements, CDEs, suicide risk

Suicide claims the lives of over 40,000 individuals in the United States each year (Centers for Disease Control and Prevention, 2018). Research has highlighted that U.S. military service members and veterans represent a particularly at-risk group (Kuehn, 2009). Rates of suicide within the U.S. military have increased in recent years (Ramchand, Acosta, Burns, Jaycox, & Pernin, 2011), currently equaling or exceeding civilian suicide rates (Kuehn, 2009). A recent report by the U.S. Department of Veterans Affairs (2016) revealed that even after adjusting for age and sex, the rate of death by suicide is 21% greater for veterans than civilians. Beyond elevated rates of death by suicide, U.S. military service members and veterans also demonstrate elevated rates of suicidal thoughts and nonfatal attempts (Nock et al., 2014; Ursano et al., 2015), as well as conditions that confer increased risk for suicide among military personnel, such as posttraumatic stress disorder (Nock et al., 2013), sleep disturbances (Hom et al., 2017), problematic alcohol use (LeardMann et al., 2013), interpersonal theory of suicide constructs (Silva et al., 2016), and traumatic brain injuries (Stanley, Joiner, & Bryan, 2017).

Notably, suicide rates are not evenly distributed within the U.S. military. In 2014, the suicide rate across all active services was 19.9 per 100,000 service members, with Army personnel evincing the highest rate (23.8 per 100,000) and Navy personnel evincing the lowest rate (16.3 per 100,000; Pruitt et al., 2015). The suicide rate appears to be increasing for nondeployed Army soldiers (Schoenbaum et al., 2014), which is contrary to previous conjectures that combat-exposed service members are at potentiated risk (see Bryan et al., 2015). Moreover, veterans who do not utilize Veterans Affairs (VA) services appear to be at elevated risk compared with those who do utilize VA services (U.S. Department of Veterans Affairs, 2016). Finally, factors that exacerbate suicide risk may be different for younger versus older veterans (Kaplan, McFarland, Huguet, & Valenstein, 2012). Together, these data suggest that there are important differences *within* the military and veteran populations regarding suicide risk; thus, assessment, prevention, and intervention

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efforts must be cognizant—and if indicated, responsive—to these differences.

An important consideration within the U.S. military is potential differences in suicide risk characteristics between current service members (i.e., active duty, Reserves, National Guard) and veterans (i.e., separated from service). One study of active duty service members (n = 1,013) and veterans (n = 746) receiving treatment for acute suicide risk found that active duty service members were 24% more likely to report a lifetime suicide attempt than veterans (Villatte et al., 2015). Active duty service members were also more likely than veterans to have a history of at least one premilitary suicide attempt (Villatte et al., 2015). Furthermore, the suicide rates for the Reserves and National Guard may be accounting in part for the overall suicide rate increase observed within the military (Franklin, 2016). A study of veterans on active duty during the wars in Iraq and Afghanistan found that suicide risk was greatest in the 3 years postdischarge (Kang et al., 2015), suggesting that leaving military service, especially early separation (i.e., <4 years; Reger et al., 2015), may confer potent suicide risk.

In response to these alarming statistics, efforts have focused on the assessment of suicide-related behaviors and conditions among military populations (Gutierrez et al., 2016; Hoge & Castro, 2012; Nock et al., 2014). One study found that mental health screening prior to deployment to Iraq was associated with statistically significant reductions in suicide risk (e.g., suicidal ideation, suicide-related mental health problems), suggesting that screening and assessment are viable methods to diminish suicide risk among military service members and Veterans (Warner, Appenzeller, Parker, Warner, & Hoge, 2011). Screening and assessment efforts—for both clinical and research purposes—can be improved by the development and testing of a standardized battery with demonstrated psychometric properties for use among military personnel, specifically (e.g., Allan, Gros, Hom, Joiner, & Stecker, 2016; Gutierrez et al., 2016). Indeed, the U.S. military presents a unique cultural milieu (e.g., values, traditions, hierarchies) that necessitates examinations of population-specific suicide risk screening and assessment approaches (Coll, Weiss, & Yarvis, 2011). Moreover, the U.S. military is heterogeneous regarding its members and corresponding duties, underscoring the need to additionally examine the utility of suicide risk screening and assessment efforts across subgroups (e.g., current military service members vs. veterans, younger veterans vs. older veterans).

One notably large and comprehensive endeavor regarding the assessment of suicide-related behaviors and conditions among military personnel is the Military Suicide Research Consortium's (MSRC) Common Data Elements (CDEs). The MSRC is chartered by the Department of Defense (DoD) to oversee the allocation of funds to investigators who submit proposals through a competitive grant review process (Joiner & Gutierrez, 2018). All MSRC-funded studies have the same overarching purpose of increasing the understanding and prevention of suicide and suicide-related conditions in military service members, veterans, and analog groups. Investigators who are funded by the MSRC are required to include the MSRC CDEs in their battery of test items (to be administered alongside study-specific assessment instruments selected by the funded investigators). The CDEs also represent a promising approach to suicide-related research beyond the MSRC, as other studies funded by the DoD and similar organizations have now opted to utilize the CDE battery in their research studies.

Importantly, the MSRC CDEs are not an instrument but reflect a collection of items from instruments assessing suicide-related constructs that are administered across MSRC-funded research. Some item sets included in the CDEs were shortened for logistical considerations; importantly, the abbreviated set of items comprising the MSRC CDEs have at least adequate internal consistency and moderate-to-strong correlations with full-length parent measures (Ringer et al., 2018). This standardized set of questions serves several purposes. For instance, because MSRC-funded investigators are required to submit deidentified CDE data to the MSRC Data Core, this approach allows for the creation of a large data set of suicide-related relevant constructs. Investigators utilizing this large data set after petitioning the MSRC for permission can then extract psychometrically supported, abbreviated scales from the CDEs that are relevant to their research questions (see Ringer et al., 2018; e.g., the Anxiety Sensitivity Index–3 [ASI-3; Taylor et al., 2007] to assess anxiety sensitivity).

However, it remains unknown if the MSRC CDEs operate differently among military subgroups, that is, measurement invariance has yet to be examined. As noted, the U.S. military, though cohesive in its readiness, represents a heterogeneous group of individuals. Connection to the military (i.e., current vs. veteran) may also be an important distinction. Given potential differences in mental health characteristics between current service members and veterans (Villatte et al., 2015) and younger and older veterans (Kaplan et al., 2012), and given that the MSRC CDEs are administered across studies that are inclusive of both current service members and veterans, it is important to examine how the MSRC CDEs operate across these groups.

The Present Study

The purpose of this study was to investigate measurement invariance of the CDEs across current military personnel and veterans. As suicide risk among veterans may vary as a function of age (Kaplan et al., 2012; Reger et al., 2015), we additionally examined measurement invariance of the CDEs across younger (i.e., <35 years) and older (i.e., ≥35 years) veterans. Examining measurement invariance serves at least

two potential purposes: (a) demonstrating the utility of the MSRC CDEs across distinct military populations and (b) demonstrating that the latent structure of suicide risk is comparable across these groups, and thus research in one group could inform clinical and public policy efforts for the others. This latter issue has logistical import, in that research in one setting (e.g., a VA clinical setting) may be more feasible than in another (e.g., many active duty settings). Thus, empirical evaluation of whether one setting or population may serve as an analog for another is needed.

Method

Participants and Procedures

The CDEs database utilized for the present study includes an amalgamation of several studies representing heterogeneous populations and recruitment methodologies. All studies are alike in their administration of the MSRC CDEs, which takes approximately 20 minutes to complete. Given the present study aims, only the MSRC-funded studies that included military service members or veterans and for which data were available were included (21 studies, $N = 3{,}393$).[1] Data from both inpatient and outpatient psychiatric samples were included, representing a gradient of clinical severity; current service members were predominately inpatient, and thus may represent elevated severity. Data derived from community settings were excluded. For all study protocols, approval was obtained from each site's institutional review board and the U.S. Army Medical Research and Materiel Command Human Research Protection Office.

Merged data from 2,015 current service members, 377 younger veterans (i.e., <35 years) and 1,001 older veterans (i.e., ≥35 years) across 21 MSRC-funded studies were utilized (Total $N = 3{,}393$). Among the total sample, most participants were male (81.6%), Caucasian (65.2%), non-Hispanic (88.4%), single (45.1%), and ranged in age from 18 to 88 years ($M = 34.46$ years, $SD = 14.68$ years). Overall, 61.0% served in the Army, 23.4% Navy, 9.4% Marine Corps, 5.5% Air Force, and 0.7% Coast Guard. See Table 1 for detailed sociodemographic and military service characteristics for the entire sample, and stratified by current service members, younger veterans, and older veterans. A standardized demographic form was not included as part of the CDEs and each study varied in the collection of these data; thus, there was a notable amount of missing data for some of the demographic and military experiences variables.

Measures

MSRC Common Data Elements. The MSRC CDEs include 57 items assessing suicide-related behaviors and conditions. The MSRC CDEs include items from existing scales (47 items; with permission to utilize items obtained from the scale's copyright holders), as well as items that were developed specifically for the CDEs (10 items). Subsets of items from specific scales demonstrate adequate psychometric properties (Ringer et al., 2018). The items were selected by the MSRC directors with input from MSRC's senior advisors and experts from the field of suicide research. The MSRC CDEs were designed to provide broad coverage for the assessment of suicidal symptoms as well as psychological constructs (e.g., anxiety sensitivity, insomnia, social disconnectedness) that have been empirically linked to suicide-related behaviors across multiple studies. Items were selected based on evidence of psychometric support for the parent measures and with consideration to covering the full content of the overall construct (Ringer et al., 2018). Importantly, the CDEs are not itself an instrument and thus were not designed to generate a total score across all items. Instead, as noted, the CDEs reflect a collection of items assessing suicide-related constructs that are standardized across MSRC-funded studies as well as other studies examining suicide-related topics among military populations. Ringer et al. (2018) found robust psychometric support for item subsets (e.g., they were highly correlated with their full parent measures, suggesting they assess the same construct). These item subsets also demonstrated acceptable-to-excellent internal consistency (Ringer et al., 2018). See below for descriptions of the measures from which items were selected for the MSRC CDEs. For a full description of the development of the MSRC CDEs, as well as the rationale for the heterogeneity of its components, the reader is referred to Ringer et al. (2018).[2]

Alcohol Use Disorders Identification Test (AUDIT; Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998). The AUDIT is a 10-item screening measure of problematic alcohol use. Participants responded to each item on a 5-point scale ranging from 0 to 4; higher scores on the AUDIT indicate more problematic drinking. The AUDIT has strong reliability and validity (de Meneses-Gaya, Zuardi, Loureiro, & Crippa, 2009). The CDEs utilize three AUDIT items; this subset of items significantly correlates with the parent measure ($r = .79$, $p < .001$) and has good internal consistency ($\alpha = .86$; Ringer et al., 2018). Internal consistency in the present sample was good for the total sample ($\alpha = .86$), current service members ($\alpha = .83$), younger veterans ($\alpha = .88$), and older veterans ($\alpha = .88$).

Anxiety Sensitivity Index–3 (Taylor et al., 2007). The ASI-3 is an 18-item measure of the fear of physical, social, and cognitive anxiety-related symptoms (i.e., anxiety sensitivity). Items are rated on a 5-point Likert-type scale ranging from 0 to 4; higher scores indicate more severe anxiety sensitivity. The ASI-3 has strong reliability and validity (Taylor et al., 2007). The CDEs utilize five items from the cognitive

Table 1. Participant Demographic Characteristics and Military Experiences.

	Total sample (*N* = 3,393)	Current service members (*n* = 2,015)	Younger veterans (<35 years; *n* = 377)	Older veterans (≥35 years; *n* = 1,001)
Demographic variables				
Age, years				
M (*SD*)	34.46 (14.68)	26.08 (7.14)	28.64 (3.63)	53.36 (10.43)
Range	18-88	18-61	18-34	35-88
Sex, *n* (valid %)				
Male	2,755 (81.6)	1,590 (79.5)	307 (81.9)	858 (85.7)
Female	612 (18.1)	401 (20.1)	68 (18.1)	143 (14.3)
Transgender	8 (0.2)	8 (0.4)	0 (—)	0 (—)
Missing	18 (—)	16 (—)	2 (—)	0 (—)
Race, *n* (valid %)				
White/Caucasian	2,193 (65.2)	1,227 (61.3)	277 (75.1)	689 (69.6)
Black/African American	690 (20.5)	435 (21.7)	39 (10.6)	216 (21.8)
Native American/Native Alaskan	36 (1.1)	19 (0.9)	3 (0.8)	14 (1.4)
Asian	78 (2.3)	57 (2.8)	10 (2.7)	11 (1.1)
Pacific Islander	8 (0.2)	0 (—)	2 (0.5)	6 (0.6)
Multiracial	61 (1.8)	19 (0.9)	18 (4.9)	24 (2.4)
Other	295 (8.8)	245 (12.2)	20 (5.4)	30 (3.0)
Missing	32 (—)	13 (—)	8 (—)	11 (—)
Ethnicity, *n* (valid %)				
Hispanic	296 (9.5)	212 (11.3)	30 (8.1)	54 (6.1)
Non-Hispanic	2,760 (88.4)	1,595 (85.2)	339 (91.9)	826 (93.9)
Other	65 (2.1)	65 (3.5)	0 (—)	0 (—)
Missing	272 (—)	143 (—)	8 (—)	121 (—)
Marital status, *n* (valid %)				
Married	987 (31.4)	698 (35.0)	71 (22.9)	218 (26.2)
Single	1,416 (45.1)	1,043 (52.2)	161 (51.9)	212 (25.5)
Cohabitating	16 (0.5)	0 (—)	6 (1.9)	10 (1.2)
Widowed	34 (1.1)	3 (0.2)	0 (—)	31 (3.7)
Divorced/separated	678 (21.6)	253 (12.7)	70 (22.6)	355 (42.6)
Other	9 (0.3)	0 (—)	2 (0.6)	7 (0.8)
Missing	253 (—)	18 (—)	67 (—)	168 (—)
Military experiences				
Combat experience, *n* (valid %)				
Yes	732 (37.4)	375 (32.6)	175 (67.0)	182 (33.3)
No	1,227 (62.6)	776 (67.4)	86 (33.0)	365 (66.7)
Missing	1,434 (—)	864 (—)	116 (—)	454 (—)
Deployment, *n* (valid %)				
Yes	1,324 (54.4)	1,008 (53.6)	104 (70.3)	212 (52.0)
No	1,111 (45.6)	871 (46.4)	44 (29.7)	196 (48.0)
Missing	958 (—)	136 (—)	229 (—)	593 (—)
Military branch, *n* (valid %)				
Army	1,870 (61.0)	1,310 (66.5)	175 (54.0)	385 (50.1)
Air Force	168 (5.5)	38 (1.9)	23 (7.1)	107 (13.9)
Navy	716 (23.4)	482 (24.5)	54 (16.7)	180 (23.4)
Marine Corps	289 (9.4)	129 (6.5)	70 (21.6)	90 (11.7)
Coast Guard	21 (0.7%)	12 (0.6)	2 (0.6)	7 (0.9)
Missing	329 (—)	44 (—)	53 (—)	232 (—)

concerns subscale, which is associated with elevated suicide risk (Oglesby, Capron, Raines, & Schmidt, 2015); this subset of items significantly correlates with the parent measure ($r = .99$, $p < .001$; Ringer et al., 2018). Internal consistency in the present sample was excellent for the total sample ($\alpha = .90$), good for current service members ($\alpha =$

.88), and excellent for both younger veterans (α = .91) and older veterans (α = .92).

Beck Hopelessness Scale (BHS; A. T. Beck & Steer, 1988). The BHS is a 20-item measure of one's negative future expectations. Items are rated on a true/false scale. The BHS has strong concurrent validity (A. T. Beck & Steer, 1988) and elevated hopelessness is associated with increased suicide risk (A. T. Beck, Brown, Berchick, Stewart, & Steer, 1990). The CDEs utilize three BHS items; this subset of items significantly correlates with the parent measure (r = .29, p < .001; Ringer et al., 2018). Internal consistency in the present sample was acceptable for the total sample (α = .74), current service members (α = .74), younger veterans (α = .76), and older veterans (α = .73).

Depressive Symptom Inventory–Suicidality Subscale (Joiner, Pfaff, & Acres, 2002). The DSI-SS is a 4-item self-report measure that assesses the presence and severity of suicidal thoughts, plans, and urges within the past 2 weeks. Items were rated on a 4-point scale ranging from 0 to 3, with higher scores reflecting greater severity of suicidal thoughts and urges. The DSI-SS has demonstrated strong psychometric properties (Batterham et al., 2015; Joiner et al., 2002). The MSRC CDEs utilize all four DSI-SS items. Internal consistency in the present sample was excellent for the total sample (α = .91), current service members (α = .90), younger veterans (α = .92), and older veterans (α = .91).

Insomnia Severity Index (ISI; Morin, Belleville, Belanger, & Ivers, 2011). The ISI is a seven-item measure that assesses the severity and impact of insomnia symptoms over the past week. Items were rated on a 5-point Likert-type scale ranging from 0 to 4, with higher scores reflecting greater severity of insomnia symptoms. Previous studies have provided evidence for the reliability, validity, and sensitivity of the ISI for detecting sleep difficulty changes (Bastien, Vallieres, & Morin, 2001; Morin et al., 2011). The MSRC CDEs utilize five ISI items. Internal consistency in the present sample was good for the total sample (α = .87), current service members (α = .88), younger veterans (α = .82), and older veterans (α = .84).

Interpersonal Needs Questionnaire (INQ; Van Orden, Cukrowicz, Witte, & Joiner, 2012). The INQ is a 15-item self-report questionnaire that assesses perceived burdensomeness (PB) and thwarted belongingness (TB). Participants rated each item on a 7-point scale, ranging from 1 to 7. Higher scores indicate higher levels of PB and TB. The 15-item INQ has demonstrated strong psychometric properties in previous research (Van Orden et al., 2012). The MSRC CDEs utilize five INQ-TB items; this subset significantly correlates with the parent measure (r = .64, p < .001; Ringer et al., 2018). Internal consistency in the present sample was excellent for the total sample (α = .92), current service members (α = .92), younger veterans (α = .91), and older veterans (α = .91).

PTSD Checklist–Military Version (PCL-M; Weathers, Huska, & Keane, 1991). The PCL-M is a 17-item self-report measure that assesses posttraumatic stress disorder (PTSD) symptoms in military populations. Participants rated the degree to which they were bothered by each symptom on a 5-point Likert-type scale, ranging from 1 to 5. The PCL-M has demonstrated strong reliability and validity as a measure of PTSD symptoms in previous research (Wilkins, Lang, & Norman, 2011). The MSRC CDEs utilize eight PCL-M items (four items assessing reexperiencing symptoms, two avoidance, and two hyperarousal); this subset of items significantly correlates with the parent measure (r = .83, p < .001; Ringer et al., 2018). Internal consistency in the present sample was excellent for the total sample (α = .94), current service members (α = .94), younger veterans (α = .93), and older veterans (α = .94).

Suicidal Behaviors Questionnaire–Revised (SBQ-R; Osman et al., 2001). The SBQ-R is a four-item measure of suicide risk (i.e., lifetime suicidal ideation and suicide attempts, frequency of recent suicidal ideation, suicide threats, future likelihood of making a suicide attempt). Items are rated on Likert scales of varying lengths and higher scores indicate more severe suicide risk. The SBQ-R has strong psychometric properties (Osman et al., 2001). The MSRC CDEs utilize all four SBQ-R items. Internal consistency in the present sample was good for the total sample (α = .82), current service members (α = .80), younger veterans (α = .85), and older veterans (α = .82).

Suicide Intent Scale (SIS; A. T. Beck, Schuyler, & Herman, 1974). The SIS is a 15-item assessment of behavior occurring prior to and during the most recent suicide attempt. Items assess objective circumstances (e.g., preparations), perceptions of potential lethality, expectations of rescue, purpose of the attempt, impulsivity, and reaction to the attempt. Items were rated on a scale from 0 to 2 and higher scores indicate greater intent. The SIS was developed for administration by a trained interviewer; however, past research has found that a self-report version correlates strongly with the original SIS (Strosahl, Chiles, & Linehan, 1992). The SIS has strong psychometric properties (A. T. Beck, Schuyler, et al., 1974; R. W. Beck, Morris, & Beck, 1974). The MSRC CDEs utilize four SIS items. Internal consistency in the present sample was good for the total sample (α = .89), current service members (α = .89), younger veterans (α = .80), and older veterans (α = .87).

Traumatic Brain Injury–4 (TBI-4; Brenner et al., 2013). The TBI-4 is a 4-item self-report screening tool for traumatic brain injuries. Each of the four questions assesses possible

occurrences that may have led to TBI-4. The TBI-4 has demonstrated good psychometric properties (Brenner et al., 2013; Olson-Madden et al., 2014). The MSRC CDEs utilize all four TBI-4 items. Internal consistency was acceptable for the total sample ($\alpha = .77$), current service members ($\alpha = .75$), younger veterans ($\alpha = .72$), and older veterans ($\alpha = .72$).

Data Analytic Strategy

All variables were examined for skewness, kurtosis, normality, linearity, and outliers. We assessed for outliers by examining the interquartile range. Outliers were identified as any data points that were more than 1.5 interquartile ranges below or above the first and third quartiles, respectively; any identified outliers were brought to the highest or lowest identified number in the acceptable range (e.g., a DSI-SS item response of three was adjusted to a two as two was the highest number in the range). Skewness and kurtosis values were considered acceptable if between −2 and 2.

Using M*plus* version 7 (Muthén & Muthén, 2015), we conducted multigroup confirmatory factor analysis (CFA) of the MSRC CDEs across current service members and veterans (Brown, 2006; Vandenberg & Lance, 2000). Multigroup CFA is a common method for examining factor invariance of an assessment scale across groups (Brown, 2006). In this case, we examined if the MSRC CDEs—a structured compilation of suicide-related scales—are invariant across current service members and veterans (as a combined group and stratified by younger [<35 years] and older [≥35 years] age). We examined a first- and second-order factor structure of the CDEs by building a model consisting of first-order factors, including items from the ASI-3, AUDIT, DSI-SS, INQ-TB, ISI, PCL-M, SBQ-R, and the SIS, and a second-order factor of overarching suicide risk composed of the aforementioned lower order factors and total scores for the BHS and TBI-4 item sets. Total scores for the BHS and TBI-4 item sets were used due to the dichotomous nature of their individual items.[3] We examined an overarching suicide risk factor to confirm the conceptual coherence of the items that comprise the CDEs.

Both sets of analyses were completed with a five-step process for multiple-group analyses. In Step 1, we applied the baseline model separately to (a) current service members and veterans and (b) current service members, veterans <35 years, and veterans ≥35 years to assess configural invariance. Once the baseline model was analyzed in each group separately, in Step 2, we assessed for metric invariance by running multiple-group analyses with factor loadings held equivalent, whereas intercepts were allowed to differ across groups. In Step 3, we ran a model testing for intercept-only invariance. In Step 4, we assessed for scalar invariance by running models where we constrained the loadings and intercepts to be equal across our groups. Following Step 4, we assessed for strict factorial invariance (i.e., full uniqueness) wherein we also fixed the residual variances to be the same across groups. We analyzed the aforementioned models according to the following indices of fit (Hu & Bentler, 1999): root mean square error of approximation (RMSEA), comparative fit index (CFI), Tucker–Lewis Index (TLI), and standardized root mean square residual (SRMR). RMSEA values less than 0.05 indicate good model fit and values between 0.06 and 0.08 suggest adequate model fit. For the CFI and TLI, values 0.95 and above indicate good model fit and values between 0.90 and 0.95 suggest adequate model fit. SRMR values of 0.08 and below indicate good model fit and values between 0.08 and 0.10 suggest adequate model fit. We note that multiple fit indices should be considered in determining whether measurement invariance exists; that is, when most fit indices converge on a cohesive story, invariance is supported (Vandenberg & Lance, 2000). We additionally note that χ^2 difference tests are generally a less useful metric of model fit for large samples, such as that used in the present study (Cheung & Rensvold, 2002; Meade, Johnson, & Braddy, 2008). As such, we also examined change in CFI when determining model of best fit and used the suggested change in CFI of ≤.01 to indicate that the null hypothesis of measurement invariance should be maintained (Cheung & Rensvold, 2002). Finally, we assessed differences in factor means and their correlations across groups.

Results of Little's MCAR test revealed that data were missing completely at random for the current service members ($p = .09$), but not for the younger veterans ($p < .001$) or older veterans ($p < .001$) subgroups. When examining the full sample, data were not missing at random (MAR) per Little's MCAR test ($p < .001$). Missing data were handled utilizing multiple imputation within M*plus*, under the assumption that data were MAR. The estimator we utilized was maximum likelihood and five imputation samples were generated. Items were treated as continuous. Analyses not related to measurement invariance (e.g., descriptive statistics, correlation matrix) were conducted using SPSS version 23.

Results

Preliminary Analyses

Intercorrelations between CDE subscales are presented in Table 2. All scales and variables are within acceptable ranges regarding skewness and kurtosis. With respect to outliers, we identified 72 outliers for DSI-SS Item 1, 237 for DSI-SS Item 2, 182 for DSI-SS Item 3, 28 for DSI-SS Item 4, 293 for AUDIT Item 2, and 435 for AUDIT Item 3. Thus, analyses were completed both with and without outliers addressed.

Table 2. Item Set Intercorrelations and Descriptive Statistics (Total Sample).

Scales	1	2	3	4	5	6	7	8	9	10
1. ASI-3	—									
2. AUDIT	.071**	—								
3. BHS	.251**	.077**	—							
4. DSI-SS	.335**	.140**	.401**	—						
5. INQ-TB	.307**	.085**	.501**	.455**	—					
6. ISI	.407**	.156**	.403**	.408**	.435**	—				
7. PCL-M	.434**	.079**	.254**	.342**	.375**	.531**	—			
8. SBQ-R	.387**	.102**	.458**	.697**	.466**	.465**	.365**	—		
9. SIS	.136**	.059*	.316**	.448**	.364**	.397**	.315**	.668**	—	
10. TBI	.134**	.085**	.116**	.172**	.191**	.254**	.277**	.231**	.287**	—
N	2,487	3,186	3,177	3,343	3,374	3,190	3,334	3,197	1,677	3,188
M	12.234	3.019	1.548	2.118	16.575	9.261	18.069	7.991	3.961	1.405
SD	6.055	3.206	1.217	2.863	8.890	5.526	9.736	5.270	2.852	1.468
Minimum	1	0	0	0	2	0	1	3	0	0
Maximum	25	12	3	12	35	20	40	18	8	4
Skewness	0.438	1.176	−0.039	1.148	0.311	−0.118	0.654	0.512	−0.097	0.517
Kurtosis	−0.941	0.613	−1.569	0.222	−1.091	−0.979	−0.814	−0.846	−1.386	−1.207

Note. CDE = Common Data Element; ASI-3 = Anxiety Sensitivity Index–3 (CDE); AUDIT = Alcohol Use Disorder Identification Test (CDE); BHS = Beck Hopelessness Scale (CDE); DSI-SS = Depressive Symptom Inventory–Suicidality Subscale (Full); INQ-TB = Interpersonal Needs Questionnaire–Thwarted Belongingness (CDE); ISI = Insomnia Severity Index (CDE); PCL-M = PTSD Checklist–Military Version (CDE); SBQ-R = Suicidal Behaviors Questionnaire–Revised (Full); SIS = Suicide Intent Scale (CDE); TBI = Traumatic Brain Injury–4 (Full).
*$p < .05$. **$p < .01$.

Multigroup Comparisons: Current Service Members Versus Veterans

For Step 1, we applied our baseline model to current service members and veterans separately. Results indicated adequate fit for current service members and veterans (Table 3), thus supporting configural invariance.[4] For Step 2, we assessed for metric invariance across both groups. Analysis of our fit indices indicated adequate fit in the full sample (Table 3). Although the results of our χ^2 difference tests comparing the metric invariance model to the configural models in both groups were significant (current: χ^2 difference = 3,636.58, critical value [CV] with 767 *df* = 832.54; veterans: χ^2 difference = 4,381.50, CV with 769 *df* = 834.62), the observed adequate model fit in addition to the minimal change in CFI (Current: ΔCFI = 0.006; veterans: ΔCFI = 0.01) suggest that model invariance was supported. For Step 3, we ran a model constraining the intercepts to be equal across groups while allowing the factor loadings to differ to assess intercept-only invariance. Analysis of the fit indices again indicated adequate model fit. We then completed Step 4, wherein we assessed for scalar invariance by constraining both the factor loadings and intercepts to be equal across groups; the model again provided adequate fit (see Table 3). Again, the χ^2 difference was significant (χ^2 difference = 646.27, CV with 38 *df* = 53.38); however, the change in CFI was not significant (ΔCFI = 0.009) and thus scalar invariance was supported. To assess whether freeing parameters across groups would improve model fit, we ran an alternative model wherein all factor loadings were freed across groups except those required for identification. This model also provided adequate fit (see fully freed model in Table 3). Although the χ^2 difference test was significant (χ^2 difference = 483.07, CV with 30 *df* = 43.77), the freed model did not result in a significant increase in CFI (ΔCFI = 0.007). As such, we determined that our results supported scalar invariance of our model. In Step 5, we ran an additional model wherein we also constrained the residual variances to be equivalent across groups. However, this additional constraint resulted in poor model fit (see Table 3). As such, we determined that our model met for strong factorial invariance, but not strict factorial invariance, based on poor model fit (Meredith & Teresi, 2006; van de Schoot, Lugtig, & Hox, 2012).

Finally, we compared our two groups on the means of our latent variables as appropriate given our establishment of strong factorial invariance (Meredith & Teresi, 2006; van de Schoot et al., 2012). Results revealed that, compared with current service members, veterans had significantly higher means on the following factors: ASI-3 (unstandardized mean difference = 0.39, $p < .001$); SBQ-R (0.58, $p < .001$); SIS (0.32, $p < .001$); INQ-TB (0.81, $p < .001$); DSI-SS (0.21, $p < .001$); PCL-M (0.67, $p < .001$); ISI (0.55, $p < .001$); and the overarching factor of suicide risk

Table 3. Summary of Fit Statistics for the Two-Group (Current Service Members vs. Veterans) Suicide-Related Measurement Model.

Models	χ^2	*df*	*p*	RMSEA [90% CI]	CFI	TLI	SRMR
Current service members	3760.48	733	<.001	0.045 [0.044, 0.047]	0.920	0.915	0.063
Veterans	3015.56	731	<.001	0.048 [0.046, 0.049]	0.924	0.919	0.088
Metric invariance	7397.06	1500	<.001	0.048 [0.047, 0.049]	0.914	0.911	0.077
Intercept-only invariance	7461.71	1500	<.001	0.048 [0.047, 0.049]	0.913	0.910	0.085
Scalar invariance	8043.33	1538	<.001	0.050 [0.049, 0.051]	0.905	0.904	0.089
Fully freed	7560.261	1508	<.001	0.049 [0.048, 0.050]	0.912	0.909	0.089
Strict factorial invariance	8590.67	1576	<.001	0.051 [0.050, 0.052]	0.898	0.899	0.092

Note: RMSEA = root mean square error of approximation; CI = confidence interval; *df* = degrees of freedom; CFI = comparative fit index; TLI = Tucker–Lewis Index; SRMR = standardized root mean square residual. The pattern of findings remained unchanged when outliers were unaddressed: Current service members model (χ^2 = 3745.43, *df* = 731, RMSEA = 0.045, CFI = 0.921, TLI = 0.915, SRMR = 0.063); veterans model (χ^2 = 2962.44, *df* = 731, RMSEA = 0.047, CFI = 0.925, TLI = 0.921, SRMR = 0.087); metric invariance (χ^2 = 7413.81, *df* = 1500, RMSEA = 0.048, CFI = 0.914, TLI = 0.910, SRMR = 0.078); intercept-only invariance (χ^2 = 7379.11, *df* = 1500, RMSEA = 0.048, CFI = 0.914, TLI = 0.911, SRMR = 0.085); scalar invariance (χ^2 = 8059.49, *df* = 1538, RMSEA = 0.050, CFI = 0.905, TLI = 0.903, SRMR = 0.089); fully freed (χ^2 = 7496.34, *df* = 1508, RMSEA = 0.048, CFI = 0.912, TLI = 0.910, SRMR = 0.089); and strict factorial invariance (χ^2 = 8610.75, *df* = 1576, RMSEA = 0.051, CFI = 0.897, TLI = 0.898, SRMR = 0.092).

Table 4. Summary of Fit Statistics for the Three-Group (Current Service Members vs. Younger Veterans [<35 years] vs. Older Veterans [≥35 years]) Suicide-Related Measurement Model.

Models	χ^2	*df*	*p*	RMSEA [90% CI]	CFI	TLI	SRMR
Current service members	3760.48	733	<.001	0.045 [0.044, 0.047]	0.920	0.915	0.063
Younger veterans (<35 years)	1467.71	731	<.001	0.052 [0.048-0.056]	0.902	0.900	0.094
Older veterans (≥35 years)	2430.58	731	<.001	0.048 [0.046, 0.050]	0.924	0.919	0.091
Metric invariance	8250.76	2269	<.001	0.048 [0.047, 0.049]	0.913	0.911	0.080
Intercept-only invariance	8311.86	2269	<.001	0.049 [0.047-0.050]	0.912	0.910	0.088
Scalar invariance	8972.31	2345	<.001	0.050 [0.049, 0.051]	0.904	0.904	0.092
Fully freed	8418.20	2285	<.001	0.049 [0.048, 0.050]	0.911	0.909	0.092
Strict factorial invariance	9635.13	2421	<.001	0.051 [0.050, 0.052]	0.895	0.899	0.095

Note: RMSEA = root mean square error of approximation; CI = confidence interval; *df* = degrees of freedom; CFI = comparative fit index; TLI = Tucker–Lewis Index; SRMR = standardized root mean square residual. The pattern of findings remained unchanged when outliers were unaddressed: Current service members model (χ^2 = 3745.43, *df* = 731, RMSEA = 0.045, CFI = 0.921, TLI = 0.915, SRMR = 0.063), younger veterans model (χ^2 = 1438.55, *df* = 731, RMSEA = 0.051, CFI = 0.907, TLI = 0.901, SRMR = 0.092), older veterans model (χ^2 = 2321.02, *df* = 731, RMSEA = 0.048, CFI = 0.925, TLI = 0.920, SRMR = 0.089), metric invariance (χ^2 = 8339.37, *df* = 2269, RMSEA = 0.049, CFI = 0.912, TLI = 0.909, SRMR = 0.080), intercept-only invariance (χ^2 = 8281.01, *df* = 2269, RMSEA = 0.048, CFI = 0.913, TLI = 0.910, SRMR = 0.087), scalar invariance (χ^2 = 9046.82, *df* = 2345, RMSEA = 0.050, CFI = 0.903, TLI = 0.903, SRMR = 0.092), fully freed (χ^2 = 8407.06, *df* = 2285, RMSEA = 0.049, CFI = 0.911, TLI = 0.909, SRMR = 0.091), and strict factorial invariance (χ^2 = 9695.31, *df* = 2421, RMSEA = 0.052, CFI = 0.895, TLI = 0.898, SRMR = 0.095).

(0.26, $p < .001$). They did not differ significantly on the AUDIT factor. This pattern of findings remained consistent when study site was included as a covariate in analyses.

Multigroup Comparisons: Current Versus Younger Veterans (<35 years) Versus Older Veterans (≥35 years)

Following completion of our two-group analyses, we utilized the same five steps described above to compare the three groups, which were divided first by enlistment status and second by age. For Step 1, we applied our baseline model to current service members, younger veterans (<35 years), and older Veterans (≥35 years) separately to assess configural invariance. Results indicated adequate fit in all groups (Table 4).[5] For Step 2, we evaluated metric invariance across all three groups. Analysis of our fit indices indicated adequate fit in the full sample (Table 4).[5] Our χ^2 difference tests were significant (Current: χ^2 difference = 4,490.28, CV with 1,536 *df* = 1,628.29; younger veterans: χ^2 difference = 6,783.05, CV with 1,538 *df* = 1,630.35; older veterans: χ^2 difference = 5,820.18, CV with 1,538 *df* = 1,630.35); however, the change in CFI was not significant in current service members (ΔCFI = 0.007), and the metric invariance model resulted in improved model fit in younger veterans (ΔCFI = 0.011). Although the change in CFI was barely significant in older veterans (ΔCFI = 0.011), given that we continued to observe adequate model fit in the metric invariance model, we determined that metric invariance was supported in this sample. For Step 3, we assessed intercept-only invariance by constraining the intercepts, but not factor loadings to be equal across groups. Analysis of our fit indices again indicated adequate fit (Table 4).

For Step 4, we examined scalar invariance. Again, the model provided adequate fit (Table 4). We then ran an alternative model where all factor loadings were freed except those required for scale dependency to determine likelihood of partial invariance. This model also provided adequate fit (see fully freed model in Table 3). The χ^2 difference test was significant (χ^2 difference = 554.11, CV with 60 *df* = 79.08); however, the fully freed model did not significantly improve the CFI fit index (ΔCFI = 0.008). As such, we determined that our results supported scalar invariance, and thus our model met requirements for strong factorial invariance. For Step 5, we assessed for strict factorial invariance. However, the additional constraint of residual variances across groups resulted in poor fit (see Table 4). Thus, our model met for strong, but not strict, factorial invariance, based on the resulting poor model fit in the strict factorial invariance model.

We again compared the latent factor means across our three groups. Regarding the comparison between current service members and younger veterans, we found that younger veterans had significantly higher means on the following factors: ASI-3 (unstandardized mean difference = 0.384, $p < .001$), SBQ-R (0.643, $p < .001$), SIS (0.323, $p < .001$), INQ-TB (0.810, $p < .001$), DSI-SS (0.243, $p < .001$), PCL-M (0.927, $p < .001$), AUDIT (0.275, $p < .001$), ISI (−0.720, $p < .001$), and the higher order suicide risk factor (0.383, $p < .001$). Regarding the comparison between current service members and older veterans, we found that older veterans had significantly higher means on the following factors: ASI-3 (unstandardized mean difference = 0.393, $p < .001$), SBQ-R (0.557, $p < .001$), SIS (0.314, $p < .001$), INQ-TB (0.805, $p < .001$), DSI-SS (0.192, $p < .001$), PCL-M (0.579, $p < .001$), ISI (0.492, $p < .001$), and the higher order suicide risk factor (0.249, $p < .001$); the two groups did not differ significantly regarding means for the AUDIT factor. Regarding the comparison between younger and older veterans, we found that older veterans had significantly lower means on the following factors: PCL-M (unstandardized mean difference = −0.348, $p < .001$), AUDIT (−0.353, $p < .001$), and ISI (0.228, $p < .001$); they did not differ significantly on the other factors. Of note, the pattern of findings remained consistent when study site was covaried in analyses.

Additional analyses are included in supplemental materials (All supplementary materials are available in online version of the article.): (a) unstandardized and standardized factor loadings (Table S1) and (b) estimated factor correlations for the scalar invariance model in current service members (Table S2), younger veterans (Table S3), and older veterans (Table S4).

Discussion

Suicide rates within the U.S. military are elevated (Kuehn, 2009; Ramchand et al., 2011), and converging evidence indicates that suicide risk is not evenly distributed within the U.S. military, including across current service members and veterans (Villatte et al., 2015) and younger and older veterans (Kaplan et al., 2012). The assessment of suicide thoughts and behaviors, as well as suicide-related conditions, has been identified as a critical suicide prevention priority (Hoge & Castro, 2012; U.S. Surgeon General & National Action Alliance for Suicide Prevention, 2012); yet, few data exist on how approaches to measuring constructs related to suicide risk operate across U.S. military subgroups. Thus, the present study sought to examine measurement invariance of the MSRC CDEs across current service members, younger veterans, and older veterans.

The results supported strong factorial invariance across current service members, younger veterans, and older veterans. The latent structure of the MSRC CDEs evinced at least adequate model fit for current service members and for the veteran subgroups. The structures of the models were comparable with few differences. Taken together, results from the present study suggest that although there are a few differences in factor loadings, overall, the factor structure of the MSRC CDEs is comparable across current service members, younger veterans, and older veterans.

Given similar latent structures, research findings in one group may, with due caution, inform clinical and policy decision making for another. Indeed, research with current service members is logistically challenging. These challenges include, for instance, frequently changing locales, especially during deployment, that result in difficulties with participant recruitment and retention efforts. Yet, findings from the present study offer one potential solution to circumvent this challenge in an empirically supported way. That is, as noted, analog military populations—younger and older veterans—demonstrated comparable factor structure regarding suicide risk on the MSRC CDEs. Thus, although the implications of research findings will likely differ for current service members versus veterans (e.g., policy decisions), it is possible that research in one population can *inform* evidence-based clinical and policy-related decisions in the other.

The present study has several limitations. First, given that pooled data were utilized, the participant recruitment strategies varied widely. While this likely enhances external validity, it does so at the potential expense of internal validity. We attempted to correct this limitation, at least in part, by covarying study site in analyses; importantly, the pattern of findings remained consistent when examining study site as a control. Relatedly, as noted, the demographic and military experience characteristics that were gathered were inconsistent across studies, leading to substantial missing data in those descriptive domains. There was also a notable amount of missing data for some of the variables that comprise the CDEs (e.g., 27% missing for the ASI-3 items) and that, overall, the data were not MAR for the full sample and

veteran subgroups. Thus, it is possible that these estimates are biased, although we note that we utilized multiple imputation to approximate missing values. Furthermore, the CDEs represent a collection of items that are assessed via self-report; there are inherent issues with self-reported symptoms of psychopathology (e.g., social desirability biases, misclassification). However, complementary research suggests that other approaches commonly used to augment self-report measures of suicidality (i.e., implicit association tests; Nock et al., 2010) may have limited utility for military populations (Chiurliza et al., 2016).

Importantly, the present study was neither positioned to examine how the CDEs operate across branches of the military nor across service members with and without combat experiences. Given the differences in suicide rates across branches and the oft-cited role of combat experiences in the pathogenesis of suicidality (for discussion, see Bryan et al., 2015), we welcome future research in this area. Furthermore, for the stratification of younger and older veterans, age was captured, as opposed to years since separation from service (cf. Reger et al., 2015). This study also examined current military service members broadly, which is a group composed of both active duty and Reserves; thus, future research should accrue samples and collect data in a way to distinguish between subgroups of current service members. Future research may also examine if the MSRC CDEs demonstrate measurement invariance across other stratifications, such as by sex, race, ethnicity, clinical status (e.g., inpatient vs. outpatient), or military connection (e.g., military vs. civilian). We also note that the present study utilized CFA to examine measurement invariance and that other approaches, such as item response theory, can be comparably used to examine measurement invariance and are worthy of consideration in future research (Meade & Lautenschlager, 2004).

Finally, the present study is cross-sectional and does not address two crucial questions: (a) do the MSRC CDEs have test–retest reliability? and (b) do the items that comprise the CDEs prospectively predict risk for suicidal behaviors and/or deaths? Research examining a military-specific suicide risk assessment approach that *prospectively* predicts suicidal behaviors is presently underway by the study investigators. However, in the interim, these cross-sectional data provide needed support that the CDEs operate similarly for current service members and veterans.

Conclusions

The present study found strong factorial invariance for the MSRC CDEs across current service members, younger veterans, and older veterans. The latent structure of the CDEs appeared comparable across these groups with minimal factor loading differences. Given the elevated rates of suicide within the U.S. military, this study provides additional evidence that the MSRC CDEs can be used in research studies with both current military service members and veterans, regardless of age. Furthermore, suicide research in one population (e.g., veterans) may, with due caution, inform clinical and public policy decision making in the other (e.g., current service members).

Authors' Note

Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the MSRC, the DoD, or the U.S. Department of Veterans Affairs.

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Declaration of Conflicting Interests

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Notes

1. A large proportion of this sample is redundant with that reported in Ringer et al. (2018); however, the present article is nonredundant in its focus on measurement invariance of the CDEs, which has not been examined in any previous analyses.

2. In the current study, we focused on 45 items. We excluded items if they were not drawn from any existing scales and/or were not amenable (e.g., qualitative items) to the current data analytic approach. We also excluded the two CDE items from the Beck Scale for Suicide Ideation because at least three items are needed for factor loadings. Importantly, the factorial space of suicidal ideation is covered by the four-item DSI-SS included in the CDEs and analyzed in the present study.
3. We also ran analyses including the BHS and TBI-4 item sets as lower order factors composed of their individual items with use of the weighted least squares means and variances adjusted (WLSMV) to assess overall model fit; however, the fit was poor. As such, we opted to utilize the total scale scores for the BHS and TBI-4 item sets to improve model fit. Results utilizing this approach are presented in footnotes.
4. The pattern of findings remained unchanged with outliers unaddressed (see Table 3). However, when WLSMV was used, the model fit was poor: current service members (χ^2 = 3035.44, *df* = 900; RMSEA = 0.03, CFI = 0.901, TLI = 0.891, WRMR = 1.21) and veterans (χ^2 = 4210.11, *df* = 935; RMSEA = 0.042, CFI = 0.848, TLI = 0.839, WRMR = 1.80).
5. The pattern of findings remained unchanged with outliers unaddressed (see Table 4).

Supplemental Material

Supplementary material for this article is available online.

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Examining the link between prior suicidality and subsequent suicidal ideation among high-risk US military service members

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Abstract

Background. Research is needed to identify the factors that explain the link between prior and future suicidality. This study evaluated possible mediators of the relationship between: (1) the severity of prior suicidality and (2) suicidal ideation severity at 3-month follow-up among a sample of high-risk military personnel.

Methods. US military service members referred to or seeking care for suicide risk ($N = 624$) completed self-report psychiatric domain measures and a clinician interview assessing prior suicidality severity at baseline. Three months later, participants completed a self-report measure of suicidal ideation severity. Three separate percentile bootstrap mediation models were used to examine psychiatric factors (i.e. alcohol abuse, anxiety sensitivity, hopelessness, insomnia, posttraumatic stress symptoms, suicidal ideation, and thwarted belongingness) as parallel mediators of the relationship between prior suicidality severity (specifically, suicidal ideation, suicide attempt, and overall suicidality – i.e. ideation/attempt severity combined) at baseline and suicidal ideation severity at follow-up.

Results. Hopelessness, specifically, and the total effect of all mediators, each significantly accounted for the relationship between prior suicidality severity and subsequent ideation severity across models. In the models with attempt severity and overall suicidality severity as predictors, thwarted belongingness was also a significant mediator.

Conclusions. Hopelessness, thwarted belongingness, and overall severity of psychiatric indices may explain the relationship between prior suicidality severity and future suicidal ideation severity among service members at elevated suicide risk. Research is needed to replicate these findings and examine other possible mediators.

Introduction

Suicide has become a growing concern within the US military, with suicide rates among service members exceeding those found among civilians (Kuehn, 2009; Nock *et al.*, 2013). Consequently, there have been calls for research to better understand suicide risk factors among military populations (Ramchand *et al.*, 2011). In the broader suicide research literature, one consistently identified risk factor is a history of suicidality (i.e. ideation, plans, and/or attempts; Franklin *et al.*, 2017). Among military samples, specifically, Bryan *et al.* (2014) found that military personnel with a history of pre-military self-injurious thoughts and behaviors (SITBs) reported more severe current suicidal ideation than those without this history. Another study of the entire active duty US military found that suicidal ideation and previous suicide attempts significantly predicted death by suicide (Hyman *et al.*, 2012). These findings, together, indicate that a suicidality history is a key signal of risk among service members. It remains unclear, however, which mechanisms account for the relationship between prior and future suicidality. Despite a paucity of research in this area, studies point to other psychiatric problems as candidate mechanisms that may underlie this association.

For one, suicidality may confer risk for the development of other psychiatric problems. Goldman-Mellor *et al.* (2014) found that suicide attempters were significantly more likely than those without an attempt history to go on to experience persistent major depressive episodes and substance dependence, even after accounting for baseline psychiatric morbidity. Multiple attempters, in particular, may go on to experience marked psychopathology as compared with single attempters (Forman *et al.*, 2004). Research also indicates that psychiatric disorders predict future suicidal thoughts and behaviors. A meta-analysis of suicidality risk factors found that depression and anxiety diagnoses were among the strongest predictors of suicidal ideation (Franklin *et al.*, 2017). Regarding military-specific findings, studies among US Army soldiers (Nock *et al.*, 2015) and active duty US military service members

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(LeardMann *et al.*, 2013) have found that mental disorders (e.g. depression, bipolar disorder, alcohol use disorder) precede suicide ideation, attempts, and deaths. Thus, not only may prior suicidality predict more severe psychiatric symptoms, but more severe psychiatric symptoms may also predict future suicidal thoughts and behaviors.

Taken together, it is plausible that psychiatric problems mediate the relationship between prior suicidality and subsequent suicide risk among service members. Studies are needed, though, to test this conjecture. Indeed, as Ribeiro *et al.* (2016) conclude in their meta-analysis, research is needed to clarify what mechanisms explain the significant relationship they observed between prior SITBs and future suicidal thoughts and behaviors. Because *more severe* attempt histories (e.g. multiple attempts) and *more severe* ideation histories (e.g. more lethal methods considered) have been linked to greater future suicide risk (Beautrais, 2003; Brown *et al.*, 2004; Forman *et al.*, 2004), it is especially important to examine *severity* of suicidality, and not simply its *presence*, as a predictor of suicide risk. This knowledge may improve our understanding of factors that maintain suicidality and reveal military suicide prevention avenues.

The present study

This longitudinal study aimed to evaluate possible explanatory factors underlying the relationship between prior suicidality and future suicidal ideation. Specifically, using a sample of high-risk military service members, we investigated various psychiatric factors (i.e. alcohol abuse, anxiety sensitivity, hopelessness, insomnia, posttraumatic stress, suicidal ideation, and thwarted belongingness) as parallel mediators of the association between: (1) lifetime suicidality severity (specifically, suicidal *ideation severity*, suicide *attempt severity*, and *overall suicidality severity* – i.e. ideation and attempt severity combined) at baseline and (2) suicidal ideation severity at 3-month follow-up. Given a lack of research in this domain, no *a priori* hypotheses were formulated. This study represents a subset of a larger investigation of suicide risk prediction among high-risk service members (Gutierrez *et al.*, n.d.). Consequently, we were limited in which psychiatric constructs we could evaluate as mediators. Even so, each of our included mediators has demonstrated associations with both suicide ideation and attempts (Beck *et al.*, 1989; Joiner and Rudd, 1996; Cougle *et al.*, 2009; Borges and Loera, 2010; Capron *et al.*, 2012; Bernert *et al.*, 2015; Chu *et al.*, 2017; Franklin *et al.*, 2017). Of note, we examined suicidal ideation as a mediator to investigate whether prior suicidality is associated with future ideation simply via the pathway of ideation, or whether other factors might better account for this relationship. Additionally, we note that because the main investigation was not designed to test our study hypotheses, data on psychiatric factors were not collected at each time point. Thus, this study serves as an initial investigation of possible mechanisms underlying the relationship between prior suicidality and future ideation, rather than a definitive test of longitudinal mediating effects (Maxwell and Cole, 2007).

Methods

Participants

Participants ($N = 624$) were military service members referred to or seeking services from a military emergency department, inpatient psychiatric unit, or outpatient behavioral health clinic for suicide risk concerns. Participants were eligible if they were: (1) active duty US military service members, and (2) scheduled to be stationed within the continental USA for at least 3 months following study enrollment. Participants ranged in age from 18 to 52 years ($M = 25.24$; S.D. = 6.08), and the majority (77.9%) identified as male (21.1% female, 1.0% transgender). Regarding race, 62.4% identified as White/Caucasian, 19.1% Black/African American, 4.2% Asian/Pacific Islander, 0.8% Native American/Alaskan Native, and 13.6% another race; among participants, 17.3% identified as Hispanic or Latino/a. A plurality (47.8%) of participants reported being single (39.7% married, 6.9% separated, 5.6% divorced). Nearly half (48.6%) reported that their highest level of education completed was high school (0.5% no high school diploma, 37.8% some college, 5.6% associate's degree, 5.9% bachelor's degree, 1.6% master's/doctoral degree). Years of military service ranged from 0 to 25 ($M = 4.62$; S.D. = 4.97); all US military branches were represented.

Measures

Due to the need for a brief survey battery to minimize participant burden, the main investigation used the Military Suicide Research Consortium's Common Data Elements (MSRC CDEs) to assess alcohol abuse, anxiety sensitivity, hopelessness, insomnia, posttraumatic stress symptoms, and thwarted belongingness (see Ringer *et al.*, 2018 and Stanley *et al.*, 2018 for details regarding the development of the MSRC CDEs using factor analyses and their validation in a military sample).

Self-Harm Behavior Questionnaire

A clinician interview version of the Self-Harm Behavior Questionnaire (SHBQ) was utilized to assess the severity of participants' lifetime histories of suicide ideation (five scored items) and attempts (six scored items) (Gutierrez *et al.*, 2001). Total scores on the ideation and attempts subscales range from 0 to 13 and 0 to 23, respectively; higher scores signal greater severity. Per the SHBQ, a more severe ideation history is indicated by more lethal methods considered, a greater number of stressors contributing to the ideation, having made a specific suicide plan, not having thought about others' reactions to one's suicide death, and/or having taken steps toward a suicide plan. Additionally, per the SHBQ, a more severe attempt history is indicated by the use of more lethal methods, a greater number of attempts, a more recent attempt, the need for medical attention following an attempt, a greater number of stressors associated with an attempt, and/or greater suicidal intent during an attempt. These subscales are summed to create an index of overall suicidality severity (range: 0–36). The SHBQ has demonstrated strong psychometric properties (Gutierrez *et al.*, 2001; Fliege *et al.*, 2006; Gutierrez and Osman, 2008). The SHBQ suicide ideation subscale demonstrated questionable but workable internal consistency ($\alpha = 0.62$), the suicide attempt subscale excellent internal consistency ($\alpha = 0.95$), and the overall suicidality index good internal consistency ($\alpha = 0.88$). SHBQ indices were included as predictors in our mediation models.

Anxiety Sensitivity Index-3

A five-item version of the 18-item self-report Anxiety Sensitivity Index-3 (ASI-3) was used to assess concerns regarding anxiety-related sensations (Taylor *et al.*, 2007). The MSRC CDEs include five items from the ASI-3's cognitive concerns subscale because elevations on this subscale have been associated with increased

suicide risk (Oglesby *et al.*, 2015). Items are rated on a 1 (*Very little*) to 5 (*Very much*) scale; higher ratings indicate greater anxiety sensitivity (range 5–25). The five-item ASI has demonstrated excellent internal consistency and a strong, significant relationship with the 18-item ASI-3 ($r = 0.94$; Ringer *et al.*, 2018). The abbreviated ASI demonstrated good internal consistency in this sample ($\alpha = 0.87$). ASI anxiety sensitivity was included as a mediator in the analyses.

Alcohol Use Disorders Identification Test-Consumption

The Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) is a three-item self-report screen for the presence of an alcohol use disorder (Bush *et al.*, 1998). Total scores range from 0 to 12, and higher scores indicate more problematic alcohol use. The AUDIT-C has demonstrated strong psychometric properties (Bradley *et al.*, 2007) and demonstrated good internal consistency in the current study ($\alpha = 0.86$). AUDIT-C alcohol use was utilized as a mediator in this study.

Beck Hopelessness Scale

A three-item version of the 20-item self-report Beck Hopelessness Scale (BHS) was used to assess past-week negative expectations about the future (Beck and Steer, 1988). Items are rated 'true' (1) or 'false' (0). Total scores range from 0 to 3; higher scores indicate greater hopelessness. The full-scale BHS has demonstrated strong concurrent validity (Beck and Steer, 1988). The three-item BHS has demonstrated a significant, but relatively weak, correlation with the 18-item BHS ($r = 0.29$; Ringer *et al.*, 2018). In this study, the three-item BHS demonstrated acceptable internal consistency ($\alpha = 0.74$) and was included as a mediator.

Depressive Symptom Inventory – Suicidality Subscale

The Depressive Symptom Inventory – Suicidality Subscale (DSI-SS) is a four-item self-report measure designed to assess the frequency and intensity of individuals' suicidal thoughts and impulses in the past 2 weeks (Metalsky and Joiner, 1997). Items are rated on a 0–3 scale, and responses are summed such that higher scores indicate greater severity of suicidal ideation (range: 0–12). The DSI-SS has previously demonstrated strong psychometric properties, and DSI-SS total scores >2 are considered clinically significant (Joiner *et al.*, 2002). The DSI-SS demonstrated excellent internal consistency in the current study ($\alpha = 0.90$). DSI-SS suicidal ideation was included as a mediator in our analyses.

Insomnia Severity Index

A five-item version of the seven-item self-report Insomnia Severity Index (ISI) was utilized to assess insomnia symptom severity (Bastien *et al.*, 2001). Individuals rate numerous sleep complaints on a 0–4 scale. Total scores range from 0 to 20; higher scores signal more severe insomnia symptoms. The five-item ISI has demonstrated good internal consistency (Ringer *et al.*, 2018), and the full seven-item ISI has demonstrated strong psychometric properties (Bastien *et al.*, 2001; Morin *et al.*, 2011). The abbreviated ISI demonstrated good internal consistency in the current study ($\alpha = 0.81$), and it was included as a mediator in our analyses.

Interpersonal Needs Questionnaire

A five-item version of the nine-item self-report Interpersonal Needs Questionnaire (INQ) thwarted belongingness subscale was used to assess perceived social isolation (Van Orden *et al.*, 2012). Items are rated on a 1 (*Not at all true for me*) to 7 (*Very true for me*) scale. Total scores range from 5 to 35; higher scores indicate greater thwarted belongingness. The full subscale has demonstrated strong psychometric properties (Van Orden *et al.*, 2012), and the five-item version has been shown to correlate significantly with the full subscale ($r = 0.64$; Ringer *et al.*, 2018). The abbreviated subscale demonstrated excellent internal consistency in this sample ($\alpha = 0.90$) and was included as a mediator in this study.

Post-traumatic Stress Disorder (PTSD) Checklist – Military Version

An eight-item version of the 17-item self-report Post-traumatic Stress Disorder (PTSD) Checklist – Military Version (PCL-M) was utilized to assess PTSD symptom severity associated with stressful military experiences (Weathers *et al.*, 1994). Individuals rate the degree to which they have been bothered by various PTSD symptoms in the past month on a 1 (*Not at all*) to 5 (*Extremely*) scale. Total scores range from 8 to 40; higher scores signal more severe PTSD symptoms. The full PCL-M has demonstrated strong psychometric properties (Wilkins *et al.*, 2011), and the eight-item version has been shown to be significantly correlated with the full PCL-M ($r = 0.81$; Ringer *et al.*, 2018). In this study, the abbreviated PCL-M demonstrated excellent internal consistency ($\alpha = 0.92$) and was used as a mediator in our analyses.

Adult Suicidal Ideation Questionnaire

The Adult Suicidal Ideation Questionnaire (ASIQ) is a 25-item self-report measure of suicidal ideation severity (Reynolds, 1987). Participants rate how frequently they have experienced various suicidal thoughts in the past month on a 0 (*I never had this thought*) to 6 (*Almost everyday*) scale. Total scores range from 0 to 150; higher scores indicate more severe suicidal ideation, and total scores >30 indicate high risk for a future suicide attempt (Reynolds, 1991). The ASIQ has demonstrated strong validity and reliability in previous studies (Reynolds, 1991; Osman *et al.*, 1999), and it demonstrated excellent internal consistency in this study ($\alpha = 0.96$). The ASIQ was administered at 3-month follow-up, and ASIQ suicidal ideation was included as the dependent variable in this study.

Procedures

This study is a subset of a larger investigation ($N = 758$; Gutierrez *et al.*, n.d.). Participants were included in our analyses if they completed measures for all variables of interest ($n = 624$); there were no significant demographic differences between those excluded and included. Military providers referred service members who presented to care with elevated suicide risk to participate in the main study. Interested individuals then met in person with a study assessor (a licensed clinician) to learn more about the study and provide written informed consent. Following study enrollment, participants completed a clinical interview with the assessor and computerized self-report measures. Three months later, participants completed a follow-up assessment, which included clinician interviews and self-report measures. All measures in this study were administered only at baseline, except the ASIQ, which was administered only at follow-up. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Data analytic approach

Study variables were screened for outliers and violations of normality. All variables were within acceptable ranges and normally distributed (see Table 1), except for ASIQ suicidal ideation, for which univariate outliers ($n = 45$) were identified. ASIQ scores two interquartile ranges above the median were brought to the appropriate fence (i.e. maximum total score of 56).†[1] Then, percentile bootstrap mediation analyses (5000 resamples) were used to examine aforementioned psychiatric factors as parallel mediators[2] of the relationship between: (1) SHBQ prior suicidal ideation severity, suicide attempt severity, and overall suicidality severity and (2) ASIQ suicidal ideation severity at follow-up (see Figs 1–3, respectively). These analyses served as an imperfect test of longitudinal mediation given our inability to control for psychiatric factors prior to our baseline assessment; however, we utilized mediation analyses given our aim of identifying explanatory factors. Regarding our use of one ideation measure (DSI-SS) as a mediator of two other ideation measures (SHBQ and ASIQ), we note that these measures assessed ideation at three distinct time points: lifetime prior to baseline (SHBQ), baseline (DSI-SS), and 3-month follow-up (ASIQ). The small-to-medium correlations between these measures ($r = 0.13$–0.30) further suggest that they captured related yet distinct constructs. Thus, we retained the DSI-SS as a mediator in analyses.[3] Mediation analyses were conducted utilizing the PROCESS macro (Hayes, 2013) in SPSS version 23.0.0. Mediators were considered statistically significant if the 95% confidence interval (CI) did not cross zero ($\alpha < 0.05$). We utilized pairwise contrasts to compare the relative strength of significant mediators ($\alpha < 0.05$).

Results

Descriptive statistics

See Table 1 for descriptive statistics and intercorrelations for all study measures. At baseline, 92.6% ($n = 578$) of participants reported a lifetime history of suicidal ideation on the SHBQ, 43.4% ($n = 271$) reported a lifetime suicide attempt history on the SHBQ, and 43.6% ($n = 272$) reported clinically significant current suicidal ideation on the DSI-SS. At follow-up, 17.8% ($n = 111$) reported clinically significant ideation on the ASIQ, with 84.1% ($n = 525$) reporting past-month suicidal thoughts (i.e. ASIQ total score >0). From baseline to 3-month follow-up, 68.9% of participants reported attending at least one psychiatric medical visit (not inclusive of non-medical appointment to address psychiatric needs; e.g. counseling).

Mediation analyses[4]

SHBQ suicidal ideation severity

The indirect effects of SHBQ suicidal ideation on ASIQ suicidal ideation (i.e. the degree to which the ASIQ suicidal ideation scores change for every one-unit increase in SHBQ suicidal ideation scores) were significant through the pathways of BHS hopelessness [95% CI (<0.01–0.15)], specifically, and the total effect of all mediators [95% CI (0.08–0.36)] (Table 2, Fig. 1). No other pathways were statistically significant.

SHBQ suicide attempt severity

The indirect effects of SHBQ suicide attempt severity on ASIQ suicidal ideation were significant through the pathways of BHS hopelessness [95% CI (<0.01–0.05)], and INQ thwarted belongingness [95% CI (<0.01–0.06)], specifically, and through the total effects of all psychiatric symptoms [95% CI (0.01–0.13)] (Fig. 2). No other pathways were statistically significant. None of the significant mediators was significantly stronger than any other mediator.

SHBQ overall suicidality severity

The indirect effects of SHBQ overall suicidality on ASIQ suicidal ideation were significant through the pathways of BHS hopelessness [95% CI (<0.01–0.05)] and INQ thwarted belongingness [95% CI (<0.01–0.05)], specifically, and the total effects of all mediators [95% CI (0.02–0.12)] (Fig. 3). No other pathways were statistically significant. None of the significant mediators was significantly stronger than any other mediator.

Discussion

This study evaluated various psychiatric factors as mediators of the relationship between prior suicidality severity and subsequent suicidal ideation severity among high-risk military personnel. Across models, hopelessness and the total effects of all psychiatric factors each significantly mediated this relationship. Thwarted belongingness was an additional significant mediator in the models examining prior suicide attempt severity and prior overall suicidality severity as predictors. Findings have implications for research and clinical practice.

First, it is noteworthy that more severe prior suicidality (i.e. more severe suicidal ideation and/or suicide attempts) was generally significantly associated with more severe psychiatric problems at baseline. These findings align with prior research indicating that individuals with an attempt history may go on to experience more severe psychiatric symptoms (Forman *et al.*, 2004; Miranda *et al.*, 2008; Goldman-Mellor *et al.*, 2014). Our findings also extend prior work by demonstrating that *more severe* prior suicide attempts (e.g. attempts resulting in medical attention) and *more severe* prior suicidal ideation (e.g. having made specific suicide plans) each predict more severe psychiatric problems. These results underscore the importance of considering the severity – and not just the presence – of prior suicidality when working with at-risk service members. We also found that more severe psychiatric problems at baseline generally significantly predicted more severe suicidal ideation at follow-up. These findings align with prior work suggesting that clinically significant psychiatric symptoms predict risk for suicidal thoughts and behaviors among service members (LeardMann *et al.*, 2013; Nock *et al.*, 2015). Furthermore, these findings build upon previous work by suggesting that this significant relationship is observed over a relatively short time frame. Thus, more severe psychiatric problems may serve as a warning sign for the experience of more severe suicidal thoughts.

With regard to our mediation findings, it is striking that hopelessness, in particular, emerged as a significant mediator across all three analytic models. What might explain these results? The interpersonal theory of suicide (Joiner, 2005; Van Orden *et al.*, 2010) posits that passive suicidal ideation emerges when individuals experience thwarted belongingness and perceived burdensomeness (i.e. belief that others would be better off if one were dead). However, it is not until they develop hopelessness

†The notes appear after the main text.

Table 1. Means, standard deviations, ranges, and zero-order correlations for study measures

	1	2	3	4	5	6	7	8	9	10	11
1. ASI anxiety sensitivity	–										
2. ASIQ suicidal ideation	0.23**	–									
3. AUDIT-C alcohol use	0.04	−0.05	–								
4. BHS hopelessness	0.26**	0.23**	0.03	–							
5. DSI-SS suicidal ideation	0.25**	0.14**	0.14**	0.33**	–						
6. INQ thwarted belongingness	0.29**	0.26**	0.03	0.44**	0.36**	–					
7. ISI insomnia symptoms	0.43**	0.20**	0.05	0.34**	0.31**	0.34**	–				
8. PCL-M PTSD symptoms	0.39**	0.16**	−0.02	0.10*	0.14**	0.15**	0.47**	–			
9. SHBQ suicidal ideation	0.18**	0.30**	0.06	0.16**	0.13**	0.07	0.11**	0.10*	–		
10. SHBQ suicide attempts	0.11**	0.22**	0.01	0.09*	0.10*	0.09*	0.04	−0.01	0.35**	–	
11. SHBQ overall suicidality	0.15**	0.29**	0.03	0.13**	0.13**	0.10*	0.07	0.03	0.63**	0.95**	–
M	12.18	16.71	2.99	1.83	2.63	17.46	10.75	19.34	6.96	6.95	13.92
S.D.	5.79	16.45	3.19	1.19	2.91	8.07	4.82	9.63	3.31	8.18	9.84
Range	5–25	0–56	0–12	0–3	0–12	5–35	0–20	8–40	0–13	0–23	0–36
Skewness	0.44	1.09	1.05	−0.42	0.84	0.27	−0.27	0.53	−0.44	0.44	0.36
Kurtosis	−0.82	0.33	0.22	−1.38	−0.38	−0.93	−0.57	−0.90	−0.58	−1.60	−1.26
α	0.87	0.96	0.86	0.74	0.90	0.90	0.81	0.92	0.62	0.95	0.88

ASI, Anxiety Sensitivity Index; ASIQ, Adult Suicidal Ideation Questionnaire; AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; BHS, Beck Hopelessness Scale; DSI-SS, Depressive Symptom Inventory – Suicidality Subscale; INQ, Interpersonal Needs Questionnaire; ISI, Insomnia Severity Index; PCL-M, PTSD Checklist-Military Version; PTSD, Post-traumatic Stress Disorder; SHBQ, Self-Harm Behavior Questionnaire.

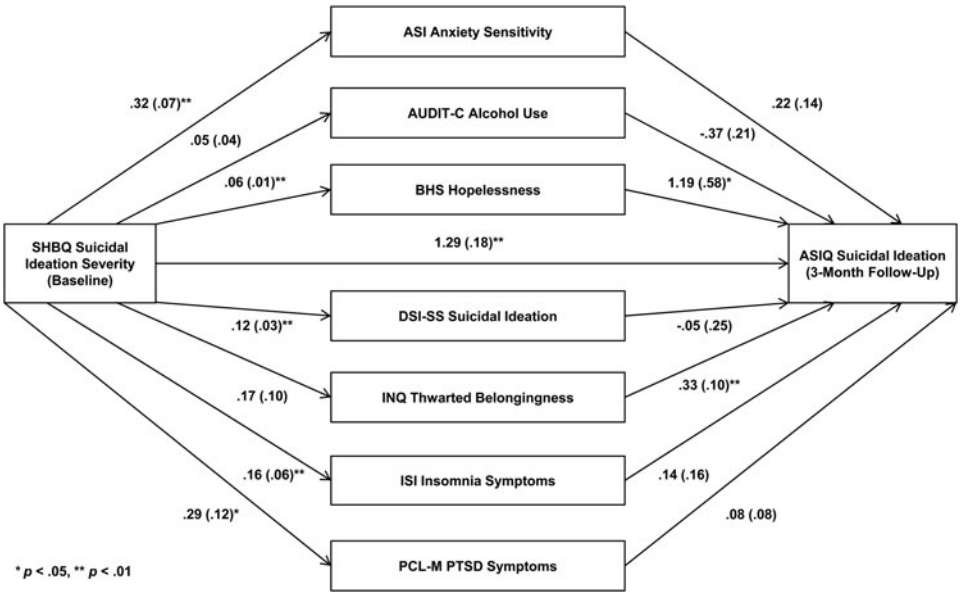

Fig. 1. Psychiatric factors as mediators of the relationship between SHBQ prior suicidal ideation severity at baseline and ASIQ suicidal ideation severity at 3-month follow-up.

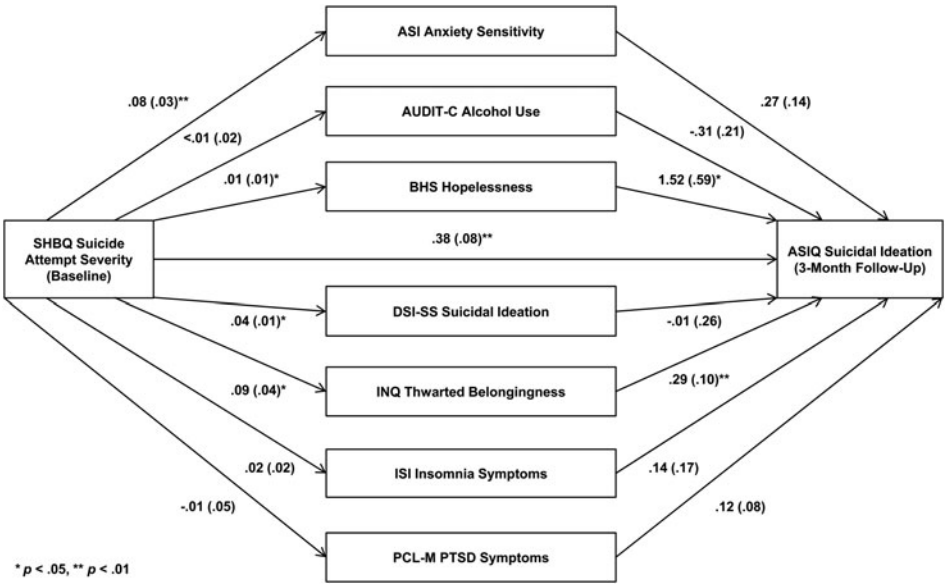

Fig. 2. Psychiatric factors as mediators of the relationship between SHBQ prior suicidal attempt severity at baseline and ASIQ suicidal ideation severity at 3-month follow-up.

regarding the tractability of thwarted belongingness and perceived burdensomeness that they experience active suicidal desire. Therefore, individuals with a history of more severe suicidal thoughts may develop hopelessness if their thwarted belongingness and perceived burdensomeness do not improve. This hopelessness, in turn, may result in more severe suicidal thoughts. Similarly, a more severe attempt history may contribute to feelings of hopelessness if individuals' stressors do not improve or their circumstances remain unchanged. Suicide attempt survivors may also regret surviving their attempt and feel hopeless that they did not die. We are unable to test these conjectures with our current data; thus, further research is needed to delineate why hopelessness might explain the relationship between prior suicidality severity and subsequent suicidal ideation severity. In particular, it will be useful to control for prior hopelessness (i.e. hopelessness at Time 1 in a three time point longitudinal design) because hopelessness may predict the initial onset of suicidality (McMillan *et al.*, 2007). It will also be useful to employ the full-scale BHS or another validated measure of hopelessness to ensure that this construct is adequately captured, as the three-item BHS appears weakly associated with the full-scale BHS (Ringer *et al.*, 2018).

Though not the primary focus of our study, also of import, the combined effects of all psychiatric factors significantly mediated the relationship between prior suicidality and subsequent suicidal ideation across all analytic models. Regarding explanations for these results, more severe prior suicidality may yield increased distress and impairment, which are associated with all forms of elevated psychiatric symptoms (American Psychiatric Association, 2013). This elevated distress and impairment may then lead to more severe suicidal thoughts in the future. It is also possible that elevated psychiatric problems precede, follow, and maintain suicidality. Though further research is needed to test this conjecture and to adequately test longitudinal mediation

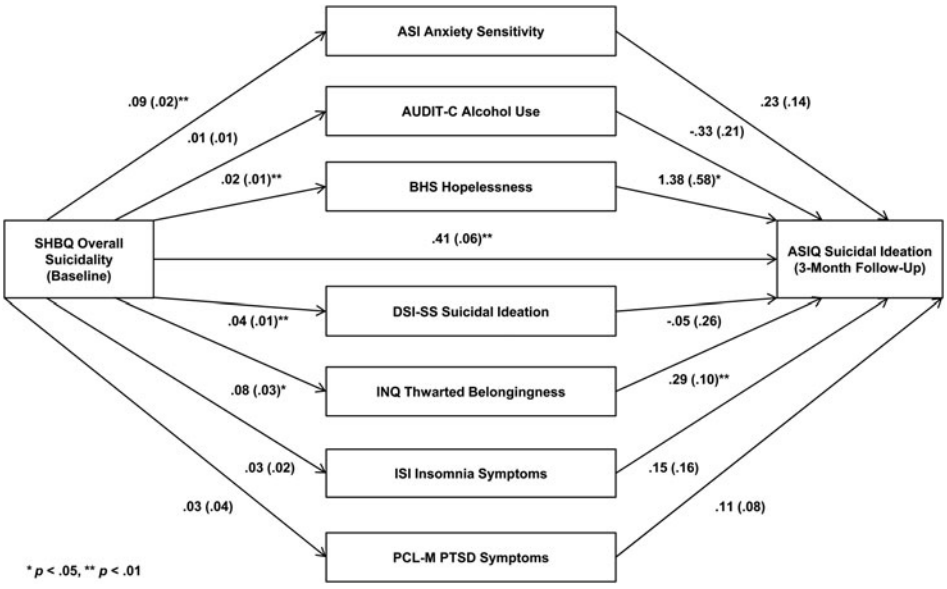

Fig. 3. Psychiatric factors as mediators of the relationship between SHBQ prior overall suicidality severity at baseline and ASIQ suicidal ideation severity at 3-month follow-up.

(i.e. by controlling for Time 1 psychiatric factors), our findings align with studies identifying psychiatric disorders as key factors in the development and maintenance of suicidality among service members (LeardMann *et al.*, 2013; Nock *et al.*, 2015; Millner *et al.*, 2017). As will be further discussed, these results may also have utility in the context of military suicide prevention efforts.

Interestingly, in the model evaluating severity of prior suicide attempts as a predictor of future suicidal ideation, thwarted belongingness emerged as an additional mediator. Suicide attempt survivors have been found to experience stigma from others, including loved ones, as a result of their attempts (Frey *et al.*, 2016; Sheehan *et al.*, 2016). It follows that a more severe suicide attempt may elevate thwarted belongingness. Higher levels of thwarted belongingness, a construct associated with more severe suicidal ideation (Chu *et al.*, 2017), may then lead to more severe suicidal thoughts. We note that, here, too, additional research is needed to illuminate data-driven explanations for this pattern of findings.

Finally, we are hesitant to interpret null findings, but it is worth noting that baseline suicidal ideation severity did not serve as a significant mediator in any of our models. These results seem to suggest that more severe prior suicidality is not necessarily associated with more severe future suicidal ideation simply because more severe suicidality leads to more severe suicidality. Also, though we could not evaluate other interpersonal theory variables in our models (e.g. capability for suicide, perceived burdensomeness), that the constructs we were able to evaluate – hopelessness and thwarted belongingness – emerged as significant predictors provides a degree of support for the theory (Joiner, 2005; Van Orden *et al.*, 2010).

In terms of clinical implications, our findings suggest that it may be useful to target psychiatric symptoms and related domains among military service members with a history of severe suicidal thoughts and behaviors. In doing so, risk for more severe suicidal ideation may be decreased. This approach could be particularly effective if the identified psychiatric symptoms are primary drivers of service members' suicidal desire (Tucker *et al.*, 2015; Jobes, 2016). Specifically, it may be useful to target hopelessness through cognitive behavioral therapy (CBT; Beck *et al.*, 1979). Promisingly, brief CBT has been shown to effectively reduce risk for future suicide attempts among at-risk military service members (Rudd *et al.*, 2015), and Bryan *et al.* (2018) have posited that the reduction of hopelessness may have served as one possible mechanism for that study's findings. More broadly, we note that efficacious interventions exist for each of the psychiatric factors examined as mediators in this study. Because the total effects of all psychiatric factors emerged as a significant mediator across models, it may be useful to ensure that all elevated symptoms are addressed. Before definitive treatment recommendations can be provided, however, we emphasize that further work is needed to replicate our findings and to test whether such interventions effectively serve to thwart the trajectory from a prior history of suicidality to recurrence of suicidal ideation.

Limitations and future directions

This study was not without limitations. First, prior suicidality severity was assessed retrospectively; thus, these data were susceptible to retrospective reporting biases. Participants may have also been prone to under-reporting symptom and suicidality severity due to confidentiality concerns (Anestis and Green, 2015). Second, the main investigation did not collect data regarding prior history of psychiatric disorders or psychiatric symptom severity at the time of suicidality onset. As a result, we were unable to control for these variables in our analyses. It is recommended that future studies collect detailed data regarding participants' psychiatric history, thereby allowing for a more robust test of the mediating effects of psychiatric factors. A thorough assessment of any psychiatric care received – not only medical visits for psychiatric reasons – may also enhance our understanding of changes in psychiatric factors over time. Third, a clinician assessment of suicidality was utilized at baseline, but a self-report measure of suicidal ideation was utilized at follow-up. Future studies would benefit from the inclusion of the same battery of measures at each assessment point. Moreover, it would also be informative for future studies to collect data over even shorter periods of time to enhance our understanding of factors that may explain acute increases in suicide risk.

Table 2. Indirect effects of prior suicidality severity at baseline on suicidal ideation severity at 3-month follow-up through the pathways of various psychiatric factors

	B	S.E.	95% CI
Independent variable: SHBQ suicidal ideation [$F_{(8,615)} = 16.62$, $p < 0.001$, $R^2 = 0.175$]			
Total effects of all mediators	0.21	0.07	0.08–0.36
ASI anxiety sensitivity	0.07	0.05	−0.02 to 0.17
AUDIT-C alcohol use	−0.02	0.02	−0.07 to 0.01
BHS hopelessness	0.07	0.04	<0.01–0.15
DSI-SS suicidal ideation	−0.01	0.03	−0.07 to 0.06
INQ thwarted belongingness	0.02	0.03	−0.03 to 0.09
ISI insomnia symptoms	0.06	0.04	−0.01 to 0.14
PCL-M PTSD symptoms	0.02	0.03	−0.02 to 0.09
Independent variable: SHBQ suicide attempts [$F_{(8,615)} = 13.81$, $p < 0.001$, $R^2 = 0.146$]			
Total effects of all mediators	0.07	0.03	0.01–0.13
ASI anxiety sensitivity	0.02	0.01	<−0.01 to 0.05
AUDIT-C alcohol use	<−0.01	0.01	−0.02 to 0.01
BHS hopelessness	0.02	0.01	<0.01–0.05
DSI-SS suicidal ideation	<−0.01	0.01	−0.02 to 0.02
INQ thwarted belongingness	0.03	0.01	<0.01–0.06
ISI insomnia symptoms	<0.01	0.01	−0.01 to 0.02
PCL-M PTSD symptoms	<−0.01	0.01	−0.02 to 0.01
Independent variable: SHBQ overall suicidality [$F_{(8,615)} = 15.96$, $p < 0.001$, $R^2 = 0.169$]			
Total effects of all mediators	0.07	0.02	0.02–0.12
ASI anxiety sensitivity	0.02	0.01	<−0.01 to 0.05
AUDIT-C alcohol use	<−0.01	0.01	−0.02 to 0.01
BHS hopelessness	0.02	0.01	<0.01–0.05
DSI-SS suicidal ideation	<−0.01	0.01	−0.02 to 0.02
INQ thwarted belongingness	0.02	0.01	<0.01–0.05
ISI insomnia symptoms	<0.01	0.01	−0.01 to 0.02
PCL-M PTSD symptoms	<0.01	0.01	−0.01 to 0.02

ASI, Anxiety Sensitivity Index; ASIQ, Adult Suicidal Ideation Questionnaire; AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; BHS, Beck Hopelessness Scale; DSI-SS, Depressive Symptom Inventory – Suicidality Subscale; INQ, Interpersonal Needs Questionnaire; ISI, Insomnia Severity Index; PCL-M, PTSD Checklist-Military Version; PTSD, Post-traumatic Stress Disorder; SHBQ, Self-Harm Behavior Questionnaire; Total effects of all mediators, the degree to which the relationship between prior suicidality (i.e. SHBQ suicidal ideation, suicide attempts, and overall suicidality) and subsequent ASIQ suicidal ideation is accounted for by the summed effects of all parallel mediators included in each respective model (i.e. total indirect effects).

Fourth, we were not able to administer full-scale measures of all constructs of interest due to the need for a brief survey battery. Use of full-scale measure would have allowed for a more nuanced evaluation of symptom clusters within disorders and robust measurement of constructs of interest. We recommend that future studies use full-scale measures, especially the full-scale BHS. Fifth, due to our recruitment approach, all participants enrolled in our study after receiving psychiatric care for suicide risk. As a result, findings may not be generalizable to lower risk populations or individuals who have not recently utilized psychiatric services. A degree of restriction of range for certain measures (e.g. ASIQ) may have also influenced results. Sixth, we were unable to test other viable explanatory mechanisms (e.g. capability for suicide, perceived burdensomeness, agitation, nightmares, and depression; Brown *et al.*, 2000; Busch *et al.*, 2003; Joiner, 2005; Van Orden *et al.*, 2010; Joiner *et al.*, 2016; Rogers *et al.*, 2016) not collected in the main study. We recommend that future studies examine these and other possible mediators of the relationship between prior and subsequent suicidality. Finally, it would be clinically useful for future studies to evaluate the other types of suicidality not assessed by the SHBQ or ASIQ (e.g. suicidal intent, controllability of suicidal thoughts) as both predictors and outcomes.

Conclusions

This longitudinal study examined mediators of the relationship between prior suicidality severity and subsequent suicidal ideation severity within a short time frame (3 months) in a high-risk military sample. Findings suggest that hopelessness and overall severity of psychiatric problems account for the relationship between each type of prior suicidality and future suicidal ideation severity. Thwarted belongingness additionally appears to play a role in the relationship between suicide attempt severity and

subsequent suicidal ideation. Thus, elevated psychiatric problems generally, and hopelessness and thwarted belongingness, specifically, may be useful therapeutic targets in reducing suicide risk among service members with a history of more severe suicidality. Despite this study's limitations, our findings offer a critical step toward better understanding the mechanisms underlying the relationship between prior and future suicidality in a high-risk group.

Notes

[1] Findings differed somewhat when we did not address outliers. INQ thwarted belongingness was a significant mediator across all models and BHS hopelessness was only a significant mediator in the model examining SHBQ attempt severity as a predictor. The total effects of all psychiatric symptoms remained a significant mediator across all mediation models.

[2] The term 'parallel mediators' indicates that we included all mediators in a single model to evaluate their effects alongside one another rather than evaluating each mediator on its own in separate statistical models.

[3] Our pattern of results remained the same across models even when we excluded DSI-SS suicidal ideation as a mediator.

[4] Hierarchical linear regression analyses revealed that our proposed mediators together explained 9.7, 9.7, and 8.7% of the variance in ASIQ suicidal ideation scores beyond that accounted for by SHBQ suicidal ideation severity, SHBQ suicide attempt severity, and SHBQ overall suicidality severity, respectively ($p < 0.01$).

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Conflict of interest. None.

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Patterns and Predictors of Persistence of Suicide Ideation: Results From the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS)

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Persistent suicide ideation (SI) is known to be a risk factor for subsequent suicidal behaviors. Reducing SI persistence among people with a history of SI consequently might be a useful target for preventive intervention; however, basic information is lacking about patterns and predictors of SI persistence. We report preliminary retrospective data on annual SI persistence in a representative sample of 3,501 U.S. Army soldiers with lifetime SI from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). Reports about age-of-onset and number of years with SI were used to estimate two definitions of persistence: persistence beyond year-of-onset and proportional annual persistence (i.e., percentage of years with SI since year-of-onset). Results revealed that for 47.8% of respondents with lifetime SI, their SI did not persist beyond the year-of-onset. For the 52.2% whose SI did persist beyond

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the year-of-onset, the median (interquartile range) proportional annual persistence was 33% (17–67%). Significant predictors of increased persistence were different for respondents with preenlistment SI onset (prior histories of attention-deficit/hyperactivity disorder [ADHD], bipolar disorder, and panic disorder) and postenlistment SI onset (male, combat support military occupation specialty, prior histories of ADHD, panic disorder, and posttraumatic stress disorder). These predictors of persistence are different from the predictors of SI onset, suggesting that secondary preventive interventions to reduce SI persistence may need to focus on different factors than primary preventive interventions to reduce SI onset.

General Scientific Summary

Suicide is a leading cause of death worldwide. Most research on this topic has focused on the prediction of presence of suicidal thoughts and behaviors; however, surprisingly little is known about the persistence of suicidal thoughts. In this study we documented the patterns and predictors of the persistence of suicidal thoughts in a large representative sample of people with thoughts of suicide.

Keywords: Army, military, persistence, suicidal ideation, suicide

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Suicide is one of the leading causes of death worldwide (World Health Organization, 2017), and beginning in 2009, the suicide rate among U.S. Army personnel surpassed that of the general population (Nock et al., 2013). One response of the Army to this trend was to fund a major epidemiological-neurobiological study of risk and protective factors for suicide, the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS; Ursano et al., 2014). Army STARRS aims to help target interventions to prevent suicide deaths among Army personnel. Although a great deal of research has been carried out on risk factors for suicide deaths (Franklin et al., 2017), disaggregation shows that most documented predictors are much more strongly predictive of suicide ideation (SI) in the total population than of attempts among ideators (Nock, Alonso, et al., 2012; Nock et al., 2016).

Primary preventive interventions for SI are challenging because of the wide SI age-of-onset distribution and, in the case of the Army, the fact that the majority of soldiers with SI had onsets prior to enlistment (Millner et al., 2017a), meaning that by the time that many soldiers enlist, it is already too late to prevent SI onset. Secondary preventive interventions focused on SI persistence may be much more realistic, as risk of future suicide is substantially higher among people with than without SI (Simon et al., 2016) and particularly so among individuals with SI that persists across weeks and months (Nock et al., 2018; Simon et al., 2017). Notably, however, studies that have examined the persistence of SI over a period of years suggest that risk of suicide attempt is highest in the first year of SI onset, and decreases with periods of SI persistence that last many years with no suicide attempt (Nock et al., 2008).

Despite the potential importance of SI persistence in the understanding and prediction of suicidal behavior, surprisingly little is known about the basic patterns or predictors of SI persistence. This information is needed to better understand the

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associations between SI persistence and suicide attempt. The few studies that have considered the issue have reported substantial variation in SI persistence. The largest such study was carried out in the World Mental Health Surveys, where annual SI persistence was examined retrospectively among more than 10,000 respondents with a lifetime history of SI across 21 countries (Kessler et al., 2012). SI did not persist beyond the year of onset for approximately half (47–55% across countries) of lifetime cases but was highly persistent among many of the remaining cases. Prospective studies with varying follow-up intervals reported similar results, finding that only about half of people with suicide ideation in a baseline assessment continued to have ideation one year later (Hintikka et al., 2001) and approximately one third continued to have ideation between two (ten Have et al., 2009) and 10 (Borges, Angst, Nock, Ruscio, & Kessler, 2008) years later. We are aware of only one study that examined SI persistence among U.S. Army soldiers (Bryan, Clemans, Leeson, & Rudd, 2015). That study focused on a small ($n = 54$) sample of suicidal soldiers in treatment and found that baseline chronic stressors were significantly associated with SI persistence over a 6-month follow-up period.

In an effort to advance the understanding of this understudied aspect of suicidality, we present data in the current report on patterns and predictors of SI persistence among U.S. Army soldiers. Data come from the 3,501 respondents in the Army STARRS Consolidated All-Army Survey (AAS) with a lifetime history of SI. Several prior reports from this sample examined prevalence, age-of-onset, and correlates of lifetime SI (Millner et al., 2017a, 2017b; Nock et al., 2017), but persistence was not considered in those prior reports. Given that these prior studies, as well as many others (Nock et al., 2008; Nock, Hwang, Sampson, & Kessler, 2010), have shown that sociodemographic factors (e.g., age, sex, education level) and mental disorders (e.g., mood, anxiety, and substance use disorders) predict SI onset, here we tested whether these factors also predict SI persistence.

Method

Sample

The consolidated AAS is a combination of three separate cross-sectional self-report surveys that collectively assessed representative samples of all U.S. Army soldiers exclusive of those in Basic Combat Training who were on active duty during the years 2011 and 2012. The first of the three component surveys, the main AAS, was based on a probability sample of Army units stratified by Command and location selected with probabilities proportional to authorized unit strength, excluding units with fewer than 30 soldiers (which comprise less than 2% of Army personnel) and units in Afghanistan. All personnel other than those with conflicting duties (20.2%) in these units attended an informed consent session where they learned about study purpose, confidentiality, and voluntary participation. Written informed consent was then obtained for a self-administered questionnaire (SAQ). A total of 17,462 respondents both completed the SAQ and consented to administrative data linkage, for a survey completion-successful record linkage rate of 58.3% and a response rate of 46.5% (see COOP1 and RR1 calculation methods, American Association for Public Opinion Research, 2016).

As the main AAS excluded soldiers deployed to a combat theater, a second sample was selected of soldiers stationed in Afghanistan who were in Kuwait in transit to or from their middeployment leave. Individual soldiers rather than units were sampled. Recruitment, consent, and data collection procedures were otherwise the same as in the main AAS. A total of 3,987 respondents provided full SAQ data and administrative data linkage for a survey completion-successful record linkage rate of 38.9%. A response rate was not calculated because we did not record the number of soldiers invited to informed consent sessions for this supplemental survey.

As soon-to-deploy units were underrepresented in the main AAS sample, the consolidated AAS included a third sample: the baseline from a prospective pre–post deployment survey (PPDS) made up of personnel from three Brigade Combat Teams surveyed just before deployment to Afghanistan. Recruitment, consent, and data collection procedures were identical to those in the main AAS. A total of 8,558 respondents provided full SAQ data and administrative data linkage. The survey completion-successful record linkage rate was 89.0% and the response rate was 86.1%.

The recruitment, consent, and data protection procedures in the above surveys were approved by the human subjects committees of Harvard University (Harvard University Area IRB #F18173; Harvard Medical School IRB #M18189) and all other collaborating organizations. SAQ responses were weighted to adjust for differences in survey responses between respondents who did versus did not agree to record linkage (Weight 1) and for discrepancies between the weighted sample who agreed to record linkage and the population in multivariate administrative record profiles (Weight 2). Weight 2 adjusted the sample to be representative of all active duty soldiers during the years 2011–2012 on the cross-classification of sociodemographics, command, occupation, rank, and deployment status-history variables that differentiated the three component samples. These Doubly weighted data make up the Consolidated AAS. More detailed descriptions of Consolidated AAS design (Kessler, Colpe, et al., 2013), field procedures (Heeringa et al., 2013), and weighting (Kessler, Heeringa, et al., 2013) are presented elsewhere.

Measures

Suicide ideation. A modified version of the Columbia Suicide Severity Rating Scale (Posner et al., 2011) was administered to assess suicidal behaviors. The variables used in the current report are those that asked about lifetime occurrence and age-at-onset (AAO) and recency of either active SI (*ever have thoughts of killing yourself*) or passive SI (*ever wish you were dead or would go to sleep and never wake up*) and number of years with SI regardless of history of suicide attempts (*about how many years did you have these thoughts*). Whereas information on suicide attempts also was collected, this information is not considered in this initial report on course of SI. SI persistence was defined in two ways: (a) persistence beyond year-of-onset, and (b) proportional annual persistence. Proportional persistence of SI was calculated as $(n_i - 1)/(\text{AAI} - \text{AAO})$, where n_i = number of years with

ideation.[1] Proportional persistence values were top-coded at 1.0, which applied to 3.9% of the sample. Time-since-onset of SI was defined as age-at-interview (AAI) minus AAO.

Mental disorders. The survey assessed lifetime prevalence and AAO of five *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (*DSM–IV*) internalizing disorders and three externalizing disorders. The internalizing disorders were broadly defined bipolar disorder (BPD), generalized anxiety disorder (GAD), major depressive episode (MDE), panic disorder (PD), and posttraumatic stress disorder (PTSD). The externalizing disorders were attention-deficit/hyperactivity disorder (ADHD), intermittent explosive disorder (IED), and substance use disorder (SUD; alcohol or drug abuse or dependence). We used screening scales from the Composite International Diagnostic Interview (CIDI; Kessler & Ustün, 2004) to assess lifetime BPD, IED, and PD and ADHD in the 6 months prior to survey. The BPD assessment included BP-I, BP-II, and subthreshold BPD (hypomania without history of major depression or subthreshold hypomania as defined in Merikangas et al., 2011). The remaining lifetime disorders were assessed with a revised self-report version of the Family History Screen (FHS; Weissman et al., 2000) modified to assess personal rather than family history of psychiatric disorders. Both the CIDI (Kessler, Santiago, et al., 2013) and the FHS (Weissman et al., 2000) have been shown to have acceptable concordance with clinical diagnoses. However, as the FHS items in the AAS yielded implausibly high prevalence estimates, diagnoses based on these items should be interpreted as encompassing both threshold and subthreshold cases. AAO of each lifetime disorder other than ADHD was assessed using retrospective reports. ADHD was assumed to have been present since childhood.

Sociodemographic and Army career variables. The sociodemographic variables considered here included sex, race/ethnicity (Non-Hispanic Black, Non-Hispanic White, Hispanic, Other), marital history (never, previously, currently married), and education (high school or less, some college, college graduate). The Army career variables considered here included age-at-enlistment, component (Regular Army vs. Reserve Component), Military Occupational Specialty (MOS; combat arms, combat support, combat service support), rank (junior enlisted E1-E4, senior enlisted E5-E9, officers [both Warrant and Commissioned officers]), and deployment history (never deployed to a combat theater, previously deployed, currently deployed).

Analysis Method

Because the data were cross-sectional, inferences were based on retrospective reports about persistence. We did not want to make strong assumptions about underlying recurrence process distributions (e.g., Shen & Cook, 2014; Yamaguchi, 2003) because of the uncertainties introduced by our use of retrospective reports. We consequently estimated a model for SI proportional persistence (i.e., number of years of persistence/number of years since onset) among respondents whose SI age-of-onset was at least two years before age-at-interview. The predictors were based on information reported retrospectively by respondents as having been true as of SI age-of-onset. These same predictors were used in earlier reports on the predictors of SI onset (Millner et al., 2017a, 2017b; Nock et al., 2018) with the addition of the age of SI onset being used as a predictor in the current report. As these earlier analyses found that the majority of soldiers with lifetime SI had preenlistment onsets (Millner et al., 2017b), our persistence models were estimated separately for respondents with preenlistment and postenlistment SI onsets.

Nested logistic regression was used to identify predictors of SI proportional persistence coded into deciles (i.e., 11 categories: 0%, 1–10%, 11–20%, etc.). This involved defining 10 dichotomous transitions across the 11 categories (i.e., proportional persistence greater than 0% in the total sample, greater than 10% among respondents whose proportional persistence was greater than 0%, greater than 20% among respondents whose proportional persistence was greater than 10%, etc.), stacking these 10 data sets into a single consolidated data file in which a dichotomous outcome variable was defined for whether or not the higher level of the outcome was achieved, and estimating a single pooled logistic regression equation in this stacked dataset that included 9 dummy variables to distinguish among the 10 transitions. The logic of this approach is identical to that of discrete-time survival analysis (Singer & Willett, 2003). We began by examining univariate predictors and then estimated multivariate models that included all significant predictors from the univariate models. Interaction tests were then used to determine if the logistic coefficients varied significantly across levels of proportional persistence. Given the lumpiness of the distribution of proportional persistence, these interactions were evaluated in a single model for the transitions from 0% to 1%+ and 0–10% to 11%+ proportional persistence and continuously across the range between 21 and 30 and 91–100% proportional persistence.

Missing data, which were for the most part uncommon, were recoded to medians for all variables other than SI age-of-onset (4.7% missing) and SI proportional persistence (11.0% missing). Data for these two variables were not missing completely at random and were less likely to be missing for those with active (vs. passive) SI, regular Army (vs. guard/reserve), and those with diagnoses of MDD, GAD, PTSD, or ADHD (detailed results available upon request). Because of the higher proportions of missing values on these two variables, the missing values were imputed with the method of multiple imputation (MI; Little & Rubin, 2002) using SAS *proc MI* (SAS Institute Inc., 2010), which takes this missingness into account. Standard errors of proportions and logistic regression coefficients were estimated using the MI-adjusted design-based Taylor series linearization method (Wolter, 1985) with a customized SAS macro. Multivariate significance

[1] Number of years with SI and SI age of recency were assessed directly in the survey, whereas the reported range of years between SI onset and recency ages was only indirectly used in the calculation of SI persistence as a top-coding procedure for estimates of "years with suicidal thoughts" that exceeded maximum possible values. To illustrate, for a given reported SI onset and recency ages of 18 and 20, respectively, if a respondent then reported having 10 years with suicidal thoughts, we did not use that value of 10, but instead a value of 3 years with suicidal thoughts was used to calculate SI persistence. However, if 2 years with suicidal thoughts were reported, then a value of 2 years with suicidal thoughts was used to calculate SI persistence, because this reported value fell within the range of possible values as defined by SI onset and recency ages. The majority of respondents who reported lifetime SI did not report current SI at the time of survey. Approximately 12.0% of lifetime SI cases also occurred in the past 30 days before interview and another 26.0% or lifetime SI cases occurred in the past 12 months before interview (i.e. current or prior ages to time-of-interview).

tests for the joint predictive effects of multiple predictors were evaluated with MI-adjusted design-based F tests. The latter were evaluated with total degrees of freedom equal to the difference between the number of sampling error calculation units (SECUs) with observed cases of SI minus the number of primary sampling units (PSUs) from which these SECUs came, noting that each PSU contained exactly two SECUs by design. Logistic regression coefficients and their MI-adjusted design-based 95% confidence intervals (i.e., estimates ± 2 standard errors) were exponentiated and are reported here as odds-ratios (*OR*s) with 95% confidence intervals (95% CIs).

Results

Basic Patterns of Persistence

Lifetime SI was reported by 3,915 respondents (13.7% of the total sample). For 47.8% of respondents with lifetime SI, their SI did not persist beyond the year-of-onset. The proportion of lifetime cases whose SI persisted beyond age-of-onset was positively associated with time-since-onset among the 3,501 respondents whose SI age-of-onset was at least two years before the survey, the subsample that is the focus of analysis in this report.[2] This proportion ranged from a low of 31.0% when time-since-onset was 2–4 years to a high of 61.1% when time-since-onset was 16 + years, and an average of 52.2% across all respondents (see Table 1). This association is expected given the fact that number of years of potential SI increases with time-since-onset. No consistent pattern existed for this proportion to be different depending on whether SI onset occurred prior to or after enlistment (Supplemental Table 1). Among respondents with persistence greater than 0%, median (interquartile) range proportional persistence was 33% (17–67%) overall, 29% (15–57%) for respondents with preenlistment SI onset, and 50% (25–80%) for respondents with postenlistment SI onset. As a result of these patterns, most soldiers with prevalent SI were persistent cases. Specifically, more than 50% of soldiers with SI in the year of interview reported SI age-of-onset more than 5 years ago and close to 25% more than 10 years ago.

Predictors of SI Proportional Persistence Among Soldiers With Preenlistment Onsets

Among respondents whose SI began prior to age-at-enlistment, proportional persistence was significantly and inversely related to AAO (meaning those with earlier AAO had more years of SI), and significantly and positively associated with the presence of active (vs. passive) SI, race-ethnicity (with generally lower odds for those who are Hispanic and higher odds for those who are Non-Hispanic Black and Other [relative to Non-Hispanic White]), and numerous prior lifetime mental disorders (see Table 2). In a multivariate model that included all predictors simultaneously, only AAO, race, and a reduced set of mental disorders (ADHD, bipolar, panic, and substance use [with an inverse effect]) remained significant predictors of proportional persistence. The interaction of age-of-onset with level of proportional persistence was nonsignificant (F_3 = 0.9, p = .45). Interactions of race-ethnicity and mental disorders with level of proportional persistence were nonsignificant as a set (F_{18} = 0.7, p = .80; Supplemental Table 2).

Predictors of SI Proportional Persistence Among Soldiers With Postenlistment Onsets

Among respondents whose SI began after age-at-enlistment, proportional persistence was significantly higher among soldiers whose military occupation specialty at the time of SI onset was a combat support occupation than combat service support (*OR* = 1.6), significantly lower among women than men (*OR* = 0.7), and positively associated with a range of prior lifetime mental disorders (see Table 3). Two of the three mental disorders that remained significant in a multivariate model that included the other significant predictors were the same as in the preenlistment model: ADHD (*OR* = 1.7) and panic disorder (*OR* = 1.4), with PTSD being the other significant disorder (*OR* = 1.6). The interaction of age-of-onset with level of proportional persistence was nonsignificant (F_3 = 1.8, p = .14). Interactions of military occupation specialty, sex, and mental disorders with level of proportional persistence were nonsignificant at a set (F_{18} = 1.4, p = .14; Supplemental Table 3). Notably, as a set, the predictors of SI persistence were significantly different for pre-versus postenlistment onset of SI (F_{14} = 4.4, p < .001; Supplemental Table 4).

Discussion

This paper provides new information about the patterns and predictors of the persistence of SI. There are two key findings that warrant additional comment. First, regarding the patterns of SI persistence, 47.8% of respondents with a history of SI reported that their SI never persisted beyond their age-of-onset. This finding, as well as the finding of an inverse association between time-since-onset and persistence, is consistent with earlier reports of the persistence of SI in the World Mental Health (WMH) Surveys (Kessler et al., 2012). Novel to the current study, we also observed that among the 52.2% who had more persistent SI (i.e., that lasted beyond the first year of onset), the median proportion of subsequent years with SI was 33%. On one hand, it is encouraging to learn that for approximately half of those who experience SI, such thoughts will not persist beyond the initial year during which they are experienced. On the other hand, the fact that such thoughts will persist for the other half of those with SI, and will do so for so many years, is cause for concern.

Prior studies suggest that whereas the persistence of SI over many years in the absence of any suicide attempt is associated with lower odds of ever making an attempt, persistence of SI over periods of days, weeks, and months is associated with higher odds of suicide attempt (Kleiman et al., 2018; Nock et al., 2018; Simon et al., 2017). These differing findings regarding the association between SI persistence and occurrence of suicide attempts highlight the need to better understand SI persistence. The current study provides more detailed information than prior studies regarding the long-term (i.e., across years) patterns of SI persistence. Future studies are needed to provide

[2] The selection of the subsample of respondents whose SI age-of-onset was at least two years before age-at-interview was based on the denominator of the calculation for SI persistence, which was the difference between age at interview and age at onset. A difference of one year would result in a denominator of 0 and thus an undefined value for SI persistence. Because this study examined SI persistence in units measured by years, rather than seasons, months, or days, the subsample with a difference of at least two years from SI onset to interview was the most inclusive subsample for study of SI persistence.

Table 1
Distribution of Suicidal Ideation Proportional Persistence by Years Since Ideation Onset Relative to Interview (n = 3,501)

Proportion of years with suicidal thoughts	Ideation onset (relative to age at survey)											
	2–4		5–7		8–10		11–15		16+		Total	
	%	*SE*	%	*SE*	%	*SE*	%	*SE*	%	*SE*	%	*SE*
0	69.0	2.6	47.7	2.4	43.6	3.2	44.8	3.1	38.9	3.0	47.8	1.2
1–10	0.0	—	0.0	—	4.2	1.2	11.1	1.6	12.9	1.9	6.5	0.6
11–20	0.0	—	15.1	1.6	11.1	1.8	10.6	1.8	13.6	2.0	10.4	0.8
21–30	5.3	1.6	2.7	0.9	9.4	2.6	7.7	1.7	11.4	1.3	7.6	0.7
31–40	4.4	1.0	6.8	1.7	5.5	1.8	8.1	2.0	5.3	1.3	6.1	0.7
41–50	6.8	1.6	4.0	1.4	7.9	2.4	3.6	0.9	2.9	0.8	4.8	0.6
51–60	0.0	—	5.5	1.2	1.5	0.7	2.0	0.8	3.1	1.0	2.5	0.4
61–70	3.2	0.7	0.8	0.5	3.1	1.2	3.2	1.3	1.6	0.6	2.3	0.4
71–80	4.1	2.0	4.6	1.0	3.6	1.3	2.3	0.6	0.9	0.3	2.9	0.4
81–90	0.0	—	6.3	1.3	6.8	1.5	1.9	0.6	2.0	0.6	3.2	0.4
91–100	7.2	1.6	6.5	1.6	3.3	1.1	4.8	1.0	7.3	0.8	5.9	0.6
Total, median/IQR[a]	50	(33–100)	43	(20–80)	40	(20–70)	27	(14–55)	24	(11–50)	33	(17–67)
(*n*)	(*n* = 675)		(*n* = 681)		(*n* = 689)		(*n* = 698)		(*n* = 758)		(*n* = 3,501)	

Note. Estimates reflect weighted data.
[a] Estimates represent median and interquartile range (IQR) values of the proportion of years with suicidal thoughts among lifetime ideators with greater than 0% of years with suicidal thoughts.

a more fine-grained assessment of SI over long periods of time. For instance, the current study was not able to carefully assess periodic fluctuations in SI presence or severity over time. Adding more frequent assessments of SI presence and severity (e.g., via monthly or yearly surveys) would shed further light on how SI varies over time, and whether such variations might help to better predict episodes of suicidal behavior.

Second, we found that the predictors of SI proportional persistence (i.e., proportion of years with SI) are quite different from the predictors of SI onset found in earlier analyses, even those using the same

Table 2
Predictors of Lifetime Suicide Ideation Proportional Persistence Among Respondents With a Preenlistment Onset That Began at Least 2 Years Before Interview (n = 2,577)

Predictor	Prevalence[a]		Univariate models[b,c]		Multivariate model[c]	
	% (Mean)	*SE*	*OR*	95% CI	*OR*	95% CI
Ideation onset (in decades)	1.5	0.0	0.6*	[0.5, 0.8]	0.6*	[0.5, 0.8]
Active ideation (vs. passive)	86.3	2.1	1.3*	[1.0, 1.6]	1.2	[0.9, 1.5]
Demographics, as of ideation onset						
Sex: Female (vs. male)	21.8	1.3	1.0	[0.8, 1.2]		
Race: Non-Hispanic Black (vs. Non-Hispanic White)	13.3	1.2	1.1	[0.8, 1.4]	1.1	[0.8, 1.4]
Race: Hispanic (vs. Non-Hispanic White)	9.4	1.2	0.8	[0.6, 1.0]	0.8	[0.6, 1.0]
Race: Other (vs. Non-Hispanic White)	6.9	0.7	1.2	[0.9, 1.7]	1.2	[1.0, 1.7]
F_3			3.4*	0.017	3.0*	0.028
Education: Student (vs. some college or more)	84.7	1.3	1.1	[0.7, 1.8]		
Education: HS or less (vs. some college or more)	13.1	1.2	2.2	[0.8, 2.1]		
F_2			0.7	0.52		
Mental disorders, as of ideation onset						
Attention-deficit/hyperactivity disorder	6.0	0.6	1.5*	[1.2, 1.9]	1.5*	[1.1, 2.0]
Bipolar disorder	2.9	0.4	1.6*	[1.2, 2.2]	1.6*	[1.0, 2.4]
Generalized anxiety disorder	21.1	1.1	1.2*	[1.0, 1.4]	1.1	[0.9, 1.5]
Intermittent explosive disorder	28.3	1.9	1.1	[1.0, 1.3]	1.1	[0.9, 1.4]
Major depressive episode	42.5	1.8	1.2*	[1.0, 1.4]	1.1	[0.9, 1.5]
Panic disorder	3.4	0.6	1.5*	[1.0, 2.1]	1.6*	[1.0, 2.6]
Posttraumatic stress disorder	22.6	1.6	1.1	[0.9, 1.4]	1.0	[0.7, 1.3]
Substance abuse or dependence	6.2	0.6	0.8	[0.5, 1.4]	0.7*	[0.4, 1.0]
$F_{8/4}$					4.0*	<.001

[a] Prevalence estimates were computed from a person-level dataset and measured at the year of ideation onset per respondent. Prevalence estimates reflect weighted data. [b] Univariate models controlled for ideation onset, years between onset and current age, and data stacks. The 10 predictor *OR*s for the nine dummy variables for the nine transitions and for the one single continuous variable for years since onset are not shown in the table. [c] Model estimates reflect weighted and multiply imputed data.
* Significant at the .05 level, two-sided test.

Table 3
Predictors of Lifetime Suicide Ideation Persistence Among Respondents With a Postenlistment Onset That Began at Least 2 Years Before Interview (n = 924)

Predictor	Prevalence[a]		Univariate models[b,c]		Multivariate model[c]	
	% (Mean)	*SE*	*OR*	95% CI	*OR*	95% CI
Ideation onset (in decades)	2.6	0.0	1.2	[1.0, 1.5]	1.2	[1.0, 1.5]
Active ideation (vs. passive)	76.9	2.4	1.4	[1.0, 1.9]		
Army characteristics, as of ideation onset						
Current years of service (in decades)	0.6	0.1	1.2	[0.7, 1.9]		
Component: regular army vs. guard-reserve	80.5	2.0	1.3	[1.0, 1.8]		
MOS: Combat arms (vs. combat service support)	30.7	2.5	1.2	[1.0, 1.5]	1.0	[0.8, 1.3]
MOS: Combat support (vs. combat service support)	25.2	2.1	1.7*	[1.2, 2.2]	1.7*	[1.3, 2.2]
F_2			6.8*	0.001	8.1*	<0.001
Rank: Junior (vs. officer)	49.2	1.9	1.1	[0.7, 1.6]		
Rank: Senior (vs. officer)	35.0	1.9	1.0	[0.7, 1.5]		
F_2			0.1	0.90		
Deployment: Currently (vs. never)	36.5	2.5	1.3*	[1.0, 1.6]		
Deployment: Previously (vs. never)	16.5	2.2	1.0	[.06, 1.5]		
F_2			2.8	0.06		
Demographics, as of ideation onset						
Sex: Female (vs. male)	14.8	1.8	0.7*	[0.5, 0.9]	0.7*	[0.5, 1.0]
Race: Non-Hispanic Black (vs. Non-Hispanic White)	19.1	1.9	0.8	[0.6, 1.0]		
Race: Hispanic (vs. Non-Hispanic White)	12.6	1.7	0.7	[0.5, 1.1]		
Race: Other (vs. Non-Hispanic White)	7.6	1.6	0.8	[0.5, 1.3]		
F_3			1.5	0.20		
Marital history: Previously (vs. currently)	5.7	0.9	0.9	[0.6, 1.4]		
Marital history: Never (vs. currently)	47.7	2.4	0.8	[0.6, 1.0]		
F_2			1.6	0.21		
Mental disorders, as of ideation onset						
Attention-deficit/hyperactivity disorder	14.3	2.1	2.1*	[1.6, 2.7]	1.8*	[1.4, 2.3]
Bipolar disorder	9.0	1.5	1.6*	[1.1, 2.5]	1.1	[0.8, 1.7]
Generalized anxiety disorder	47.0	3.0	1.3	[1.0, 1.7]	0.9	[0.6, 1.2]
Intermittent explosive disorder	36.4	2.4	1.4*	[1.1, 1.7]	1.1	[0.9, 1.4]
Major depressive episode	57.3	2.2	1.3*	[1.1, 1.7]	1.1	[0.9, 1.4]
Panic disorder	10.2	1.4	1.6*	[1.2, 2.2]	1.4*	[1.0, 2.0]
Posttraumatic stress disorder	47.4	2.6	1.7*	[1.4, 2.1]	1.6*	[1.3, 2.1]
Substance abuse or dependence	20.8	2.1	1.3	[0.9, 1.8]	1.1	[0.8, 1.5]
$F_{8/3}$					9.8*	<0.001

[a] Prevalence estimates were computed from a person-level dataset and measured at the year of ideation onset per respondent. Prevalence estimates reflect weighted data. [b] Univariate models controlled for ideation onset, years between onset and current age, and data stacks. The 10 predictor *OR*s for the nine dummy variables for the nine transitions and for the one single continuous variable for years since onset are not shown in the table. [c] Model estimates reflect weighted and multiply imputed data.
* Significant at the .05 level, two-sided test.

dataset. With regard to sociodemographics and Army career variables as predictors: whereas previously married, junior enlisted soldiers, and women were found in previous analyses to have significantly elevated lifetime presence of SI (Millner et al., 2017a, 2017b), we found here that marital status is not significantly associated with either type of persistence, that officers have SI persistence comparable with that of enlisted soldiers despite their comparatively low risk of SI onset, that sex is unrelated to SI proportional persistence among soldiers with SI preenlistment onset, and that women have significantly lower proportional persistence than men of SI with postenlistment onset. Soldiers with combat support occupations, who operate behind the scenes to support combat troops in areas such as engineering, intelligence, and communications, have significantly higher persistence than soldiers in combat arms (e.g., infantry) or combat service support (e.g., supply, transportation, maintenance) occupations, even though SI onset is highest among soldiers in combat arms.

Although active (vs. passive) SI had a small positive association with SI persistence in a univariate model, after controlling for other predictors, this association was no longer significant. This was surprising and suggests that passive SI can persist over time in the same way that active SI can. With regard to temporally primary lifetime mental disorders as predictors: Previous analyses have reported that a range of different mental disorders ae associated with significantly elevated risk of subsequent SI onset, with major depression being a considerably stronger predictor than other disorders (Millner et al., 2017a; Nock et al., 2008, 2010). In the current report, in comparison, only ADHD and panic disorder were consistently (i.e., in models for both preenlistment and postenlistment SI onsets) associated with SI persistence. Panic disorder, although not ADHD, has been linked with SI persistence in studies in the general population (Nock, Deming, et al., 2012). However, it is not clear why panic disorder or ADHD are associated with SI persistence. Both disorders have been linked with SI onset and can have a relatively chronic course, which may represent one reason for the observed association with SI persistence. However, this explanation is speculative and the observed associations in this study between panic and ADHD and SI persistence, although replicated across pre- and postenlistment onsets, could be spurious and may not replicate in future studies. Obtaining a clearer

understanding of the predictors of SI persistence represents another important direction for future research.

These differences between the predictors of SI onset and SI persistence are broadly reminiscent of evidence from a number of prior studies that the predictors of SI onset are quite different from the predictors of progression from SI to suicide plans and attempts (Bruffaerts et al., 2010; Nock et al., 2008, 2016; Stein et al., 2010). These differences in predictors of SI persistence versus onset signify that efforts to target secondary interventions for soldiers at highest risk of SI persistence may need to focus on different factors than those to target primary interventions aimed at preventing SI onset. Planned analyses of in-progress Army STARRS follow-up surveys will give us an opportunity to explore these distinct associations prospectively. Similar efforts among civilian samples are needed to test whether the patterns and predictors of SI persistence observed here are seen in people more generally.

The current findings should be viewed in the context of several key limitations. First, our ability to study persistence was limited in the AAS because we relied on retrospective reports with only a handful of questions about course of SI. This assessment did not include information about long-term fluctuations in SI, did not allow us to measure the persistence of passive and active SI for each respondent, and did not include a method for testing the reliability of the reports of SI persistence given by respondents. Second, and related, we also used retrospective self-reports of putative predictors of SI persistence, which in the case of mental disorders also involved the use of screening scales for some disorders. The use of self-reports of mental disorders may have led to underreporting in some respondents because of concerns about stigma and confidentiality, whereas the use of screening scales may have led to overestimates for some disorders. Although prior reports on Army STARRS have supported the validity of the assessment of mental disorders used in this study (i.e., via good agreement with semistructured clinical interviews; Kessler, Santiago, et al., 2013), these potential sources of bias remain an important consideration. Third, as we know that a positive association exists between psychopathology and early attrition from service (Lancaster et al., 2013; Niebuhr et al., 2013), informative right censoring of the SI persistence distribution might have led to an underestimation of proportional persistence in the sample and/or to bias in estimates of the predictors of proportional persistence even in the absence of recall bias. Future STARRS analyses of in-progress follow-up surveys with baseline AAS respondents, including those who left service, will be able to address the possibility of recall bias as well as loss to follow-up. Fourth, this initial report examined the patterns and predictors of SI persistence; however, we did not report here on the association between SI persistence and subsequent suicide attempts and suicide death. We are carrying out a National Death index search of deceased AAS respondents that will provide additional information on this association, as well as additional information about loss to follow-up.

These limitations notwithstanding, the current study provides previously unavailable information about the patterns and persistence of SI. We are hopeful that future studies will incorporate assessments of SI persistence over time, and that in turn a better understanding of SI persistence will help to advance the understanding, prediction, and ultimate prevention of suicidal behavior.

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Psychometric Properties of Four Commonly Used Suicide Risk Assessment Measures: Applicability to Military Treatment Settings

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ABSTRACT

Clinicians working in U.S. Department of Defense behavioral health settings rely on standardized suicide risk assessment measures to guide their treatment of service members. Most of the measures used were developed, normed, and validated for use with civilians. Although there is reason to believe such measures will perform similarly in civilian and military treatment settings, that assumption has rarely been confirmed empirically. The purpose of the current study was to examine data from a large assessment study to confirm the reliability and validity of 4 widely used suicide risk assessment measures for military personnel. The risk assessment measures were (a) Columbia-Suicide Severity Rating Scale; (b) Self-Harm Behavior Questionnaire; (c) Suicidal Behaviors Questionnaire—Revised; and (d) Beck Scale for Suicide Ideation. Items from the Military Suicide Research Consortium's Common Data Elements were used to examine convergent validity. Data from 1,044 military service members at risk for suicide who completed baseline assessments were used in the current analyses. Small differences were found across the measures, but overall performance was acceptable and all are considered valid and reliable to use when assessing active duty U.S. military personnel.

KEYWORDS psychometrics; suicide measures; military

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Background

U.S. Department of Defense behavioral health clinicians have many options for gathering information about suicide risk from the service members they treat. Best practices (Veterans Affairs and Department of Defense, 2013) are to gather data from multiple sources and to include standardized suicide risk assessment measures. Clinicians choose which measures to use based on a variety of decision points, and available information on the psychometric properties (e.g., reliability and validity) should factor heavily in those decisions; moreover, it is important that the psychometric properties of measures are examined within the specific population in which the measures are used clinically (cf. Chiurliza et al., 2018). However, in the case of military treatment settings, most of the widely used suicide risk assessment tools have no such available data as they were developed, normed, and validated in civilian samples. For

example, the measures selected for the current study have demonstrated reliability (e.g., internal consistency), convergent and discriminant validity (i.e., positive correlations with validity measures of similar constructs and negative correlations with measures of conceptually distinct constructs), and factor structures (i.e., extent to which individual items cluster as a measure of an overall construct or subfactors) in adult and adolescent clinical samples (Beck & Steer, 1991; Gutierrez et al., 2001; Osman et al., 2001; Posner et al., 2011). Although there are likely many similarities between civilian psychiatric patients and military behavioral health patients, there are also significant cultural differences between the two groups that may influence responses to these assessment measures. Military service members form tight bonds with their coworkers, which are often more like family ties than peer relationships, and in combat situations they literally depend on each other for survival (Castro, Kintzle, & Hassan, 2015). Those types of experiences alter service members' attitudes, beliefs, and approach to life.

Therefore, using a large sample of active duty U.S. military service members referred to a military treatment setting for suicide risk concerns, we examined the psychometric properties of four widely used suicide risk assessment measures: (a) Columbia-Suicide Severity Rating Scale (C-SSRS; Posner et al., 2011); (b) Self-Harm Behavior Questionnaire (SHBQ; Gutierrez et al., 2001); (c) Suicidal Behaviors Questionnaire-Revised (SBQ-R; Osman et al., 2001); and (d) Beck Scale for Suicide Ideation (BSS; Beck & Steer, 1991). Our overall hypothesis was that the four measures would each be psychometrically sound when used with active duty U.S. military participants, because we assumed the similarities in presentation between them and civilian psychiatric patients would be greater than the differences. We tested the stability, internal consistency reliability, and generalizability of each measure's factor structure. We also tested convergent validity in relation to other suicide-related measures (e.g., measures of suicidal ideation, loneliness, and hopelessness).

Methods

Participants

This study focuses on analyses of data collected as part of a large suicide risk assessment study (Gutierrez, Joiner, & Hanson, 2018), with an emphasis on the psychometric properties of the measures described below. Confirming the reliability and validity of the study measures was the first aim of that study, but due to the large number of complex results generated we decided to present just the psychometric findings here and the other findings in a separate report. The participants in this study were referred because a military provider deemed them to be at some level of suicide risk through usual clinical practices in their treatment setting. Service members were primarily referred from inpatient psychiatry, emergency department, and outpatient behavioral health clinics. All participants were active duty members of the U.S. military across all branches of service. Baseline data (N = 1,044) were used for the current analyses. The majority of participants were male (76%) and White/Caucasian (60%); on average, participants were 25 years old and had been in the military for 4.5 years. Table 1 provides more detailed demographic information.

Table 1. Participant Demographic and Military CharacteristicsTable Layout

Characteristic	(N = 1,044)
Age, M (SD)	24.95 years (6.02 years) [Range: 18–55 years][a]
Sex, no. (valid %)	
Male	775 (75.5%)
Female	243 (23.7%)
Transgender	9 (0.9%)
Missing	17 (—)
Race, no. (valid %)	
White/Caucasian	614 (59.7%)
Black/African American	221 (21.5%)
[a]Data on age are missing for 4 participants.	
[b]Data on years of military service at baseline are missing for 60 participants.	

Native American or Alaska Native	8 (0.8%)
Asian/Pacific Islander	40 (3.9%)
Other	146 (14.2%)
Missing	15 (—)
Ethnicity, no. (valid %)	
Hispanic or Latino/a	159 (17.8%)
Not Hispanic or Latino/a	670 (74.9%)
Other	66 (7.4%)
Missing	149 (—)
Education, no. (valid %)	
Did not complete high school	8 (0.8%)
High school graduate/GED	535 (51.4%)
Some college, no degree	367 (35.2%)
College graduate, associate's	58 (5.6%)
College graduate, bachelor's	57 (5.5%)
Graduate degree (e.g., masters doctoral)	15 (1.4%)
Missing	4 (—)
Relationship status, no. (valid %)	
Married	389 (37.4%)
Single	526 (50.6%)
Separated	75 (7.2%)
Divorced	50 (4.8%)
Missing	4 (—)
Years of military service, *M* (*SD*)	4.42 years (4.89 years) [Range: 0–26 years][b]
Military branch, no. (valid %)	
Army (Active Duty)	374 (36.4%)
Army (National Guard)	1 (0.1%)
Air Force (Active Duty)	31 (3.0%)
Air Force (National Guard)	1 (0.1%)
Navy (Active Duty)	563 (54.8%)
Navy (Reserves)	2 (0.2%)
Marine Corps (Active Duty)	40 (3.9%)
Coast Guard (Active Duty)	14 (1.4%)
Coast Guard (Reserves)	1 (0.1%)
Missing	17 (—)
History of combat experience, no. (valid %)	
Yes	260 (25.4%)
No	763 (74.6%)
Missing	21 (—)
[a]Data on age are missing for 4 participants.	
[b]Data on years of military service at baseline are missing for 60 participants.	

Procedures

Eligible participants were provided information about the study, given the opportunity to ask questions, and completed consent procedures in a private setting within the treatment facilities where the study assessors were based. These procedures were carried out by trained, licensed providers, serving as site assessors, at the military installations where data were collected. Military providers at the installations had received information about the study during staff meetings and had available as a resource a written description of the study purpose and recruitment procedures. They directly referred potentially eligible participants to the site assessors who scheduled an appointment with the service member and met with them individually in private offices located in clinics at the installations. The baseline assessments providing data for the current analyses were completed by participants using study laptop computers, in random order. This approach reduces risk of data entry error and increases participant confidentiality because of greater control over the data than is available with paper-and-pencil measures. All necessary university and military institutional review boards as well as the Department of Defense Human Research Protection Office approved the study procedures.

Measures

Demographic data were gathered with a form developed for the study.

The *Columbia-Suicide Severity Rating Scale* (C-SSRS; Posner et al., 2011) is based on the Columbia Suicide History Form (CSHF; Oquendo, Halberstam, & Mann, 2003), which is used to classify information in medical records regarding suicidal behaviors. The form has since been adapted as an assessment guide for other types of research. Two of the C-SSRS subscales assess the *severity* and *intensity* of a participant's thoughts about suicide. Per the C-SSRS scoring guidelines, users have flexibility in deciding which subscale to use (Nilsson et al., 2013). Therefore, we constructed models separately for each subscale. The C-SSRS subscale that assesses the type and potential lethality of suicidal behaviors was not utilized in the current analyses. In this study, the C-SSRS was administered as an interview. Several studies using adolescent and adult civilian samples provide evidence for the reliability and validity of the C-SSRS (Posner et al., 2011).

The Self-Harm Behavior Questionnaire (SHBQ; Gutierrez, et al., 2001) is a measure with four subscales (Gutierrez & Osman, 2008) that can be administered as either a self-report or interview. The SHBQ was administered as an interview in this study, to facilitate gathering follow-up information if needed. High Cronbach alpha estimates for scores on all SHBQ subscales support its reliability (Gutierrez & Osman, 2008). Fliege et al. (2006) found strong support for test-retest reliability for each subscale over periods of 7–150 days among psychiatric inpatients. Evidence for the concurrent-convergent validity of the SHBQ is also available (Gutierrez & Osman, 2008); a cutoff score of 22 distinguished between adolescent psychiatric patients admitted for suicide-specific concerns versus adolescent psychiatric controls.

The Suicidal Behaviors Questionnaire—Revised (SBQ-R; Osman et al., 2001) is a self-report measure assessing lifetime suicide ideation and attempts, frequency of recent suicidal ideation, suicide threats, and likelihood of future suicide-related behavior. It is valid and reliable for both adolescent and adult civilian use (Gutierrez & Osman, 2008). A cutoff score of eight distinguished adult psychiatric inpatients with recent suicidal ideation or suicide attempts from psychiatric controls (Osman et al., 2001).

The Beck Scale for Suicide Ideation (BSS; Beck & Steer, 1991) is a 21-item self-report measure of the intensity of suicidal ideation over the previous week. It assesses thoughts, behaviors, plans, and intent. Responses for Items 1–19 range from 0 to 2 and are summed to derive at a total score between 0–38. The last two items assess lifetime suicide attempts and the intent of the most recent attempt; these items are not part of the BSS total score but were used in examining convergent validity of the other measures. The BSS has acceptable reliability and validity for use with adult civilian psychiatric inpatients and outpatients.

The Military Suicide Research Consortium (MSRC) Common Data Elements (CDEs) were designed for use by all MSRC-funded studies and cover a broad spectrum of suicide-related thoughts, behaviors, and risk factors. The items for the CDEs were chosen by a group of expert suicide researchers and clinicians. The MSRC CDEs consist of 57 items, 47 from existing measures and 10 specifically created for the CDEs. These items have been determined to be psychometrically sound for assessing suicide risk-specific constructs (Ringer et al., 2018). The following item sets from the CDEs were used to examine convergent validity: current suicidal ideation (Depressive Symptom Inventory–Suicidality Subscale; Joiner, Pfaff, & Acres, 2002), suicide attempt history, hopelessness (Beck Hopelessness Scale;

Beck & Steer, 1988), and thwarted belongingness (Interpersonal Needs Questionnaire; Van Orden, Cukrowicz, Witte, & Joiner, 2012).

Data analyses

To test the study hypothesis, confirmatory factor analytic (CFA) and structural equation modeling (SEM) techniques were used to confirm that the four measures are psychometrically sound when used with active duty U.S. military personnel. Each measure was evaluated with respect to the stability, reliability, and generalizability of its factor structure as well as its convergent validity. Specifically, model fit was assessed using the chi-square test of model fit (χ^2), comparative fit index (CFI), Tucker-Lewis Index (TLI), root mean squared error of approximation (RMSEA), and weighted root mean square residual (WRMR); good model fit is represented by a non-significant χ^2, CFI $\geq$ .95, TLI $\geq$ .90, RMSEA $\leq$ .08, and WRMR $\leq$ 1 (Hu & Bentler, 1999; Schreiber et al., 2006). Because items were scored on an ordinal scale, weighted least squares estimation was utilized in these analyses. Once a replicable factor structure was identified for each scale, the reliability and generalizability of that factor structure across key comparison groups was evaluated using multiple group analyses (i.e., tests of measurement invariance and population heterogeneity across deployment history). Specifically, a baseline model with no cross-group constraints was first tested to establish that the scales performed similarly across groups (i.e., configural invariance). Next, metric invariance was tested to determine whether the factor loadings for items were equal across groups by constraining factor loadings to be equal across groups. Third, scalar invariance was tested to examine whether item intercepts and latent means were equivalent across groups by constraining item intercepts to be equal across groups. Finally, residual variances were constrained to equal across groups to determine whether residual variances were comparable across groups. Differences in model fit were tested at each stage of these measurement invariance analyses using the chi-square difference test, consistent with best practices (Vandenberg & Lance, 2000). As is discussed in more detail later, tests of invariance determine if scales are measuring the same thing across groups that differ on key characteristics, in this case combat experience. In the absence of invariance, observed differences may be due to factors other than those used to create comparison groups). We chose to focus on combat experience as our comparison condition due to the importance of this variable in understanding suicide risk among service members (Shen, Cunha, & Williams, 2016). Convergent relationships with relevant outcome variables were examined using SEM. In four separate SEM models (each examining one of the four assessment measures), outcome variables were regressed on the assessment measure's measurement model to evaluate evidence for the scale's convergent validity. For each assessment measure, convergent validity relationships were specified between the assessment measure's measurement model and suicide risk status as determined by assessment as usual, current severity of suicidal thoughts as assessed by the MSRC CDEs, history of suicidal behavior, and hopelessness.

Results

The four primary measures demonstrated acceptable to excellent internal consistency reliability—for the C-SSRS α = 0.77, for the severity subscale, and α = 0.64 for the intensity subscale; SHBQ α = 0.85; SBQ-R α = 0.71; BSS α = 0.95. In support of the first study aim, the BSS, SBQ-R, and SHBQ each had excellent model fit in CFA models. See Table 2 for model fit indices. The C-SSRS severity scale exhibited adequate fit in a CFA model, and the C-SSRS intensity scale had poor model fit. Metric invariance was partially supported for the BSS (BSS10 loaded differently across groups), scalar invariance was supported (with no latent mean estimate differences), but full uniqueness was not supported. For the C-SSRS, metric invariance was supported, scalar invariance was partially supported (intercepts for C-SSRS Items 7 and 9 were freed; there were no differences in latent mean estimates for severity, intensity, or behavior), and full uniqueness was not supported. Metric invariance was partially supported for the SHBQ (SHBQ Suicide Ideation item 4 loaded differently across groups), scalar invariance was supported (with no latent mean estimate differences for nonsuicidal self-injury [NSSI], suicide attempts, and suicide threats; however, there were differences in ideation such that those who had past deployments had higher ideation scores), but full uniqueness was not supported. Full measurement invariance was supported for the SBQ-R (metric, scalar, full uniqueness) across individuals with and without a history of deployment (see Tables 3 through 6  specific fit indices and model comparisons).

Table 2. Confirmatory Factor Analysis Model Fit Indices for Each Measure of Suicidal Ideation/BehaviorTable Layout

Measure	χ^2	CFI	TLI	RMSEA	WRMR
BSS	788.05***	.989	.988	.064	1.565
C-SSRS Severity	65.51***	.989	.977	.108	1.625
C-SSRS Intensity	189.42***	.896	.791	.192	2.007
SBQ-R	3.88	.999	.996	.030	.337
SHBQ	743.74***	.995	.995	.051	1.490

Note. χ2 = chi-square test of model fit; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean squared error of approximation,; WRMR = weighted root mean square residual; BSS = Beck Scale for Suicide Ideation; C-SSRS = Columbia-Suicide Severity Rating Scale; SHBQ = Self-Harm Behavior Questionnaire; SBQ-R = Suicidal Behaviors Questionnaire—Revised.

***$p < .001$.

Table 3. Multiple Group Analysis Between Service Members Who Have and Have Not Deployed on the Beck Scale for Suicide Ideation (BSS)Table Layout

Variable	Deployment group	No-deployment group	Configural model	Metric invariance	Metric–Freed BSS Item 10	Scalar invariance	Full uniqueness
N	485	520	1,005	1,005	1,005	1,005	1,005
χ^2	1,008.15	1,013.44	2,021.60	2,053.41	2,045.55	2,073.31	2,134.42
df	152	152	304	322	321	339	358
CFI	.87	.89	.88	.88	.88	.88	.87
TLI	.85	.87	.86	.87	.87	.87	.88
RMSEA	.11	.10	.11	.10	.10	.10	.10
$\Delta\chi^2$				31.82	23.95	27.76	61.11
Δdf				18	17	18	19
p value				.023	**.121**	**.066**	< .001

Note. χ2 = chi-square test of model fit; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean squared error of approximation. Because of a nonpositive definite weight matrix, these analyses were conducted using the maximum likelihood (ML) estimator, resulting in poorer overall model fit but still allowing for multigroup comparisons.

Table 4. Multiple Group Analysis Between Service Members Who Have and Have Not Deployed on the Columbia-Suicide Severity Rating Scale Severity Subscale[AQ5]Table Layout

Variable	Deployment group	No-deployment group	Configural model	Metric invariance	Scalar invariance	Full uniqueness
N	473	505	978	978	978	978
χ^2	169.65	101.06	270.71	273.25	277.15	291.00
df	5	5	10	14	18	23
CFI	.81	.86	.83	.83	.83	.82
TLI	.61	.71	.66	.76	.81	.85

Note. χ2 = chi-square test of model fit; df = degrees of freedom; CFI = comparative fit index, TLI = Tucker-Lewis Index, RMSEA = root mean squared error of approximation. Because of a nonpositive definite weight matrix, these analyses were conducted using the maximum likelihood (ML) estimator, resulting in poorer overall model fit but still allowing for multigroup comparisons. The Severity subscale was used, rather than the Intensity subscale, because of the latter's poor model fit in initial CFAs.

Variable	Deployment group	No-deployment group	Configural model	Metric invariance	Scalar invariance	Full uniqueness
RMSEA	.26	.20	.23	.20	.17	.15
$\Delta\chi^2$				2.54	3.90	13.85
Δdf				4	4	5
p value				**.638**	**.420**	.017

Note. χ2 = chi-square test of model fit; df = degrees of freedom; CFI = comparative fit index, TLI = Tucker-Lewis Index, RMSEA = root mean squared error of approximation. Because of a nonpositive definite weight matrix, these analyses were conducted using the maximum likelihood (ML) estimator, resulting in poorer overall model fit but still allowing for multigroup comparisons. The Severity subscale was used, rather than the Intensity subscale, because of the latter's poor model fit in initial CFAs.

Table 5. Multiple Group Analysis Between Service Members Who Have and Have Not Deployed on the Self-Harm Behavior QuestionnaireTable Layout

Varible	Deployment group	No-deployment group	Configural model	Metric invariance	Metric–Freed Ideation Item 4	Scalar invariance	Full uniqueness
N	474	517	991	991	991	991	991
χ^2	959.58	1,094.30	2,053.87	2,084.81	2,080.92	2,095.83	2,178.23
df	203	203	406	424	423	441	463
CFI	.92	.91	.92	.92	.92	.92	.91
TLI	.91	.90	.91	.91	.92	.92	.91
RMSEA	.09	.09	.09	.09	.09	.09	.09
$\Delta\chi^2$				30.93	27.04	14.91	82.41
Δdf				18	17	18	22
p-value				.029	**.057**	**.668**	< .001

Note. χ2 = chi-square test of model fit; CFI = comparative fit index, TLI = Tucker-Lewis Index, RMSEA = root mean squared error of approximation. Because of a non-positive definite weight matrix, these analyses were conducted using the maximum likelihood (ML) estimator, resulting in poorer overall model fit but still allowing for multigroup comparisons.

Table 6. Multiple Group Analysis between Service Members Who Have and Have Not Deployed on the Suicidal Behaviors Questionnaire—RevisedTable Layout

Varible	Deployment group	No-deployment group	Configural model	Metric invariance	Scalar invariance	Full uniqueness
N	477	516	993	993	993	993
χ^2	3.69	6.69	11.01	13.21	15.56	19.60
df	2	2	4	7	10	14
CFI	.99	.98	.99	.99	.99	.99
TLI	.97	.94	.96	.98	.99	.99
RMSEA	.04	.07	.06	.04	.03	.03
$\Delta\chi^2$				2.20	2.35	4.04
Δdf				3	3	4
p value				**.533**	**.502**	**.401**

Note. χ2 = chi-square test of model fit; Weighted least squares (WLS) estimator was used. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean squared error of approximation.

Examining convergent validity for the four suicide risk assessment measures (using items from the MSRC CDEs), the BSS and SBQ-R were positively related to current ideation (BSS: $B = 2.52$, $SE = 13.$, $p < .001$; SBQ-R: $B = 3.07$, $SE = .22$, $p < .001$), attempt history (BSS: $B = .39$, $SE = .05$, $p < .001$; SBQ-R: $B = .84$, $SE = .04$, $p < .001$), hopelessness (BSS: $B = .69$, $SE = .07$, $p < .001$; SBQ-R: $B = 1.18$, $SE = .04$ $p < .001$), and thwarted belongingness (BSS: $B = 5.01$, $SE = .37$, $p < .001$; SBQ-R: $B = 5.23$, $SE = .52$, $p < .001$). The SHBQ ideation subscale was related to current ideation ($B = .78$, $SE = .23$, $p = .001$), the attempt subscale was related to attempt history ($B = .82$, $SE = .04$, $p < .001$), and the NSSI and ideation subscales were related to ideation: $B = .35$, $SE = .09$, $p < .001$), hopelessness (NSSI: $B = .21$, $SE = .06$, $p < .001$; ideation: $B = .35$, $SE = .10$, $p < .001$), and thwarted belongingness (NSSI: $B = 1.42$, $SE = .36$, $p < .001$; ideation: $B = 1.37$, $SE = .65$, $p = .035$). The C-SSRS severity subscale was related to current ideation ($B = 1.19$, $SE = .18$, $p < .001$), attempt history ($B = .61$, $SE = .03$, $p < .001$), hopelessness ($B = .38$, $SE = .07$, $p < .001$), and thwarted belongingness ($B = 2.38$, $SE = .47$, $p < .001$); the C-SSRS intensity subscale was not assessed for convergent validity due to its poor model fit.

Discussion

In support of our hypothesis, four commonly used suicide risk assessment instruments—the C-SSRS, SHBQ, SBQ-R, and BSS—were found to be valid and reliable when used with active duty U.S. service members at risk for suicide. Differences in performance across scales and within scales containing subscales suggest that clinicians should make informed decisions about which specific measures to use in clinical practice. For example, the C-SSRS severity subscale has acceptable psychometric support, whereas the intensity subscale does not. Those decisions should also be informed by the ease of administration and scoring of the selected measures. Behavioral health clinicians working in clinics already using one or more of the tested measures can be confident in their continued use. Clinics where consideration of adding or changing the suicide-specific measures used for routine assessment may want to consider the BSS, SHBQ, and/or SBQ-R given the overall superior performance of these measures relative to the C-SSRS.

Further reason to consider using one or more of these measures in standard clinical practice is the data supporting that service members with and without combat experience respond similarly to items on each. There is concern within the military suicide research field that certain combat experiences may increase suicide risk (Shen et al., 2016). We therefore decided to test measurement invariance across the participants with and without combat experience. This was done to make sure these scales are measuring the same thing across heterogeneous groups (i.e., those who have deployed to combat and those who have not). Metric invariance tells us that the factor loadings are equivalent across groups. In other words, within a given measure or subscale the individual items most conceptually related to each other are also mathematically related to each other regardless of which group is responding to the measure. Scalar invariance shows that intercepts are equivalent across groups. This is a precursor to being able to compare scores across groups—without scalar invariance, we cannot be sure that any group mean differences are true differences. Full uniqueness is rarely ever met in practice, but it demonstrates that the error/residual variances are equivalent across groups (Vandenberg & Lance, 2000). With metric and scalar invariance being met for these measures we are still satisfied with partial invariance in these analyses. And we are comfortable recommending use of these measures for service members with and without combat experience.

A few limitations of the current study are worth noting. The large sample of active duty service members used increases the generalizability of the findings, but with the caveat that all were identified as being at risk of suicide to be eligible to participate. Therefore, these findings are likely most applicable to service members receiving care for suicide risk or diagnosed with disorders known to correlate with suicide risk. The three-month follow-up period used in the current study is also a strength, but detailed analyses testing the performance of the selected measures over shorter follow-up periods were not conducted. It therefore is not possible to speak to the utility of these measures when administered repeatedly over the course of routine clinical care, for example.

Although the focus of this study was on the psychometric properties of the chosen measures when used with U.S. military service members, recent analyses by members of our research team have found that suicide-specific assessment tools tend to perform similarly when used with service members and veterans (Stanley et al., in press). Therefore, the results of these analyses provide additional evidence of the psychometric support for use of the chosen measures in a broad range of military-related clinical settings.

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Predicting suicide attempts among soldiers who deny suicidal ideation in the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS)

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ABSTRACT

Most nonfatal suicide attempts and suicide deaths occur among patients who deny suicidal ideation (SI) during suicide risk screenings. Little is known about risk factors for suicidal behaviors among such patients. We investigated this in a representative sample of U.S. Army soldiers who denied lifetime SI in a survey and were then followed through administrative records for up to 45 months to learn of administratively-recorded suicide attempts (SA). A novel two-stage risk assessment approach was used that combined first-stage prediction from administrative records to find the subsample of SI deniers with highest subsequent SA risk and then used survey reports to estimate a second-stage model identifying the subset of individuals in the high-risk subsample at highest SA risk. 70% of survey respondents denied lifetime SI. Administrative data identified 30% of this 70% who accounted for 81.2% of subsequent administratively-recorded SAs. A relatively small number of self-report survey variables were then used to create a prediction model that identified 10% of the first-stage high-risk sample (i.e., 3% of all soldiers) at highest SA risk (accounting for 45% of SAs in the total sample). We close by discussing potential applications of this approach for identifying future SI deniers at highest SA risk.

Most identified risk factors for suicide in the general population are actually predictors of suicidal ideation (SI; Kessler, Borges, & Walters, 1999; Nock, Kessler, & Franklin, 2016). Knowledge of such risk factors is of limited value in predicting suicidal behaviors in clinical settings, where the focus is on the small proportion of patients with SI who go on to engage in suicidal behavior (ten Have et al., 2009). Little is known about the predictors of these behaviors among patients with SI. Accordingly, researchers have begun to investigate predictors of suicide attempts among ideators (e.g., Nock et al., 2018). However, these investigations do not address the much larger segment of the at-risk population made up of individuals who engage in suicidal behaviors despite denying SI. Some recent studies have reported that the *majority* of suicide attempts (SAs) and suicide deaths occur among patients who denied SI at previous healthcare appointments or surveys (Louzon, Bossarte, McCarthy, & Katz, 2016; Simon et al., 2013). For the sake of conciseness, we refer to these individuals as "non-ideators," but it is important to recognize that such individuals are non-ideators by self-report at a single point in time. Some may truly have no history of SI, but others may be concealing their SI. In addition, some may have no SI history as of the time of their healthcare encounter but subsequently develop SI.

The high proportion of SAs made by non-ideators poses a major challenge for healthcare providers who wish to prevent suicide, most of whom assess suicide risk using a gateway question that inquires about SI. Administering an in-depth assessment to all non-ideators is clearly not an option because risk of suicidal behavior is very small in this group, even though the majority of suicide attempts occur among them. Consequently, any action taken to screen the many non-ideators would

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be cost-ineffective; it could also have a negative impact on rapport if a provider continued to insist upon asking suicide-related questions of a patient who had explicitly stated that suicidality was not a concern.

In this paper we present the results of an innovative approach to identifying non-ideators at high risk of suicidal behaviors among US Army soldiers. The approach involves a two-stage assessment process (Kessler et al., in press). The first stage takes advantage of the extensive amount of administrative data available for soldiers to develop a prediction model that can be implemented passively to identify the small proportion of non-ideators who have elevated SA risk. Although predictions based on this first-stage model are incapable of identifying the small proportion of non-ideators who have sufficiently high SA risk to warrant preventive intervention, previous research suggests that such a model can identify a large proportion of soldiers who are at low SA risk for exclusion from further assessment (Ursano et al., 2016). The remaining non-ideators are then the focus of further analysis. These soldiers are administered a series of self-report questions that are used to estimate a second-stage model to identify non-ideators at highest SA risk. This two-stage approach limits the number of non-ideators required to receive this self-report assessment in an effort to keep patient burden to a minimum.

We apply this two-step approach here to predict nonfatal SAs among non-ideators in a large sample of U.S. Army soldiers who participated in the main survey component of the Army Study to Assess Risk and Resilience in Servicemembers (STARRS; Ursano et al., 2014). The likelihood of denying SI is high in this population given that reporting SI could have negative career implications. Yet the need to implement suicide prevention programs in this population is particularly urgent given that the Army suicide rate climbed steeply in recent years (Schoenbaum et al., 2014) and preventing suicide represents a major priority and area of investment for the Army (Department of the Army, 2012).

1. Method

1.1. Participants

Participants were drawn from the STARRS Consolidated All-Army Survey (AAS). We focus on the 27,501 Regular Army soldiers who participated in that survey, who agreed to have their survey data linked to their Army administrative data, and whose survey dates were non-missing. The consolidated AAS is made up of three component surveys. The largest of the three was a representative survey of non-deployed soldiers no longer in Initial Military Training carried out in 2011–2012 that contributed 17,462 respondents to the consolidated AAS (95.0% survey consent rate, 97.3% survey completion rate among consenters, 61.3% administrative data linkage consent rate among survey completers). The second was a survey of soldiers from three Brigade Combat Teams preparing to deploy to Afghanistan in 2013 that contributed 8558 respondents to the consolidated AAS (98.7% survey consent rate, 99.2% survey completion rate among consenters, 90.9% administrative data linkage consent rate among survey completers). This second survey was added because soon-to-deploy soldiers were under-represented for logistical reasons in the first survey. The third was a survey of soldiers in transit to and from mid-deployment leave in Kuwait in 2013 that contributed 3987 respondents to the consolidated AAS (80.9% survey consent rate, 86.5% survey completion rate among consenters, 55.6% administrative data linkage consent rate among survey completers). This third survey was added because none of the respondents in the first two surveys were currently deployed. The three surveys are described in detail elsewhere, along with a description of the methods used for data collection and for weighting the combined data to adjust for differential probabilities of selection and discrepancies between the sample and the population on a range of administrative variables (Kessler et al., 2013; Millner et al., 2018). Procedures for obtaining informed consent and collecting data in all three surveys were approved by the Human Subjects Committees of the Uniformed Services University of the Health Sciences, the Institute for Social Research at the University of Michigan, and all other collaborating organizations. The analyses presented here focus only on soldiers who responded in the negative to two survey questions about active ("Did you ever in your life have thoughts of killing yourself?") and passive ("Did you ever wish you were dead or would go to sleep and never wake up?") SI.

1.2. Measures

Outcome measure: Post-survey suicide attempts. The outcome variable, presence of a suicide attempt subsequent to AAS survey completion, was assessed prospectively using administrative data available through December 2014 from the Army STARRS Historical Administrative Data System (HADS). The HADS integrates records from numerous data sources, four of which include information on SA: (i) the Department of Defense Suicide Event Report (DoDSER; Gahm et al., 2012) and DoDSER's predecessor (i.e., the Army Suicide Event Report; ASER; Gahm et al., 2012); (ii) the Military Health System Data Repository; (iii) the Theater Medical Data Store; and (iv) the TRANSCOM (Transportation Command) Regulating and Command and Control Evacuating System. These databases together contain comprehensive healthcare encounter information from military and civilian treatment facilities, deployed operations, and aeromedical evacuations. The data used to define SA (described in more detail elsewhere; Ursano et al., 2015) included attempts documented in DoDSER records and International Classification of Diseases, Ninth Revision, Clinical Modification codes for self-inflicted poisoning or injury with suicidal intent (codes E950-E958) from any of the other databases. Information was recorded on the date of the first SA of every AAS respondent subsequent to the date of survey.

Administrative predictors of suicide attempts. We included in our prediction models a number of basic socio-demographic variables (age, sex, race/ethnicity, education, marital status, number and ages of children, religious denomination, country of origin) and Army career variables (years since enlistment, rank, current deployment status, number of prior combat deployments, major command) that are available for all soldiers in Army administrative records and that have shown associations with suicidal behavior in some literature. We also included in the models a composite score representing the predicted probability of suicide *fatality* (not attempt) developed from a comprehensive historical analysis of HADS data for the entire Army over the years 2004–2009. In other words, we assessed whether the predicted probability of death by suicide was a predictor of SA, as no comparable historical model exists for SA. That score combined predictions from separate models reported in earlier publications for suicides among soldiers with a history of psychiatric hospitalization (Kessler et al., 2015) and other soldiers with a history of outpatient treatment for mental health problems (Kessler et al., 2017) along with an unpublished model developed using similar methods for soldiers with no history of inpatient or outpatient treatment of mental health problems. Close to 500 administrative variables were considered for inclusion in these models and between 12 and 20 were selected as final predictors after adjusting for the possibility of false positives. The coefficients were then applied to HADS data available for each AAS respondent as of the month prior to completion of the AAS survey in 2011–2013 to generate a predicted probability of subsequent suicide. The predicted probabilities were standardized to a mean of 0 and variance of 1 in the subsample of respondents who reported no history of SI in the survey to facilitate interpretation of the regression coefficient associated with that predictor. By adding this composite historical variable into the model, we were able to aggregate a great deal of risk information from the HADS in a single variable, thereby preserving statistical power. However, it remained necessary to include additional predictors (i.e., the socio-demographic and career variables mentioned above) because

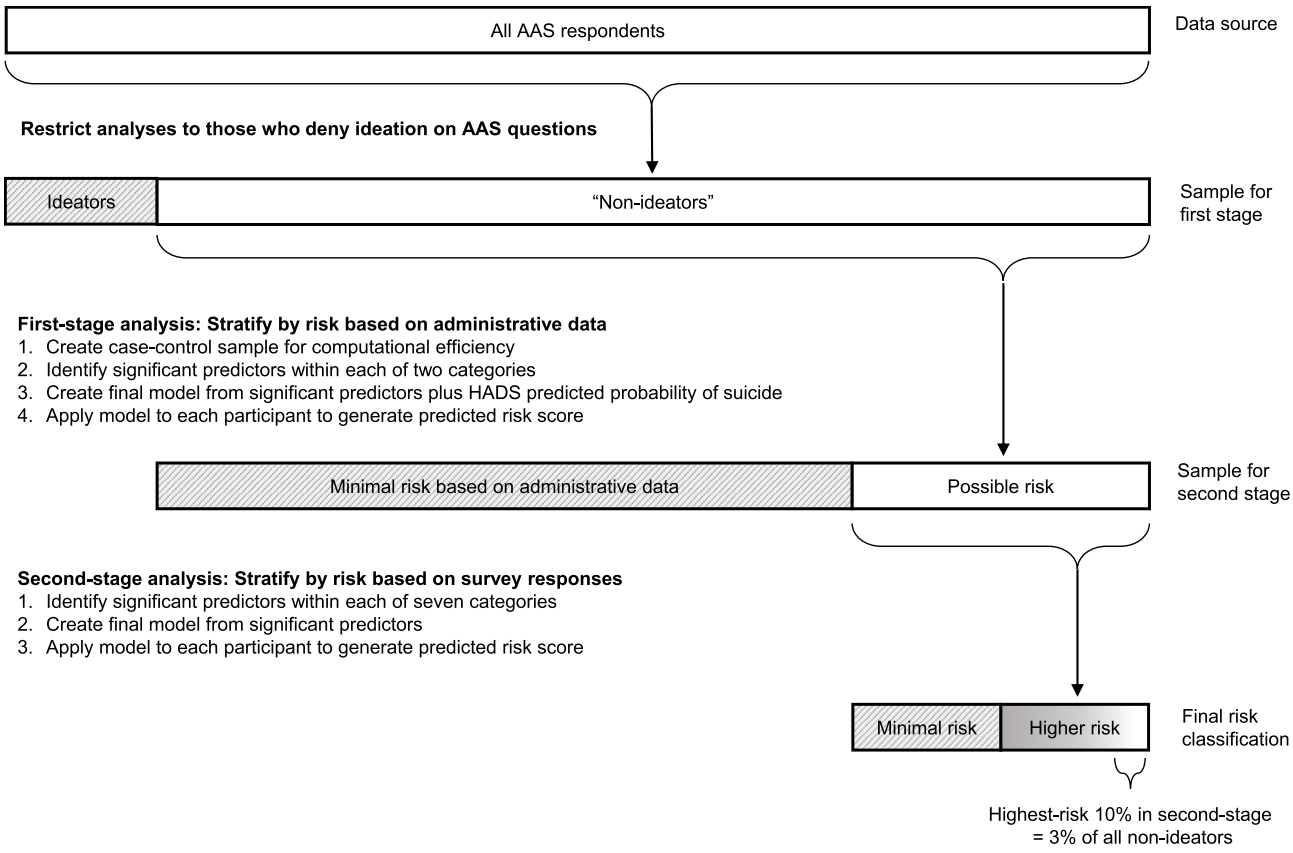

Fig. 1. Data analytic steps. White boxes represent the sample to which each stage of the analysis was applied. Gray boxes represent the portion of the sample from the previous stage that was excluded.

suicide fatality and SA are distinct events with differing risk factors.

AAS self-reported predictors of suicide attempts. AAS self-reports were used as predictors of SA in a number of previous STARRS analyses that used retrospective self-reports of lifetime SA as the outcome variable (Millner et al., 2017; Millner et al., 2018; Nock et al., 2018). Seven categories of AAS self-reports that were found in these studies to be significant predictors of SA were considered in the prospective model here: 8 predictors for lifetime mental disorders, 4 for severity of 30-day mental disorder symptoms (i.e., in the 30 days prior to the survey), 27 for lifetime exposure to traumatic events (e.g., sexual assault, combat exposure), 29 for 12-month exposure to more common stressful events (e.g., divorce, death of a loved one, being jailed), 5 for severity of chronic stressors at the time of survey (e.g., in such areas as finances and romantic relationships), 3 for traumatic brain injury (both lifetime exposure and severity of 30-day post-concussive symptoms), and 6 for social support-related factors.

1.3. Data analysis

Fig. 1 depicts the stages of the analytic process, including which subset of the AAS sample was analyzed at each stage.

First-stage analysis. The goal of the first stage of data analysis was to predict SA from administrative data available at the time of the survey. As noted above in the section on measures, we used for this purpose a composite suicide prediction score based on an earlier historical analysis of the HADS data for the years 2004–2009 in addition to basic socio-demographic and Army career variables available for each AAS respondent as of the month of survey. Discrete-time survival analysis with person-month the unit of analysis (Singer & Willett, 1993) was used to estimate the model. To increase computational efficiency, we created a case-control sample consisting of all person-months with SA plus twenty randomly-selected control person-months for each attempt. The control person-months were weighted by the inverse of their probability of selection to reconstruct their population proportions. We began model-building by estimating two preliminary models, one for the administratively-recorded socio-demographic variables described above in the section on measures and the other for the Army career variables. Both models controlled for time since survey and season (to adjust for the seasonal pattern of SAs for which evidence was found in previous STARRS studies). The significant predictors in those models along with the standardized HADS composite suicide prediction score described above in the section on measures were then included as the predictors in a final first-stage model. A receiver operating characteristics (ROC) curve for the predicted values based on that model was then plotted to inspect the sensitivity (SN; the proportion of all observed SAs that occurred among soldiers in a given range of the risk distribution) and positive predictive value (PPV; number of observed SAs per 100,000 person-years among soldiers in that range of the risk distribution) in predicting administratively-recorded SAs.

Second-stage analysis. Inspection of the ROC curve for the first-stage model led us to focus additional analysis on the subset of AAS respondents who had high predicted probabilities of SA based on administrative data. We used the AAS survey data as the predictors in this second-stage analysis. We again used discrete-time survival analysis with person-month as the unit of analysis, beginning with separate models for each of the seven categories of predictors, controlling for seasonality and number of months since the survey. Predictors with significant univariate associations with SA were combined to generate within-category multivariate models, which were then trimmed to exclude nonsignificant predictors. The predictors in each of these within-category multivariate models were then combined into a final second-stage model.

To evaluate the possibility of over-fitting, we used 20 replicates of 10-fold cross-validation (10F-CV; James, Witten, Hastie, & Tibshirani,

Table 1
Final first-stage model of administrative characteristics predicting subsequent administratively-recorded suicide attempts among Regular Army soldiers who denied lifetime suicidal ideation in the Consolidated AAS Survey ($n = 3251$).

	Distribution		Univariate		Multivariate	
	Est.[a]	SE	OR	95% CI	OR	95% CI
Demographics						
Age (in decades, mean)	2.9	0.0	0.5*	[0.3–0.8]	0.4*	[0.2–0.9]
Racial/ethnic minority (vs. non-Hispanic White)	37.6	1.7	2.8*	[1.7–4.6]	2.8*	[1.5–5.2]
Not a college graduate (vs. college or more)	74.3	2.3	17.7*	[3.9–79.4]	2.8	[0.4–19.8]
First generation (vs. others)[b]	14.6	1.2	3.2*	[1.5–6.6]	2.5*	[1.1–5.7]
Army career characteristics						
Enlisted rank (vs. officer)	79.4	2.2	42.8*	[5.8–315.0]	5.1	[0.4–75.4]
Number of prior deployments[c]	1.3	0.1	1.4*	[1.1–1.8]	1.5*	[1.2–2.0]
HADS composite predicted suicide score (mean)[d]	0.0	1.0	2.0*	[1.5–2.7]	2.0*	[1.5–2.6]

Note. Based on a discrete-time person-month survival model that subsampled a probability sample of 20 controls for each suicide attempt and weighted the control person-months by the inverse of their probability of selection to reconstruct their population proportions, resulting in a total of 3528 person-months. Model OR's control for seasonality and months since survey. Predictor values were defined as of the month of survey.

*$p < .05$.

[a] All estimates are percentages unless labeled otherwise.

[b] Soldiers are defined as being first generation if either they were born outside the U.S. or both their parents were born outside the U.S.

[c] This variable was coded in the range 0–4. Soldiers with more than 4 deployments were coded 4 to stabilize the regression coefficient.

[d] This is a standardized transformation of a composite measure to generate a predicted-probability-of-suicide from HADS administrative data based on an earlier analysis of the HADS database for the years 2004–2009. See text for further detail.

2013) to generate estimates of out-of-sample performance based on the final second-stage model. 10F-CV is an approach in which model prediction accuracy is assessed in a sample of people separate from the sample in which the model was estimated by dividing the sample into 10 subgroups of equal size, estimating the model 10 separate times leaving out cases in one subsample each time, and using the coefficients from the model estimated when a given subsample was excluded to make predictions only for that omitted subsample. A pooled ROC curve is then estimated based on these combined predicted values to estimate how well the model would predict if it were applied to a new sample. Prior simulations have shown that this method yields fairly accurate estimates of out-of-sample performance of prediction models when model results are evaluated in the same sample as the one in which the model was estimated, but that performance can be improved in samples with sparse outcomes, which is the type of sample we have here, if the 10F-CV is repeated 20 separate times with independent designation of subsamples (i.e., 20 replications of the sample being divided into 10 random subsamples) and results averaged across these replicates (Smith, Seaman, Wood, Royston, & White, 2014). This is what we did here.

This second-stage discrete-time survival model assumed that the joint predictive effects of the risk factors were linear and additive. However, most theories of suicidal behaviors hypothesize that non-additivities exist among risk factors (Selby, Joiner, & Ribeiro, 2014). To address this issue, we used the super learner (SL) ensemble machine learning algorithm (van der Laan, Polley, & Hubbard, 2007) to apply a series of interactive models to the predictors in the final stage-two model to find the best-fitting specification. In addition to a penalized additive model (elastic net; Zou & Hastie, 2005), the non-additive models in the SL ensemble included adaptive splines (Friedman, 1991), random forests (Breiman, 2001), support vector machines with radial and polynomial kernels (Steinwart & Christmann, 2008), Bayesian additive regression trees (Chipman, George, & McCulloch, 2010), and gradient boosting (Freund & Schapire, 1999). 5F-CV was used to generate an ROC curve based on the SL ensemble. We used 5F-CV (i.e., cross-validation dividing the sample into five separate subsamples) rather than the 20 replicates of 10F-CV used to estimate the ROC curve for the second-stage model because SL already uses internal 10F-CV both to estimate individual models and to develop the weights to combine results across component models.

2. Results

2.1. Prevalence of suicide attempts separately among AAS ideators and non-ideators

Lifetime SI was reported by 13.2% ($n = 3647$ of 27,501) of AAS respondents. Subsequent SAs were administratively recorded for 243 of the AAS respondents, a weighted 32.5% of whom ($n = 75$) reported SI in the survey and 67.5% ($n = 168$) of whom did not. The association between survey reports of SI and subsequent administratively-recorded SA was statistically significant (OR 3.0, 95% CI 1.8–5.0); the SA rate among those who denied SI was 124.8 per 100,000 person-years compared to 378.0 per 100,000 person-years among those who reported SI.

2.2. First-stage model: predicting suicide attempts from administrative data

We focused on the 86.8% of AAS respondents ($n = 23,854$) that reported no lifetime SI in the survey. These respondents were followed administratively for a total of 718,055 person-months until either the first SA after the survey was recorded (subsequent SAs were ignored in the analysis), they separated from service, they died, or it was December 2014, whichever came first. (Suicide fatalities, $n = 11$, were considered deaths rather than SAs. This was done based on evidence that the predictors of nonfatal SA are quite different from the predictors of suicide death, the most striking example being the much higher suicide death rate among men than women but much higher nonfatal SA rate among women than men. A case might be made that suicide deaths should be considered SAs and included in the analysis, although results are unlikely to have been affected strongly due to the small number of suicide deaths in the sample.) There were 168 person-months in which an attempt took place among non-ideators; therefore, sampling of 20 control person-months for each attempt resulted in a total analytic sample of 3528 (i.e., 168*20 + 168) person-months.

The final first-stage model appears in Table 1. (Detailed results of the two preliminary models are available on request.) Odds of administratively-recorded SA were inversely associated with age and positively associated with racial/ethnic minority status, having less than college education, being a first-generation American, enlisted rank, number of prior deployments, and the standardized HADS composite suicide prediction score.

The area under the ROC curve (AUC) of the model was 0.82. An inspection of PPV by decile of predicted risk showed a clear

Table 2
The operating characteristics of predictions based on the model in Table 1 applied to all Regular Army soldiers who denied lifetime suicidal ideation in the Consolidated AAS Survey (n = 3251).

	Positive predictive value[a]		Sensitivity[b]	
Risk decile	Attempts/100K person-years	SE	%	SE
91–100%	1024.8	166.8	50.5	7.3
81–90%	324.0	79.8	16.8	5.4
71–80%	458.4	140.4	13.9	5.5
61–70%	89.2	37.8	2.3	1.1
51–60%	8.0	42.8	2.4	1.1
41–50%	180.0	100.5	7.9	4.2
31–40%	172.8	73.2	4.3	2.0
21–30%	93.8	48.8	1.9	1.4
11–20%	34.6	27.3	0.1	0.1
0–10%	0.0	0.0	0.0	–
Total	232.8	2.5	100.0	–

Note. As explained in the text, the 20:1 sampling of control person-months to attempt person-months, followed by selection of only those person-months of participants who denied lifetime suicidal ideation, resulted in a total of 3528 person-months. Values reflect weighted data.

[a] Positive predictive value refers to the number of attempts per 100,000 person-years in each decile.

[b] Sensitivity refers to the weighted percentage of observed attempts that fell in each decile.

discontinuity between the three highest-risk deciles, where the SA rate was in the range of 458.2–1024.8 per 100,000 person-years, and the lower risk deciles, where the SA rate was in the range of 0.0–180.0 per 100,000 person-years, as shown in Table 2. The cumulative PPVs for the lower-risk deciles were all below the rate in the general U.S. population (Piscopo, Lipari, Cooney, & Glasheen, 2016). Half of all soldiers with SA were in the highest risk decile (SN = 50.5%) and 81.2% in the three highest risk deciles. Based on these results, we focused second-stage model-building on the 30% of observations with highest predicted risk.

2.3. Second-stage model: predicting suicide attempts from AAS survey data

We began model-building in this 30% high-risk segment of the case-control sample by estimating a series of seven preliminary models, one for each of the seven categories of AAS predictors described above in the section on measures. All these models controlled for seasonality, months since survey, and number of prior deployments (the variables from the first model that remained significant in the 30% high-risk subsample). (Detailed results of the seven preliminary second-stage models are available on request.) We then estimated a final second-stage model, shown in Table 3, that combined all the significant predictors from these seven preliminary models. Odds of administratively-recorded SA were positively associated with having any lifetime mental disorder, ever being bullied while in the Army, ever being responsible for the death of an enemy, and having been in jail or custody in the past year ("spent time in jail, stockade, correctional custody, or brig" on the survey). The AUC of the model was 0.62, computed by applying the coefficients from 20 replicates of 10F-CV model based on the matched case-control subsample to the entire population of all person-years observed among the 30% of the sample defined in the first-stage model as being at high risk (n = 718,055). As noted in the section on analysis methods, replicated 10F-CV was used to estimate the likely performance of the model if applied in a different sample.

We also used all variables included in this final model (not just those that were significant when entered together) to estimate an SL ensemble machine learning model that allowed for nonlinearities and interactions among the predictors to see if the performance of the final logistic model could be improved on by relaxing the linearity and additivity assumptions implicit in that model. This entire series of procedures was applied five separate times in calculating the 5F-CV SL AUC, which was 0.83.

We inspected the ROC curves for the cross-validated second-stage and SL models, shown in Fig. 2, and used these to guide the creation of relatively homogeneous risk strata, which are shown in Table 4. The SL model had substantially better out-of-sample performance than the original second-stage model. The highest risk stratum in the SL model, which consisted of the 5% of high-risk soldiers (i.e., 5% of 30% = 1.5% of all non-ideators) with highest cross-validated predicted SA risk, had a PPV of 3273.6 per 100,000 person-years and a SN of 48.1% (compared to PPV = 702.0/100,000 person-years and SN = 10.1% in the cross-validated second-stage model). The second highest risk stratum in the SL model consisted of another 5% of high-risk soldiers, who had a PPV of 514.1 per 100,000 person-years and a SN of 7.4%, resulting in 55.5% of all SAs occurring among the 10% of soldiers at highest risk (within this 30% high-risk sample already selected by the administrative model, i.e., 3% of all non-ideators). It is striking that the 50% of soldiers with lowest predicted risk in the high-risk sample had PPV (61.6/100,000 person-years) considerably lower than in the general U.S. population (Piscopo et al., 2016), indicating that despite their classification as higher-risk based on the first-stage administrative predictors, the AAS survey data subsequently showed that they were actually lower-risk.

3. Discussion

The goal of this study was to determine the feasibility of developing a two-step procedure for identifying non-ideators at risk of SA among U.S. Army soldiers who denied SI. The study had three key findings. First, consistent with recent prospective studies in other settings (Louzon et al., 2016; Simon et al., 2013), the preponderance of attempts (67.5%) occurred among soldiers who denied any lifetime SI. This is especially notable given that soldiers who completed the survey were assured their responses would be confidential, which should have reduced motivation to conceal information. It may, then, be a robust phenomenon that most SAs are made by non-ideators, at least among Army soldiers.

Second, the two-stage procedure showed the potential for strong predictive performance while limiting burden on patients and providers. The first-stage model was able to classify 70% of non-ideators as having minimal risk of SA based solely on administrative data. The second-stage model, which was based on responses to a limited number of self-report survey questions, was able to identify an additional 15% of non-ideators as minimal-risk (i.e., 50% of 30%) and classify the remainder as high-risk, with almost half of all attempts among non-ideators made by the stratum containing the 3% (i.e., 10% of 30%) at highest risk.

This model performance is particularly impressive given that it might be expected that predicting attempts among soldiers who denied SI would be more difficult than predicting attempts among ideators for several reasons. First, individuals who deny SI may be less willing or able to report risk factors accurately. Second, the characteristics of ideation and other suicidal behaviors are strong risk factors for transitioning from ideation to attempt (Nock et al., 2018), whereas such predictors do not exist for non-ideators. Finally, it is possible that attempts among non-ideators are more frequently driven by situational variables that unfold quickly, whereas the drivers of attempts among ideators may be more stable or chronic (Millner, Lee, & Nock, 2017). It is striking that despite these challenges we were able to predict attempts among non-ideators with good accuracy.

A third key finding is that risk factors for SA among non-ideators in the Army are largely comparable to predictors found in other studies, although additional research is needed to clarify this by directly comparing ideators and non-ideators. Several of the risk factors found here correspond to predictors found among all Army soldiers in previous STARRS studies, including age, education, rank, deployment history, and mental illness history (e.g., Millner et al., 2017; Nock et al., 2014; Ursano et al., 2015; Ursano et al., 2016). The elevated risk of SA among racial/ethnic minority non-ideators contrasts with the finding in some

Table 3
Final second-stage model of AAS survey variables predicting subsequent administratively-recorded suicide attempts among the high-risk (based on the first-stage model) Regular Army soldiers who denied lifetime suicidal ideation in the Consolidated AAS Survey (n = 1141).

	Distribution		Univariate		Multivariate	
	Est.[a]	SE	OR	95% CI	OR	95% CI
DSM-IV symptoms and disorders						
Any lifetime mental disorder	47.6	3.6	4.2*	[1.7–10.1]	3.5*	[1.0–12.0]
Current mental disorder symptoms (mean)[b]	0.0	1.0	1.4*	[1.1–1.8]	0.9	[0.6–1.4]
Traumatic and stressful experiences						
Ever bullied by unit	15.9	2.2	2.3*	[1.1–4.7]	2.2*	[1.1–4.6]
Ever responsible for death of an enemy	6.6	1.1	3.1*	[1.6–6.0]	3.1*	[1.2–7.7]
Recent interpersonal problems (mean)[c]	0.3	1.0	1.8*	[1.2–2.6]	1.5	[0.9–2.5]
Spent time in jail	2.0	0.6	4.6*	[1.1–18.7]	6.8*	[1.7–27.4]
Recent general stressors (mean)[d]	0.0	1.0	1.5*	[1.1–2.0]	1.1	[0.7–1.8]
Traumatic brain injury (TBI)						
More-than-mild TBI in past 5 years	6.5	1.2	3.7*	[1.3–10.7]	1.3	[0.4–4.4]
Any other TBI[e]	26.7	3.1	1.0	[0.4–2.4]	0.5	[0.2–1.3]
HADS composite predicted suicide score (mean)[f]	0.0	1.0	1.5	[1.0–2.1]	1.4	[0.9–2.0]

Note. The sample for this model represents the 30% high-risk subsample of the full sample shown in Table 1 and has a total of 1248 person-months. See the text for a description of the method used to define the high-risk subsample. Model estimates reflect weighted data. Model OR's control for seasonality and months since survey. Predictor values reflect information at the month of survey.
*$p < .05$.
[a] All estimates are percentages unless labeled otherwise.
[b] Current mental disorder symptoms is the standardized sum of the 4 scores for severity of depression, anxiety, irritability, and PTSD. Higher values reflect more severe symptoms.
[c] Recent interpersonal problems is a summary measure of four individual events: separation/divorce from spouse/partner, spouse/partner cheated, betrayal by someone close, and serious ongoing arguments/break-up with friend/relative. Values ranges from 0 to 3, with 0 indicating no recent interpersonal problems (75.1% of sample), 1 indicating exactly 1 (13.0% of sample), 2 indicating exactly 2 or 3 (9.9% of sample), and 3 indicating exactly 4 (2.0% of sample).
[d] Recent general stressors is the standardized sum of the maximum scores in each of five life areas: financial situation/career, health, love life, relationship with family and health of loved ones, and problems with unit. Higher values reflect more severe life stress.
[e] Any other TBI included more-than-mild TBI that occurred 6 or more years ago and any mild or any less-than-mild TBI.
[f] This is a standardized transformation of a composite measure to generate a predicted-probability-of-suicide from HADS administrative data based on an earlier analysis of the HADS database for the years 2004–2009. See text for further detail.

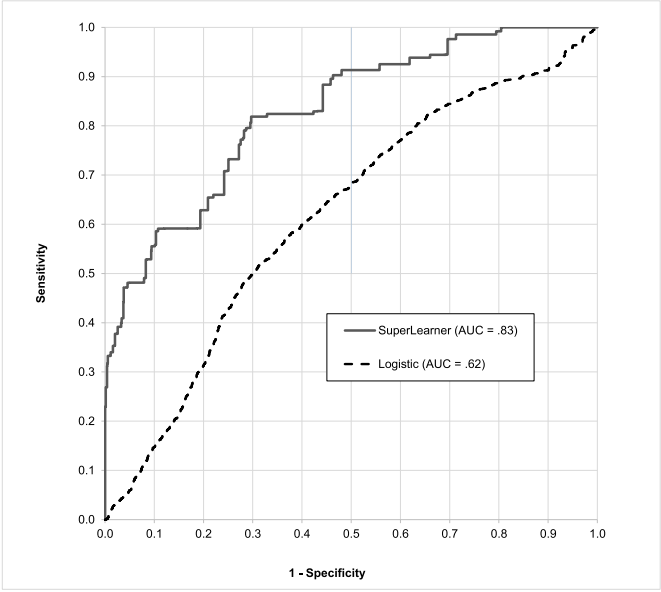

Fig. 2. Receiver operating characteristics (ROC) curve for 20 replicates of ten-fold cross-validated logistic regression versus five-fold cross-validated SuperLearner in predicting prospective suicide attempts among high-risk subsample of non-ideators.

previous STARRS studies (Millner et al., 2017; Ursano et al., 2015) that identifying as a racial/ethnic minority is protective, but the civilian literature is mixed, finding complex and inconsistent associations between racial/ethnic minority status and risk for suicidal behaviors (Mościcki, 2014). The finding that elevated life stress and interpersonal stressors, particularly bullying victimization, are risk factors is congruent with the civilian literature (e.g., Liu & Miller, 2014; McFeeters, Boyda, & O'Neill, 2015; Nielsen, Nielsen, Notelaers, & Einarsen, 2015; van Geel, Vedder, & Tanilon, 2014) and with a previous STARRS study finding that *childhood* bullying victimization is a risk factor for SAs (Campbell-Sills et al., 2017). A handful of studies in veterans found associations between killing enemy combatants and SAs and SI (Bryan et al., 2015). Finally, regarding the association between recent jail time and suicide attempt, there is a body of research showing increased risk for suicide among recently-released prisoners (Zlodre & Fazel, 2012), and that elevated risk may be related to a stable set of traits or may persist (Kariminia et al., 2007). Most of the past studies cited here have not differentiated between ideators and non-ideators. Consequently, it is unclear whether overlap between the risk factors found in this study and those in previous studies reflects the fact that most individuals are non-ideators, so they comprise a large part of previous studies' samples, or whether the risk factors for ideators and non-ideators are truly similar. Future studies would need to directly compare ideators and non-ideators to address this question.

3.1. Limitations and future directions

The circumstances in which the survey was administered might limit the generalizability of these findings. As noted previously, participants in this study were guaranteed confidentiality when asked about both SI and risk factors. This would not be the case in a healthcare setting nor in any other setting in which self-reported information might be used to determine the need for further screening or intervention. And in the Army, such information could have negative career consequences. Higher rates of concealing ideation might consequently be expected when applying these findings in clinical practice in the military and possibly in other settings. There might also be some distortions in self-reports about other risk factors and in the predictive model based on such differences. As a result, any efforts on the part of

Table 4
Operating characteristics of final logistic and super learner models predicting suicide attempt among high-risk and full sample of lifetime non-ideators (n = 1189).

	Sensitivity[a]											
	High-risk subsample				Full sample[b]				Positive predictive value[c]			
	Logistic regression		SuperLearner		Logistic regression		SuperLearner		Logistic regression		SuperLearner	
Risk stratum[d]	%	SE	%	SE	%	SE	%	SE	Attempts	SE	Attempts	SE
95–100%	6.0	2.0	48.1	7.0	3.8	1.6	39.1	6.1	702.0	250.8	3273.6	848.8
90–95%	8.7	3.0	7.4	4.0	7.6	3.2	6.0	3.3	1024.8	418.8	514.1	304.7
90–100%	14.7	4.3	55.5	7.1	11.4	3.8	45.1	6.2	862.8	304.8	1909.8	423.0
71–90%	35.1	4.4	26.3	6.5	25.5	4.5	21.4	5.5	1028.4	158.4	457.8	145.9
50–70%	18.2	2.2	9.5	4.1	13.1	3.8	7.7	3.3	534.0	80.4	156.1	73.3
0–50%	32.0	6.1	8.7	3.8	22.1	5.7	7.0	3.1	376.8	92.4	61.6	28.1
0–30%	15.6	5.1	2.4	1.4	9.5	4.6	1.9	1.1	304.8	112.8	27.4	16.2

Note. Selection of the person-months in the top 30% of risk based on the administrative model (see Tables 1 and 2) resulted in a total of 1246 person-months. Values reflect weighted data.

[a] Sensitivity refers to the weighted percentage of observed attempts that fell in each quantile.

[b] Sensitivity for the full sample is the percentage of suicide attempts made by respondents in each quantile as a proportion of all suicide attempts in the full non-ideator sample, as opposed to the attempts made by the 30% of non-ideators classified as "high-risk" (who made 81.7% of all attempts among non-ideators). Thus, the 95–100% row shows the sensitivity among all non-ideators for the 0–1.5% (0.05*0.3 = 0.015) highest-risk of all non-ideators.

[c] Positive predictive value refers to the number of attempts per 100,000 person-years in each stratum.

[d] Risk strata were created by collapsing cross-validated ventiles with comparable likelihood ratios of SA (Deeks & Altman, 2004).

the Army to develop a system to collect self-report data of the sort we used to develop our model would need to experiment in order to determine the best way to collect such information and the strength of the resulting prediction model.

A related limitation in applying our results to a civilian population is that the rich administrative data available for all soldiers are either not available or not relevant for the general population. Given this limitation, a promising direction for this line of work in future research on civilians might be to develop a first-stage model that combines predictor variable data from electronic medical records with publicly available electronic administrative data systems available from commercial sources that might approximate the kinds of administrative data available for soldiers (e.g., www.accurint.com).

Another limitation is that the model was used to predict only the subset of SAs that come to medical attention. We know from comparisons of STARRS survey data with administrative data linked to survey reports that a substantial proportion of the SAs reported by soldiers in their surveys are not recorded in administrative records. And there are presumably yet other SAs that are both denied in surveys and not recorded in administrative records. Access to comprehensive data on all SAs would presumably allow a model to be created that would improve on the accuracy of our model in projecting future SA risk. Future research that uses panel survey data could address this limitation by using information reported in the baseline survey to predict the subsequent occurrence of SAs either reported in subsequent surveys and/or recorded in administrative records.

An additional limitation of this study is that, although strong, the predictive performance of the model is far from perfect. Enriching the feature set of previously-existing administrative data in the first-stage model could shrink the proportion of individuals who would require second-stage assessments. For example, the first-stage model could use text scraped from electronic medical record notes or social media postings (Ben-Ari & Hammond, 2015; Bryan et al., 2018). Performance of the second-stage model might also be improved, since it is unlikely that the questions asked in the AAS happened to include the perfectly optimal items for predicting suicidal behavior. Future investigations could add other self-report measures or performance-based measures such as the Suicide Implicit Association Test, which in one study predicted SAs beyond patients' report of ideation and likelihood of reattempt (Nock et al., 2010). Further, the present study did not differentiate between those who attempted suicide soon after survey administration and those who attempted suicide several years later. The ideal model may differ for individuals at imminent versus long-term risk. Developing models with a variety of time horizons could improve accuracy and could inform the nature of the intervention offered (e.g., crisis intervention versus longer-term skills training or psychotherapy).

Despite this study's limitations, we believe the strategy presented here is unique in suggesting a practical way to assess SA risk among non-ideators. The optimal way to do so is yet to be determined, though, because the variables available to us are unlikely to be the best ones in building models and we do not know either the ideal setting or the ideal frequency for this assessment. As one possible implementation in the Army, though, one could imagine a scenario in which all soldiers who report for routine healthcare visits are asked about SI, perhaps on a tablet or computer while in the waiting room. For those who deny ideation, the tablet could compute the risk score based on the first-stage algorithm by pulling the soldier's administrative data (i.e., with no additional input). Soldiers deemed at minimal risk based on the first-stage administrative model would receive no further assessment, whereas soldiers at higher risk would be administered an additional battery of self-report questions and a second-stage algorithm would be applied to those responses to determine the need for a more in-depth clinical assessment by a healthcare provider.

The question remains, then, what steps a clinician should take when faced with an at-risk individual who denies ideation after an in-depth clinical assessment. Appropriate interventions for non-ideators have yet to be identified; the best-supported treatments for reducing SA risk among servicemembers (e.g., Rudd et al., 2015) involve directly treating suicidal thoughts and behaviors, but such treatments are obviously not applicable for individuals who deny ideation. However, the risk factors for attempts found in this study do hint at possible targets for intervention among U.S. Army soldiers who deny ideation but are predicted to be at high risk. If these risk factors play a causal role in SAs (which would need to be confirmed in future studies), then treating those risk factors should be a viable strategy for reducing risk. Notably, we found that meeting criteria for one or more common mental disorders is a risk factor for SA. Being bullied was another significant predictor. Interventions for treating common mental disorders exist, as do training programs also exist for coping with interpersonal stressors. Such interventions might reduce SAs among high-risk soldiers who deny ideation. Given the observational nature of this study and the lack of evidence for the effects of such interventions on SAs, though, these suggestions remain speculative.

Once way of advancing our understanding of potentially effective preventive interventions for high-risk soldiers who deny SI would be to carry out in-depth suicide-focused assessments of need for services with

such soldiers and use the information obtained in such assessments both to guide treatment planning and to develop third-stage models that might be used for clinical decision support in selecting optimal treatments keyed to the varying risk factors of high-risk soldiers (Kessler et al., in press). Future research is also needed to replicate our findings regarding optimal first-stage and second-stage predictors and to investigate the ideal frequency and setting for assessment in order to pinpoint soldiers at high risk of suicidal behaviors for more in-depth clinician assessments and targeted preventive interventions.

Funding

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Declarations of interest

In the past 3 years, Dr. Kessler received support for his epidemiological studies from Sanofi Aventis; was a consultant for Johnson & Johnson Wellness and Prevention, Sage, Shire, Takeda; and served on an advisory board for the Johnson & Johnson Services Inc. Lake Nona Life Project. Kessler is a co-owner of DataStat, Inc., a market research firm that carries out healthcare research. Dr. Stein has in the past three years been a consultant for Actelion, Aptinyx, Bionomics, Janssen, Neurocrine, Oxeia Biopharmaceuticals, and Resilience Therapeutics. The remaining authors have no financial disclosures.

Acknowledgments

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.brat.2018.11.018.

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Military Suicide Research Consortium: Extensions to New Opportunities and Challenges

13172001; 13172002

W81XWH-16-2-0003; W81XWH-16-2-0004

PIs:. Thomas Joiner, Ph.D. & Peter M. Gutierrez, Ph.D

Org: Florida State University & Denver Research Institute

Award Amount: $15,865,461 FSU
$17,894,035 DRI

Study/Product Aim(s)

•Maintain situational readiness, research infrastructure, intellectual capacity, and institutional memory to ensure that the resources exist to meet future military suicide research needs as they change and develop.
•Continuing to produce new scientific knowledge about suicidal behavior in the military.
•Use high quality research methods and analyses to extend significant findings from studies completed in the first five years of MSRC.
•Conduct after-action analyses of null findings from initial MSRC studies to determine whether interventions significantly affected other outcomes (e.g., mechanism variables covered by the Common Data Elements [CDE]).
•Capitalize on the CDE (variables collected by all currently funded studies) to encourage rigorous secondary analyses, exploring rival mediators and mechanisms, and moving toward making the data available to the broader research community.
•Build on the first five years of research conducted by the MSRC, by continuing to disseminate Consortium knowledge, information, and findings through a variety of methods appropriate for decision makers, practitioners, and others who are accountable for ensuring the mental health of military personnel.
•Train future leaders in military suicide research.

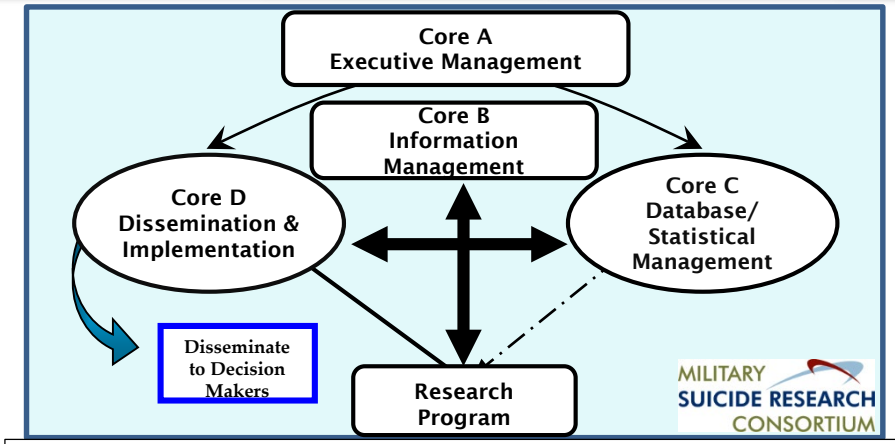
Approach

The MSRC's ultimate impact is on suicide prevention in the military through research. Findings will be used to influence policy, best practices, and programmatic changes.

Timeline and Cost

Activities	CY16	CY17	CY18	CY19	CY20
Revise infrastructure and refine and develop research priorities					
Fund and oversee funded studies					
Perform analyses on findings from years 1-5 and after-action analyses					
Capitalize on CDE secondary analyses					
Development of D&I plans					
Organized dissemination					
Continue training experiences					
FSU Estimated Budget ($Million)	**$5.4**	**$5.9**	**$1.5**	**$1.5**	**$1.5**
DRI Estimated Budget ($Million)	**$3.9**	**$4.8**	**$4.2**	**$3.2**	**$1.8**

Updated: (03/31/2019)



Accomplishments: The MSRC supports a total of 24 funded projects, including 5 long-term follow-up studies of MSRC 1.0 projects; 4 secondary data analyses of the MSRC Common Data Elements; 11 intervention studies; 3 assessment studies; and 1 postvention study.

Goals/Milestones

Year 1 Goal:
☑ Infrastructure updated and review functions defined and in place
☑ Research priorities updated and research studies funded
☑ Establish dissemination & implementation (D&I) relationships and create D&I plans for funded studies

Year 2 Goal:
☑ Maintain defined schedule of data uploads and meetings
☑ Analyses completed on previous studies
☑ Start dissemination of research findings
☑ Career development and training experiences established

Year 3 Goal:
☑ Refine research priorities and continue research projects

Year 4 Goal:
❑ Continued dissemination of research findings
❑ Present at relevant conferences and develop manuscripts

Year 5 Goal:
❑ Communication of MSRC deliverables achieved

Budget Expenditure to Date

FSU Actual Expenditure: $2,667,477
DRI Actual Expenditure: $4,045,175

Efficacy of a Computerized Cognitive Behavioral Treatment for Insomnia: Increasing Access to Insomnia Treatment to Decrease Suicide Risk

Award Number: W81XWH-16-2-0004

PI: Sarra Nazem, Ph.D. **Org:** Rocky Mountain MIRECC **Award Amount:** $1,155,292

Study Aim & Hypotheses

Specific Aim: Determine the efficacy of Sleep Healthy Using the Internet (SHUTi), a potential upstream suicide prevention intervention, for treatment of insomnia in OEF/OIF/OND Veterans.

Hypothesis 1.1: Participants randomized to SHUTi will report a significant pre-intervention to post-intervention decrease in insomnia symptoms, and improvement in functioning compared to participants who are randomized to the educational website control.

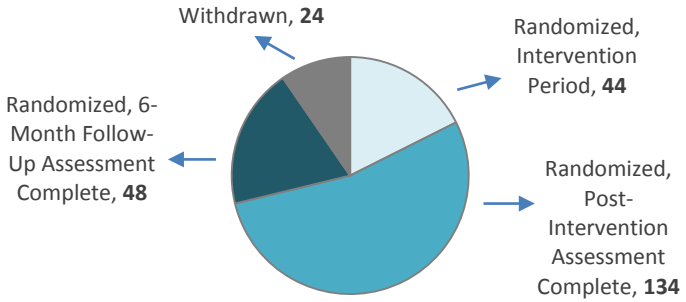
Hypothesis 1.2 & 1.3: Participants randomized to SHUTi will report a significant pre-intervention to six-months and one-year post-intervention decrease in insomnia symptoms, and improvement in functioning compared to participants who are randomized to the educational website control.

Exploratory Objective: Determine whether SHUTi is associated with significant reductions in sleep parameters and key suicide risk variables (e.g., suicidal ideation, depressive symptoms).

Approach

Efficacy will be evaluated using a two group (SHUTi vs. educational website control) longitudinal (four time points: baseline, post-intervention, 6-month and 1-year follow-up) RCT design.

Participant Status



Accomplishments: Completed recruitment, screening, and enrollment. Continued baseline assessment, randomization, post-intervention assessment, and 6 month post-intervention assessment. This quarter, randomized 37 participants, to bring cumulative randomized total to 231. Collected post-intervention assessment data from an additional 71 participants and 6-month follow-up assessment data from an additional 44 participants.

Timeline and Cost: Project Period: 04/10/17-04/09/20

Activities	04/17-04/18	04/18-04/19	04/19-04/20
Study Start Up			
Conduct RCT: Baseline & Post-Intervention Assessments			
Conduct RCT: 6-Month and 1-Year Follow-Up Assessments			
Evaluate and Disseminate RCT			
Estimated Budget ($1,155,292)	$409,913	$367,116	$378,263

Updated: March 2019

Goals/Milestones

Year 1 Goals
- Research staff hired and trained (completed)
- Regulatory approvals obtained (completed)
- Begin RCT recruitment and enrollment (completed)

Year 2 Goals
- 226 participants randomized to RCT (completed)
- Begin 6-month and 1-year assessments (in progress)

Year 3 Goals
- 6-month and 1-year assessments completed
- Manage and analyze data
- Disseminate findings
- Submit final research progress and fiscal reports

Comments/Challenges/Issues/Concerns
- Exceeded randomization target of 226 (randomized 231)

Budget Expenditure to Date
- Projected Expenditure: $777,028.80
- Actual Expenditure: $630,681.46

Interoceptive Deficits and Suicidality

Award Number: W81XWH-16-2-0004

PI: April Smith, Ph.D. **Org:** Miami University **Award Amount:** $149,966

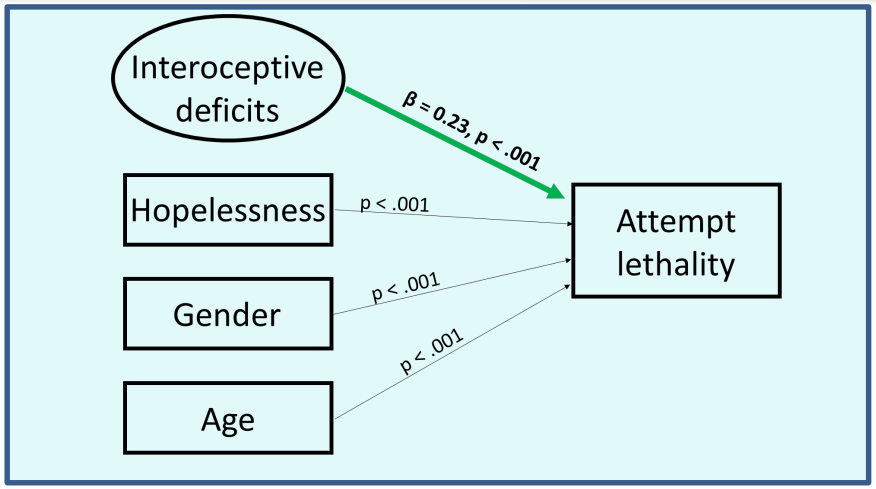
Study/Product Aim(s)

- Interoceptive deficits (i.e., being disconnected from one's body) differentiate those who think about suicide from those who engage in suicidal behavior, and may tell us who is at imminent risk for suicidal behavior.
- Aim 1: Test whether interoceptive deficits differentiate Service members based on their lifetime suicidal behavior.
- Aim 2: Test whether interoceptive deficits will associate with suicidal behavior severity, over and above established risk factors.

Approach

Items from the MSRC Common Data Elements (CDE) will be used to create a latent interoceptive deficits variable.

Multiple group confirmatory factor analysis will test Aims 1, while regression models will test Aim 2.



Aim 2 results demonstrating interoceptive deficits associate with attempt lethality over and above other risk factors.

Timeline and Cost

Activities CY	17	18	19	20
Obtain Institutional Review Board (IRB) approval				
Prepare CDE dataset				
Complete analyses for Aims 1–3				
Disseminate study findings				
Estimated Budget ($K)	**$0**	**$106**	**$43**	**$0**

Updated: 4/03/2019

Goals/Milestones

CY17 Goal – Obtain IRB approval

☑Miami University IRB approval granted 12/5/2017

CY18 Goals – Prepare CDE dataset and complete analyses

☑Create syntax and complete measurement models

☑Use multiple group confirmatory factor analysis for Aim 1

☑ Use structural equation regression models for Aim 2

CY19 Goal – Disseminate study findings

☑ Prepare manuscript

☐ Submit manuscript (to be submitted by grant end date 5/16/19)

☑ Submit abstract to American Association for Suicidology (AAS) conference

Comments/Challenges/Issues/Concerns

Expenditures appear lower than projected, however, this is because several larger budget items (i.e., course release time) have not been charged to the grant, though they will be soon. Overall, our spending is on track.

Budget Expenditure to Date

Projected Expenditure: $149,996 Actual Expenditure: $101,949.40

Three Year Follow-Up on Study on Suicide Risk Assessments within Suicide Specific Group Therapy Treatment for Veterans

Award Number: W81XWH-16-2-0004

PI: Johnson & O'Connor **Org: Clinical Research Foundation (Dept. of VA)** **Award Amount: $148,982**

Study/Product Aim(s)

The intent of conducting this three year follow-up study is to gather data that may demonstrate the long-term safety of a suicide-specific group therapy, while also investigating the extent to which mechanisms found to be significant correlates of clinical symptoms in our original study are associated with long-term pragmatic outcomes, such as suicide attempts, hospitalizations and outpatient behavioral health treatment.

Approach

The quantitative aspects of the study involve data collection through abstraction of electronic health record. The qualitative aspects of the study involve conducting semi-structured interviews with 15 participants from each original study condition (total N = 30) in order to better understand how the group therapy experience impacted the Veterans' trajectories after inpatient psychiatric hospitalization.

Accomplishment: All approvals in place and training completed. Double entry chart extractions complete on all but 29 (of 134) cases. 29 (of 30) interviews completed.

Timeline and Cost

Activities CY	17	18	19	20
Finalize procedures and train				
Data collection				
Data Analysis/Dissemination				
Estimated Budget ($K)		**$101,297**	**$47,685**	

Updated: April 5, 2019

Goals/Milestones

CY18 Goals – Finalize Procedures and Train

- ✓ Complete process planning and obtain necessary approvals
- ✓ Fully train all staff on data extraction and coding procedures

CY19 Goal – Data Analysis and Dissemination

- ❑ Complete 2nd chart extractions (29 remain) and remaining subject interviews (1)
- ❑ Conduct analyses and interpret for publication submission and sharing at scientific conferences
- ❑ Share any applicable findings with CAMS-G development team to inform ongoing development and investigation into the utility of a CAMS Group approach.

Budget Expenditure to Date

Projected Expenditure Y1: $101,297

Actual Expenditure To Date: $57,083.69

Establishing Measurement Equivalence of MRSC Database Assessments Across Demographic Groups

Award Number: W81XWH-16-2-0004

PI: David Vogel, PhD **Org:** Iowa State University **Award Amount:** $149,761

Study/Product Aim(s)

- **Specific Aim 1**: Test the ME/I of the suicide and related risk factor measures
- **Specific Aim 2**: Examine latent mean differences of the measures across groups
- **Specific Aim 3**: Establish the validity of the brief screening measures

Approach

The objective of this project is to examine the psychometric properties of the assessments included in the MSRC database. ME/I and latent mean analyses will be conducted using the sequential constraint imposition approach on 14 suicide and related risk factor measures. For the five measures in which both the brief and full measure was collected, we will examine the convergent validity of the two versions by examining how the measures predict other scales included in the MSRC database.

Invariance Tests Completed Across Demographic Categories

Scale	Latent Mean Analyses	Full vs. Brief Screener Comparison
CDE – DSI	X	NA
CDE – SBQ	O	NA
CDE – SIS	X	NA
CDE – BHS	O	NA
CDE – INQ	O	X
CDE - ASI	X	NA
CDE - PCLM	O	X
CDE – PCLC	O	X
CDE – AUDIT	O	NA
CDE – ISI	X	NA
BSS	O	X
SSI	O	X
BDI	X	X
BHS	O	NA
INQ-15	X	X
ACSS	O	X
AUDIT	O	X
PCLC	O	X
PCLM	O	X

Accomplishment this Quarter: In Table above 'X' denotes completed analyses, 'NA' denotes insufficient data to perform analyses, 'O' denotes upcoming analyses.

Timeline and Cost

Activities / CY	17	18	19	20
Major Task: Prepare Documents & Research Protocols				
Major Task: Data Analysis and Reporting				
Subtask 1: Analyze Data & Report Findings				
Subtask 2: Dissemination of Findings				
Estimated Budget ($149,761)	**$000**	**$104,919**	**$44,842**	**$000**

Updated: 4/3/2019

Goals/Milestones

CY18 Goal 1 – Prepare Documents and Research Protocols

✓ HRPO and University IRB approvals for all protocols

✓ Refine Data Analytic Plan

CY18 Goal 2 – Data Analysis and Reporting (Subtask 1)

✓ Perform ME/I analyses and share findings with MSRC

CY19 Goal 2 – Data Analysis and Reporting (Subtask 1)

❑ Perform mean invariance and validity analyses and share findings with MSRC

CY19 Goal 2 – Dissemination of Findings (Subtask 2)

❑ Work with MSRC data core and disseminate findings

Comments/Challenges/Issues/Concerns

Budget Expenditure to Date

Projected Expenditure: $$114,941.67

Actual Expenditure: $$98,019.08

Profiles of Behavioral Warning Signs (BWS) for Suicide Attempts in the Prediction of Future Suicidality Award #: W81XWH-16-2-0004

PI: Courtney L. Bagge, PhD; **Org:** Univ. Mississippi Medical Center; **Amount: $149,355**

Study/Product Aims: Start date (3/15/18)

Key Question: Can BWS predict future suicidal thoughts and behaviors during a period of pronounced risk (w/in 12 mo. of hospitalization)?

Aims: Determine if BWS groups can predict presence of, and onset to, reattempt and worst suicidal ideation

- Over and above traditional risk factors

Specific Hypothesis: No extant data to inform this question

Military Relevance: Inform more precise discharge decisions, innovative treatments, and longer-term prevention efforts to reducing the burden of suicide among service members.

Follow-Up Methodology:

Participants: N=181 adults hospitalized after a suicide attempt

Procedure: Phone follow-up. Use of well-established follow-up measures

- SASI-Count: Presence of reattempt; # days to first attempt within 12 mo
- SSI-Worst: Level of worst SI within 12 mo

Accomplishments: We have enrolled 128 participants (126-fully completed and 2-partially completed/in progress). This is 88% of expected at this date. We have obtained a NCE to finish enrollment.

Timeline and Cost (Direct and Indirect)

Activities	Mo. 1-12	Mo. 13-18
Build Infrastructure for the project		
Recruit/Consent 144 Participants; Enter Data		
Variables Created/Data Cleaned/Coded Analyzed		
Disseminate Findings		
Submit Final Research/Fiscal Report		
Estimated Total Budget ($K)	$123,333	$26,022

Goals/Milestones

Build Infrastructure for Project–

☐ Hire and train assessor (completed)
☐ Regulatory approval (completed)
☐ Creation of databases (completed)

Recruit and Collect Data; Enter Data

☐ Enroll 144 participants (in progress)
☐ Data double-entered

Manage and Analyze Data; Disseminate Findings

☐ Variables created
☐ Data cleaned, coded, and analyzed
☐ Manuscript and report writing; Disseminate findings

Projected Budget: $149,355; Expenditures: $120,915
PoP: 03/15/18 – 09/14/19

Couples Crisis Response Planning to Reduce Post-Discharge Suicide Risk

Award Number: W81XWH-16-2-0004

PI: Alexis May, PhD **Org:** University of Utah **Award Amount: $1,481,083**

Study/Product Aim(s)

Objective: To develop and test the C-CRP, a single-session suicide-specific couples intervention, among post-9/11 military service members, veterans, and their partners.

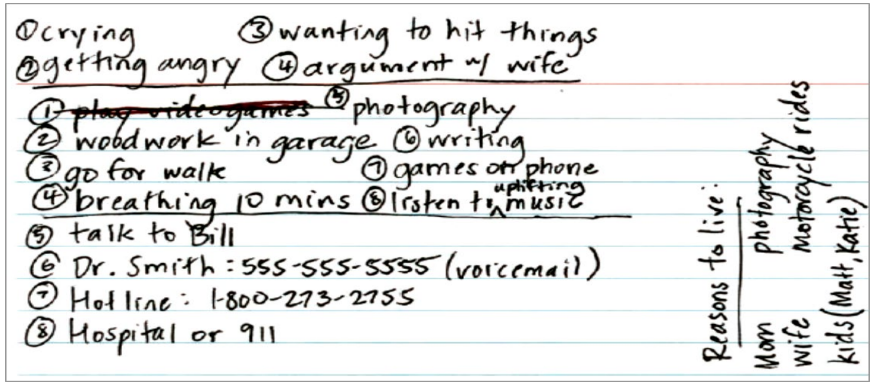
Aims:

- To compare the effect of C-CRP to TAU on suicide ideation in the 6 months following treatment service members hospitalized for suicide risk.
- To determine how use of the C-CRP impacts suicide ideation and identify the role of partners in use of the plan and managing risk.
- To to determine the needs and preferences of service members, veterans and their partners for suicide prevention interventions.

Approach

50 military couples will complete an online survey to determine the needs and preferences of service members and their partners for suicide prevention interventions. 78 service members hospitalized for suicidal thoughts and/or behaviors and their partners will be randomized to C-CRP or TAU. Follow up assessments will occur at discharge, 1, 3, and 6 months.

Sample Crisis Response Plan



Accomplishment: In Q5 we continued to pursue regulatory approvals. Resolution is still ongoing, but progress is being made. University of Utah IRB approval was achieved 01-APR-19. Training of staff continued and a consultant meeting was completed.

Timeline and Cost

Activities / CY	18	19	20	21
IRB approvals, database construction, staff hiring & training				
Participant enrollment (P1 and P2), completion of baseline assessments				
Follow up interviews				
Data analyses, manuscript and report writing, dissemination of results				
Estimated Budget ($K)	**$345**	**$526**	**$496**	**$115**

Updated: Mar 31, 2019

Goals/Milestones

CY18 Goal – IRB approvals and Hiring
- ☐Obtain IRB and HRPO approval
- ☐Begin P1 data collection

CY19 Goals – Begin P2 Data Collection
- ☐Begin P2 Enrollment
- ☐Begin P2 Follow up assessments
- ☐P1 Data analysis and dissemination

CY20 Goal – Continue P2 Data collection
- ☐Continue P2 enrollment
- ☐Continue P2 follow up assessments

CY21 Goal – Conclude follow up assessments
- ☐Complete P2 follow up assessments
- ☐P2 data analysis and dissemination

Comments/Challenges/Issues/Concerns

Regulatory approval delays.

Budget Expenditure to Date

Projected Expenditure: $431,250

Actual Expenditure: $147,206

Enhancing Identification of Suicide Risk among Military Service Members and Veterans: A Machine Learning Approach to Suicidality

Award Number: W81XWH-16-2-0004

PI: Andrew K. Littlefield **Org:** Texas Tech University **Award Amount:** $260,729

Study/Product Aim(s)

- To develop algorithms using CDE variables that optimize classification of (a) non-attempters/non ideators vs. ideators/non-attempters vs. attempters, (b) classify current passive suicide ideation (vs. no current passive ideation), (c) current active suicide intent (vs. no current active suicide intent), (d) presence of a current suicide plan (vs. no current suicide plan), (e) suicide attempt history (vs. lack of attempt history), (f) level of lethality among attempters
- To identify classes of individuals based on demographic CDE variables using both a priori designations and latent class analysis (LCA)
- To determine the extent to which the aforementioned prediction algorithms are invariant across key demographic variables and across classes of individuals identified with LCA, with a focus on comparing prediction models across military status
- To develop algorithms that optimally predict attempt characteristics (lethality) among attempters within each demographic group
- To create "suicide risk scores" that quantify the likelihood of key suicide outcomes
- To test which ML technique and which variable selection method best minimizes classification error among key suicide outcomes.

Approach

Various Machine Learning approaches will be used to develop algorithms that maximize the classification of key outcomes and to identify key assessments of suicidal thoughts and behaviors. Available Common Data Elements variables will be entered as potential predictors of outcomes described in the Aims. To identify latent classes of individuals with similar endorsement of demographic variables, Latent Class Analysis will be used.

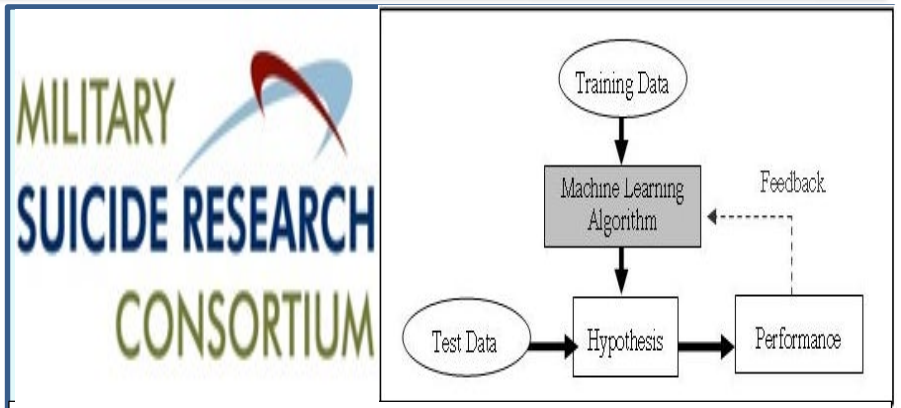


Figure Caption: Machine Learning Algorithms based on the Military Suicide Research Consortium's Common Data Elements will be developed to enhance current suicide risk assessments for Military Service members and Veterans.

Accomplishment: IRB/HRPO approval has been obtained. Data cleaning and preparing data for analysis is currently ongoing.

Timeline and Cost

Activities CY	18	19	NA	NA
Obtain IRB/HRPO APPROVAL	X			
Data Cleaning and Examination	X			
Analyses (LCA, EFA, ML)	X	X		
Manuscript Preparation, Dissemination of Findings		X		
Estimated Budget ($K)	**$145,392**	**$115,337**		

Updated: 04/08/2019

Goals/Milestones

CY18 Goal – Project Approval and Preliminary Analyses for ML

- ☑ Obtain project approval from IRB/HRPO
- ☑ Data cleaning and preparing data for analysis
- ☑ Determine optimal number of classes in LCA
- ☑ Conduct EFA
- ☑ Review analytic plan with data analysis team

CY19 Goal – Conduct ML Analyses, Dissemination of Findings

- ☐ Conduct ML within entire sample, within latent classes
- ☐ Optimize classification algorithms through ensemble methods
- ☐ Prepare manuscripts/disseminate findings (e.g., white paper)

Comments/Challenges/Issues/Concerns

- Secure common workspace has been established
- Coupled with IRB/HRPO determination, timeline can allow for extended preparation of manuscripts/dissemination efforts

Budget Expenditure to Date

Projected Expenditure: ~$183,800

Actual Expenditure: $137,978.55 (see quarterly report for details)