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TITLE: Development of a Military-Specific Transdiagnostic Eating-Disorder Survey and Screening Tool in a Nationally Representative Sample of Veterans

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13. SUPPLEMENTARY NOTES

14. ABSTRACT Military personnel must adhere to body mass index (BMI) and bodyfat percentage requirements, as well as physical performance standards. Failure to maintain these standards can result in referral to weight-loss programs and, eventually, discharge from service. The emphasis on body weight within the military may promote unhealthy attempts at weight loss and the development of eating disorders (EDs). If left untreated, EDs result in significantly greater VA healthcare (VHA) utilization, physical and psychiatric morbidity, and mortality. Yet, despite the public-health importance of addressing EDs in active-duty and veteran populations, there are no universal ED screening measures implemented in the VHA system and there are no national VHA treatment programs for EDs. Our primary objectives are to validate/develop: 1) a transdiagnostic ED assessment for use in VHA research and clinical settings and 2) a transdiagnostic short-form screening tool to identify veterans with an eating, mood, anxiety, or trauma-related disorder. Objectives will be achieved through two large studies that will recruit nationally representative samples of veterans separated from service within the past year. Item-response theory analysis was used to develop a preliminary trans-diagnostic screening tool as part of Aim 1 (Study 1). Aim 1 resulted in the Brief Assessment of Stress and Eating (BASE), a 17-item screener that is suitable to screen for EDs and internalizing symptoms in military veterans across both clinical and VA settings.

15. SUBJECT TERMS Eating disorders; assessment; screening tools; veterans					
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1. INTRODUCTION:

Despite the seriousness of eating disorders (EDs) among active-duty and veteran populations, there are currently no tools developed for use in military personnel or veterans to screen for possible EDs. Thus, there is a **critical need** to develop screening tools to identify and refer veterans with EDs for treatment. Our **central hypothesis** is that an integrated transdiagnostic framework for assessing EDs will lead to improvements in the ability to identify veterans who are at-risk for poor post-discharge psychosocial adjustment and need referral to treatment services. Our **preliminary data strongly** supported our hypothesis, specifically showing the need for transdiagnostic screening tools to accurately identify disordered eating in veterans. To address this need, we implemented the Eating Pathology Symptoms Inventory (EPSI), a self-report measure that has been shown to have a more comprehensive measure of disordered eating concerns in both men and women compared to other ED measures. Our preliminary data showed that veterans' scores on certain EPSI scales were higher than outpatients being treated for an ED. Moreover, our previous work in civilians with EDs showed that by combining the EPSI with a proven measure of depression, anxiety, and trauma (the Inventory of Depression and Anxiety Symptoms – II [IDAS-II]), we were able to predict future recovery and psychosocial adjustment at three- and six-month follow-ups. Although the EPSI and IDAS-II represent potentially useful screening measures, the total number of items across these measures is 144, which is too long for screening purposes. Thus, our **primary objective** is to create a short-form screening tool based on the EPSI and IDAS-II to identify veterans who may have an eating, mood, anxiety, or trauma disorder. **Secondary objectives** are to: **1)** test relationships among eating, mood, anxiety, trauma, and substance misuse in the first six months following discharge and **2)** conduct interviews in a subset of 50 veterans on perceived institutional/organizational barriers to obtaining ED and trauma-related treatment during active duty. Objectives will be achieved through two studies. **Study 1:** Veterans (N=1,000) will complete the EPSI and IDAS-II at four time points. We will assess the reliability and validity of these measures in veterans and develop a short-form screener. **Study 2:** Veterans (N=400) will complete our new shorter form and we will test whether our screen can identify true cases of eating, mood, anxiety, and trauma disorders. Post 9/11 veterans (discharged between October 1, 2018 and September 30, 2019) will be recruited from the VA/DoD Identity Repository.

2. KEYWORDS:

Eating disorders; veterans; assessment; screening tools; depression; anxiety; post-traumatic stress disorder

3. ACCOMPLISHMENTS:

What were the major goals of the project?

Primary Objectives: Our primary objectives are to validate/develop: **1)** the Eating Pathology Symptoms Inventory (EPSI) and Inventory of Depression and Anxiety Symptoms-II (IDAS-II) for use in VA research and clinical settings and **2)** a short-form (brief) screening tool based on the EPSI and IDAS-II to identify veterans who may have an eating, mood, or anxiety disorder (including trauma).

Secondary objectives: Our secondary objectives are to: **1)** elucidate temporal relationships among ED symptoms and internalizing and externalizing psychopathology in the first six months following military discharge and **2)** obtain qualitative data on perceived institutional/organizational barriers to obtaining ED and trauma-related treatment during military service.

As stated in our approved SOW, we had the following major goals with target dates within the timeframe of this progress report.

1. **Major Task 1: Prepare Research Protocol**
   Milestone Achieved: All sites IRB approval (100% achieved)
   a. Finalize human subjects' protocol and secure IRB approval. *Target Date*: Pre-award to 3 Months. *Completion Date*: 11/06/2019
   b. Coordinate with sites for IRB protocol submission. *Target Date*: Pre-award to 3 Months. *Completion Date*:11/06/2019
   c. Coordinate among sites for annual IRB continuing reviews. *Target Date*: As needed.
   d. Receive DoD HRPO approval. *Target Date*: Pre-award to 6 Months. *Completion Date*: 12/06/2019

2. **Major Task 2: Hiring and Training**
   Milestone Achieved: Research staff trained (100% achieved)
   a. Advertise and interview for project-related staff. *Target Date*: Pre-award to 6 months *Completion Date*: 10/31/2019
   b. Hire and train staff. *Target Date*: 1-6 Months *Completion Date*: 02/04/2020
   c. Provide training to research staff in issues relevant to military and veteran culture. *Target Date*: 4-6 Months *Completion Date*: 09/27/2019

3. **Major Task 3: Aim 1 (i.e., Study 1) Participant Recruitment and Testing**
   Milestone Achieved: First participant returns online or mail-in survey (100% achieved)
   a. Coordinate with sites to ensure readiness for data collection. *Target Date*: 3-6 Months *Completion Date*: 01/27/2020
   b. Extract data from VADIR to obtain list of potential participants to recruit. *Target Date*: 6 Months *Completion Date*: 12/30/2019
   c. Initiate subject recruitment and survey mailing (N=4,500 invited participants to achieve target sample size of N=1000). *Completion Date:* 09/01/2020
   Milestone Achieved: Aim 1 data collection completed (100% achieved)
   d. All baseline surveys are completed. *Target Date*: 12 Months. *Completion Date:* 03/12/2022
   e. Initiate follow-up survey mailings. *Target Date*: 6 Months. *Completion Date:* 09/01/2020
   f. All follow-up surveys are completed. *Target Date*: 18 Months *Completion Date:* 06/12/2022

4. **Major Task 4: Aim 1 (i.e., Study 1) Data Entry, Cleaning, and Analysis**
   Milestone Achieved: Survey database is cleaned and ready for analysis (100% achieved)
   a. Baseline data are entered and cleaned. *Target Date*: 14 Months. *Completion Date: 8/24/2022*
   b. Follow-up data are entered and cleaned. *Target Date*: 18 Months. *Completion Date: 8/24/2022*
   Milestone Achieved: Aim 1 (Study 1) Survey database is cleaned and ready for analysis (10% achieved)
   a. Data analyses for Aim 1. *Target Date*: 18-21 Months.

5. **Major Task 5: Aim 2 (Study 2) Participant Recruitment and Testing**
   Milestone Achieved: First participant returns online or mail-in survey (100% achieved)
   a. Coordinate with sites to ensure readiness for Study 2 data collection. *Target Date*: 21-23 Months. *Completion Date:* 07/12/2021
   b. Extract data from VADIR to obtain list of potential participants to recruit. *Target Date*: 24 Months *Completion Date:* 04/13/2021
   c. Initiate subject recruitment and survey mailing (N=1,000 invited to participant to achieve target sample size of N=400). *Target Date*: 24 Months *Completion Date: 4/6/2022*

Major Task 5, Continued.

Milestone Achieved: Aim 2 (Study 2) data collection completed (20% achieved)

a. All surveys are completed. Target Date: 30 Months (47% achieved)
b. Initiate interviews. Target Date: 24 Months. (100% achieved). Completion Date: 5/02/2022
c. All interviews are completed. Target Date: 33 Months (5% achieved)

8. **Major Task 6: Aim 2 (Study 2) Participant Recruitment and Testing (20% achieved)**
Milestone Achieved: Survey database is cleaned and ready for analysis (0% achieved)
   a. Data entered and cleaned. *Target Date*: 33-36 Months

Milestone Achieved: Sensitivity, specificity, positive/negative predictive power, and ROC curve analyses completed (0% achieved)

   b. Data analyses for Aim 2. *Target Date*: 34-36 Months

Milestone Achieved: Report results from Aim 1 and Aim 2 analyses (0% achieved)

   c. Collaborate as a team to disseminate findings (presentations, publications, VA) *Target Date*: 24-36 Months

9. **Major Task 7: Exploratory Aim 1 Data Analysis (10% achieved)**
Milestone Achieved: Exploratory Aim 1 analyses are completed. (10% achieved)
   a. Conduct linear mixed model analyses. *Target Date*: 24-27 Months

10. **Major Task 8: Exploratory Aim 2 (Study 2) Qualitative Interview Development, Testing, and Analysis Milestone Achieved: Qualitative semi-structured interview developed and interviewers trained (100% achieved)**
   a. Develop and pilot test qualitative survey questions with study team experts. *Target Date*: 9- 18 Months (100% achieved) *Completion Date: 03/09/2022*
   b. Train graduate-student interviewers to conduct qualitative interviews. *Target Date*: 16-18 Months (100% achieved) *Completion Date: 08/15/2022*

Milestone Achieved: Qualitative analyses are completed (10% achieved)

   c. Qualitative interview coding and analysis. Target Date: 24-36 Months

What was accomplished under these goals?

Major Findings, Developments, or Conclusions
We are excited to report that participant baseline recruitment is complete for Aim 1. Data are cleaned and we are prepared to begin additional analyses within the next few months.

Major Activities: Specific objectives included: **1)** Completion of study 1 data collection and cleaning data, **2)** Development of the BASE, **3)** Aim 2 data collection launch, 4) Publication of initial results.

Below we elaborate on our accomplishments:
Our study design involved recruiting a nationally representative sample of veterans from the VA/DoD Identity Repository (VADIR), a VA office with access to DoD records. For Aim 1, we obtained data for all 179,111 post-9/11 veterans separated from military service between October 1, 2018 and September 30, 2019. From this population, we selected a random sample of 19,250 veterans stratified by *race*, *ethnicity*, *personnel category, rank* (which we operationalized through pay grade), *branch*, *age at discharge,* and *deployment status*. We oversampled women to recruit a 1:1 ratio of men to women to achieve an adequate sample of women. We achieved an equal sex ratio by dividing the full population into a group of women and a group of men, and then performed the stratification process separately for each group. The VADIR variables requested for Study 2 were identical to those requested for Study 1 (see above). For Study 2, we attained a representative sample of 7,316 cases from the 119,380 individuals separated from military service between October 1, 2019 and September 30, 2020.

We conducted a series of analyses to evaluate how well our stratification procedure worked for drawing nationally representative samples from the VADIR database for Aim 1 and 2. To assess sample representativeness, we computed correlations by creating a single variable to represent all unique strata within the full population of veteran men and women. Next, we correlated the frequencies of strata observed in the population with strata we observed in our sample. In both Studies 1 and 2 (which correspond to Aims 1 and 2), the correlation of demographic characteristics between the stratified sample and the full population of veterans was .95 or higher for each sex; thus, our stratified samples were representative of the full populations from which they were drawn (see table below).

	Study 1		Study 2	
	Strata	r	Strata	r
Females	1305	0.98	965	0.95
Males	1756	0.99	1441	0.97

***Figure 1**. Effectiveness of Stratification*

We evaluated the extent to which demographic characteristics that were used to draw stratified samples from VADIR were associated with (1) non-response to our initial recruitment, and (2) retention from our initial recruitment at one-week follow-up. As shown below, certain demographic variables were predictors of baseline response. However, only age at discharge was significantly related to retention at follow-up. These analyses revealed the importance of applying post-stratification weights to our sample to correct for non-response bias. We computed non-response weights and observed an error rate of less than .01% when comparing the weighted demographics from our sample against the population demographics. These analyses represent an important step in our overall project. **We have firmly established the national representativeness of our sample and can affirm that valid inferences can be made in generalizing results to the entire population of recently separated U.S. veterans**. Our analyses, along with a thorough description of our stratification procedure were **accepted for publication to the *International Journal of Methods in Psychiatric Research* (Forbush et al., in press).** Our dataset and publication will provide a rich source of secondary data analyses for researchers world-wide to study EDs and related issues, such as substance misuse and PTSD.

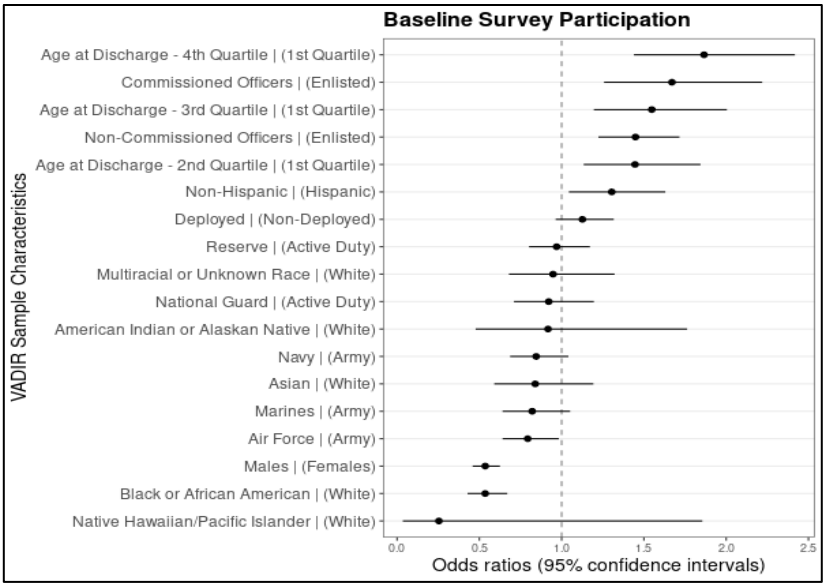

***Figure 2**. Predictors of Baseline Response*

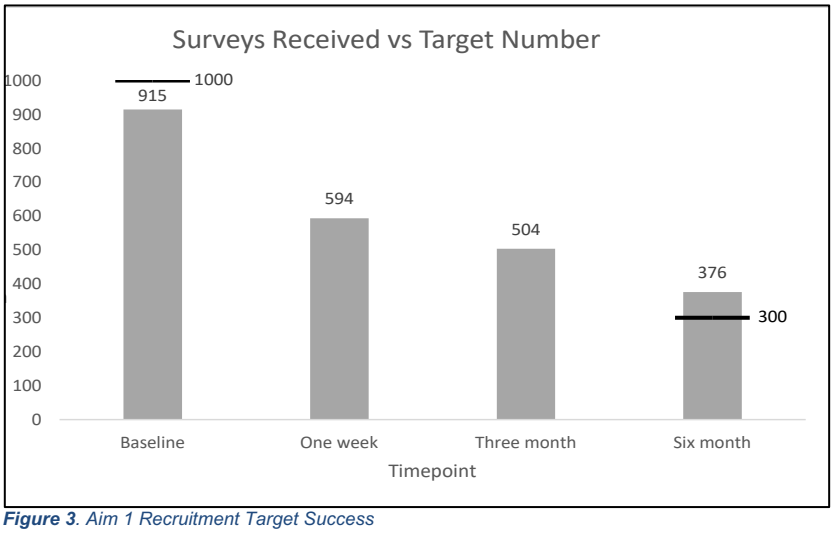

***Figure 3**. Aim 1 Recruitment Target Success*

As can be seen in the figure above **Fig. 3,** we were highly successful in achieving our recruitment targets for Aim 1. Our goal was to recruit 1,000 individuals at baseline to achieve a sample of N=300 at six-month follow-up. A sample of 300 at six-month follow-up is necessary to conduct adequately powered exploratory analyses that will use linear mixed models to test longitudinal relationships among ED psychopathology, mood and trauma problems, and substance misuse. As shown above, **we exceeded our target N goals due to excellent retention** that was better than other published studies that used the VADIR dataset.

Aim/Study Status: Aim 1 (Study 1) is complete, and all objectives were achieved. We are still enrolling veterans in Aim 2 (Study 2) and expect all study aims and objectives will be completed this year by the end of the no-cost extension. However, in addition to our FY18 award, we conducted an additional large-scale study that strongly supports the BASE as a screening tool (see **Fig. 5**, below).

Creation of the Brief Assessment of Stress and Eating (BASE): To select items for the BASE, we performed a series of analyses using complete responses from the Study 1 baseline survey. We began by computing the composites for all subscales of the EPSI and IDAS-II, and we used these in a series of linear regression models in which the subscales were used to predict clinical impairment, psychosocial impairment, and self-reported ED diagnoses. Using a machine learning algorithm designed to detect the most important and reliable predictors of these outcomes—a process called *stability selection*—we determined the subscales from each measure that performed best in predicting negative outcomes. The results of this analysis, along with theoretical considerations, led us to choose 6 subscales from the EPSI and 4 subscales from the IDAS-II to sample items for constructing the BASE.

Next, we performed an item analysis on each subscale using Item Response Theory (IRT), which allowed us to obtain item information curves. We used these results to select our initial items for the BASE. Specifically, we chose items that struck an optimal balance between the threshold and discriminability of each item, such that we could maximize the range of scores for which an item represented each subscale, as well as the extent to which it could be used to distinguish different levels of ED severity. As a result, our preliminary BASE screen is comprised of 17 items, with 10 items assessing EDs and 7 items assessing internalizing symptoms. **Fig. 4** provides an example of the item information curves related to the Body Dissatisfaction subscale from the EPSI. Higher values on the y-axis indicate an item had higher discrimination and provides more information about a certain ED severity level. For this subscale, we selected item 18 (*I did not like how my body looked*), because it contained more information about the subscale than all other items and performed well across the range of scores.

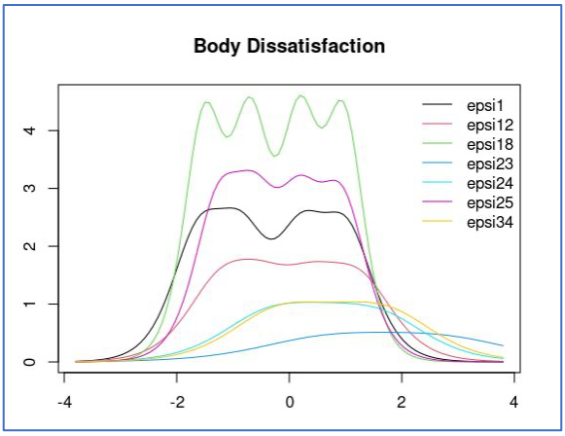

Figure 4. Body dissatisfaction severity is plotted on the x-axis and information is plotted on the y-axis. Larger area under the curve suggests the item provides more information about the scale.

<u>Predictive validity of the BASE</u>: We tested whether the ED items from the BASE predicted relevant outcomes. Using linear mixed models, we found that BASE scores at baseline predicted future psychiatric impairment (as assessed by the Clinical Impairment Assessment; CIA) at both the three- and six-month follow-up in our nationally representative sample of post-9/11 veterans from Study 1. We also compared the full 45-item EPSI and the Eating Disorder Examination – Questionnaire EDE-Q to test the predictive validity of the BASE relative to these other measures. Results showed that baseline BASE scores predicted 36.3% of the variance CIA scores at baseline, 25.1% of the CIA scores at three-months follow-up, and 32.0% of the CIA scores at six-months follow-up. In comparison, the full 45-item version of the EPSI predicted 44.9% of the CIA scores at baseline, 34.9% of the CIA scores at three-months, and 36.7% of the CIA scores at six-months follow-up. The EDE-Q scores at baseline predicted 20.7% of the CIA scores at baseline, 21.5% of the CIA scores at three-months follow-up, and 22.2% of the CIA scores at six-months follow-up. Overall, this analysis showed that **the BASE may have a better ability to predict current and future psychiatric impairment than the EDE-Q in military-relevant populations**. **Comparison with the EPSI also showed that the BASE preserved the majority of the EPSI's predictive abilities with fewer items.**

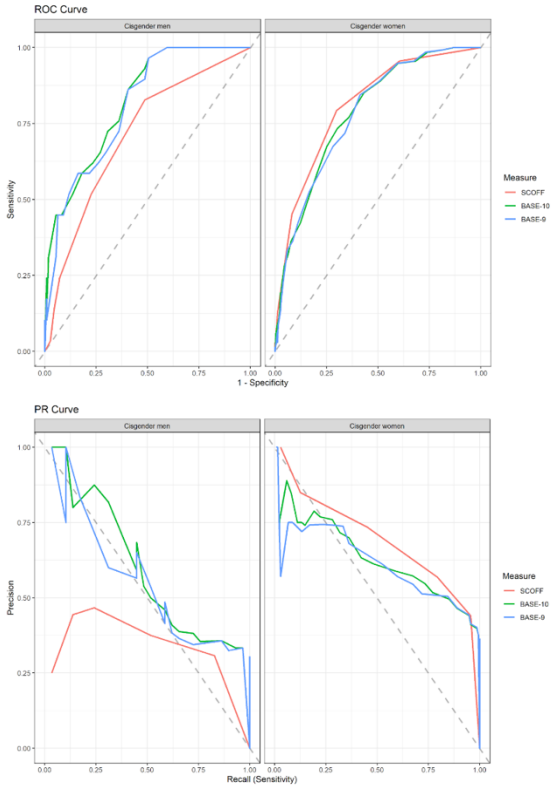

Figure 5. ROC and PR Curves for the BASE vs. SCOFF. Men are on the left and women on the right. These data show the BASE significantly outperforms the SCOFF in men.

<u>Accuracy of the BASE</u>: Our next step was to test the ability of the BASE to accurately identify cases of an ED. Although we are currently testing the performance of the BASE in a nationally representative sample of veterans in Study 2, we recently administered the BASE and SCOFF (which is the most commonly used ED screen in medical settings) to a separate sample of non-veteran civilians (*N*=596; 68.2% cisgender women). The Eating Disorder Diagnostic Scale (EDDS) was used to generate *DSM*-5 ED diagnoses. We evaluated AUC for both receiver operating curves (ROC) and precision-recall curve (PRC) (see **Fig. 5**). In the full sample, the BASE performed significantly better than chance at identifying probable EDs (AUC: ROC=.799, PRC = .648) and similarly to the SCOFF (AUC: ROC=.797, PRC = .626). However, the BASE (AUC: ROC=.821, PRC = .605) **significantly outperformed the SCOFF** (AUC: ROC=.710, PRC = .354) **for identifying probable EDs in cisgender men**.

These results (shown in **Fig. 5**) showed the BASE is a promising new screening tool for identifying EDs in veterans and military-relevant populations, who represent a largely male population.

Aim 2 Progress and Accomplishments: Aim 2 recruitment and testing was launched in March 2022. Prior to Aim 2 recruitment and testing, several months were spent preparing recruitment materials, creating the database and survey, developing the BASE, training individuals who will be conducting interviews, and enrolling new graduate student clinicians in a clinical-research practicum supervised by Dr. Forbush so that they can assist with the interviewing. All individuals are now trained, and we are progressing toward completion of Aim 2 recruitment, which will be complete by the end of the no-cost extension period.

In addition to training graduate students, rigorous training has been in effect for several new undergraduate RAs to ensure we stay on track in meeting project milestones and study aims. RAs are enrolled in a laboratory course to assist with the project. Undergraduate RAs meet weekly with project coordinators and full lab, as well as monthly with the full study team.

Number of completed surveys: 188/400 (47%)
Number of completed interviews: 20/400 (5%)
Number of completed qualitative interviews: 5/50 (10%)

Additional Accomplishments:

Establishment of the Longitudinal Eating Disorders Assessment Project (LEAP) research consortium. Our FY18 PRMRP allowed us to establish the *first consortium dedicated to the study of EDs in veterans and military service members.* LEAP brings together researchers and clinicians across state lines to develop novel screening, assessment, classification, and treatment tools for veterans and military members with a focus on EDs and other forms of internalizing psychopathology. Our consortium includes researchers with expertise in qualitative methods and public policy, with a focus on identifying formal and informal policies and practices that can potentially inform ED treatment implementation efforts in military-relevant populations. We published our first paper from the consortium last month (Forbush et al., in press).

Creation of the first longitudinal nationally representative sample of US veterans to include EDs and comorbid disorders. We created the first *longitudinal* nationally representative sample of US veterans to include EDs and comorbid disorders, which provided much-needed information about the temporal relationships among EDs, mood, anxiety, and trauma-related symptoms. Together, these data are crucial for the development/adaptation of ED treatments to ensure sensitivity to the cultural needs of military-relevant groups. Once publicly available, these data will allow collaborators across the globe to conduct secondary analyses of this critically important database.

Statistical Software Development: We created a statistical program in R called “sampleVADIR,” (Swanson & Forbush, 2021) which enables applied researchers to draw nationally representative samples from the VADIR database in their own research. Although the VADIR database is restricted and requires permission prior to accessing the data, our program makes it easy for researchers to create representative sub-samples and post-stratification sampling weights once data are obtained. sampleVADIR reduces the time, effort, and advanced statistical programming expertise needed to use this important database resource.

Research Outcomes:
Forbush, K. T., Swanson, T. J., Gaddy, M., Oehlert, M., Doan, A., Morgan, R. W., O’Brien, C., Christian, K., Song, Q. C., Watson, D., & Wiese, J. (in press). Design and methods of the Longitudinal Eating Disorders Assessment Project (LEAP) research consortium for veterans. *International Journal of Methods in Psychiatric Research*.

Forbush, K. T., Swanson, T. J., Richson, B. N., Thomeczek, M. L., Negi, S., Johnson, S. N., Chapa, D. A. N., Morgan, R. W., O’Brien, C. J., Gould, S. R., Christensen, K. A., & Chen, Y. (in press). Screening for Eating Disorders: Initial Validation of the Brief Assessment of Stress and Eating (BASE). *International Journal of Eating Disorders.*

Swanson, T. J., Forbush, K., T. (2021). sampleVADIR: Draw stratified samples from the VADIR database. R package version 1.0.0.

Grant Submissions: The rich amount of data collected under the FY18 award provided an opportunity to expand our work in two important ways, which we describe below:

Expansion Award Submission. Through our FY18 PRMRP award, we created the BASE using a large nationally representative sample of veterans. However, before the BASE can be implemented in DoD and VA healthcare (VHA) settings, it will be necessary to demonstrate it performs comparably to (or better than) other existing screening tools, is appropriate for use in active-duty military populations, and predicts relevant real-world outcomes, such as onset and progression of EDs and psychosocial adjustment during the transition from pre-military civilian life to active-duty service.

Given that some active-duty military service members have unique considerations that veterans do not, additional testing of the BASE in servicemembers is needed. For example, although items measuring compulsive exercise and muscle dysmorphia were important for identifying EDs in veteran and non-veteran civilian men, these behaviors may be less relevant for detecting EDs in active-duty samples where regular, intense exercise is normative. Our proposed expansion work (which is focused on the FY22 PRMRP Topic of EDs) is, therefore, highly significant and impactful because our team successfully developed the first ED screening tool for use in veterans and we are poised to take the next step toward implementation of the BASE within the DoD and VA through additional testing in servicemembers.

Clinical Trial Award Submission. Preliminary findings from FY18 PRMRP has revealed that veterans experience **substantial** rates of EDs and unhealthy eating behaviors, yet there are few treatment resources available to veterans because less than 50% of VHAs offer ED-focused treatment. Our clinical trial aims to address this critical gap through the creation of a cost-effective and easy-to-disseminate intervention that is designed to address ED and comorbid PTSD symptoms – a significant source of comorbidity for veterans and non-veterans with an ED. The proposed work is significant because many veterans do not have easy access to a specialist mental health provider, particularly in rural areas. The proposed research is expected to result in the first mHealth app for bulimia nervosa or binge-eating disorder and comorbid PTSD symptoms that is tailored to treat the unmet healthcare needs of veterans who experience an ED. If successful, we expect this new intervention will result in significant cost savings to the VHA system and improve military readiness for those veterans who continue to serve in the U.S. military.

Stated Goals Not Met

Although Aim 2 recruitment is now underway and will be completed at the end of the no-cost extension period, the Aim 2 study launch occurred much later than originally anticipated. This was due to several factors, such as COVID-related mailing delays for the Aim 1 study and minor delays in approval of IRB modifications that were needed to update our study recruitment materials, consent forms, protocol, and Aim 2 materials (e.g., we added some additional short screeners to compare the performance of our new screening tool to established measures [GAD, PCL-5, PHQ-9, and AUDIT]). Despite a low number of completed clinical interviews (20/400), we have approximately 18 interviews scheduled over the next 60 days, which is near maximum capacity for what interviewers can feasibly accomplish. We also now have more trained interviewers to increase our capacity for enrolling veterans in the study.

Finally, we had a lower-than-expected response rate to our survey mailing for Aim 2. We believe that this is likely due less attractive financial compensation after inflation and less interest in research participation after experiencing numerous stressors related to the COVID pandemic. Given that we cannot address some of these factors, we chose to strategically address this concern by recruiting additional participants from VADIR. Increasing the number of veterans in our recruitment mailing by sending recruitment materials to an additional 15,645 veterans will boost our recruitment numbers and allow us to achieve our final Aim 2 sample size within the no-cost extension period.

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

There have been several professional development opportunities provided to research team:

Group Training Workshop: We developed a database management training program for DoD grant team members. The training provided an overview of the participant tracking database, REDCap. The goal was to provide a better understanding of the database prior to the launch of Study 2. Team members were asked to watch a series of tutorial videos before the training. The training included a demonstration of the database. A list of individualized tasks was assigned to the lab members to complete on a mock training database. Lab members were required to complete the list of tasks correctly before they were allowed to have access to the project on the database. Additionally, Dr. Swanson (former post-doctoral fellow, who recently took a full-time position in industry) developed an intensive R-Studio workshop, which consisted of several two-hour teleconference sessions over the course of a week. This training covered the essentials of working in R for experienced and new users. Dr. Melinda Gaddy (Co-I) gave a training workshop on substance usage in respect to U.S. military culture. Joanna Wiese (Consultant) presented a training workshop to the full DoD on PTSD psychopathology. Brianne Richson (Graduate Student) gave a detailed presentation on suicidal behavior and suicidality risk assessment.

Qualitative Interview Professional Training: Dr. Alesha Doan (Co-I) is currently providing a rigorous, comprehensive training protocol for undergraduate RAs and study team personnel. Trainees met with Dr. Doan in two primary Zoom meetings to understand the qualitative interview process and methodology. In addition to meeting with Dr. Doan, RAs watch a video series on interviewing skills and review existing qualitative interviews. With this training, study team members are able to confidently administer qualitative-oriented interviews with military veteran participants. Finally, Dr. Doan meets with each qualitative interviewer after the interview to de-brief, strategize ways to improve their interviewing skills, and answer any questions.

Clinical Interview Professional Training: Dr. Forbush (PI) and two of her senior graduate students provided group and individual training in conducting the Eating Pathology Inventory – Clinician Rated Version (EPSI-CRV) and Structured Clinical Interview for DSM Disorders (SCID). These interviews are comprehensive diagnostic interviews to assess ED psychopathology and general mental health disorders, respectively. Training included approximately 16 hours of videos and individual/group meetings (split into several sessions) and weekly attendance at diagnostic consensus meetings. New assessors were required to demonstrate ≥ .80 inter-rater reliability with an audiotaped “gold-standard” interview and shadow seasoned laboratory interviewers. All assessors conducted at least one joint interview with Dr. Forbush or a senior graduate student as a “check out” prior to conducting independent interviews. Finally, all completed interviews are reviewed prior to data entry by an independent interviewer to ensure coding accuracy. Consensus meetings are held weekly (led by Dr. Forbush) and required for all team members and provide opportunities to refine interviewing skills and learn about diverse ED presentations in veterans.

Lab Meetings/DoD Project Meetings: The research laboratory meets each Friday morning for one hour to discuss progress across all laboratory projects. A separate DoD meeting is held each week and led by Dr. Chen. Lab meetings also involve discussion of research articles and presentations by graduate students and post-doctoral fellows and critique of these projects to facilitate professional development. Finally, all senior personnel meet once per month via Zoom.

Individual Meetings: Dr. Forbush meets regularly (monthly) with the Project Coordinators (Mr. O’Brien & Mr. Morgan) and (weekly) with Post-Doctoral Fellow (Dr. Chen) to talk about study progress, grant and individual research goals and progress, and provide one-on-one training across numerous areas (e.g., instruction on how to submit IRB proposals). Dr. Chen also meets weekly with the Project Coordinators to ensure appropriate oversight and support.

Other Opportunities: The University of Kansas offers a wealth of additional opportunities for professional development (see https://kupce.ku.edu/browse-subjects), including leadership training; training in information technology; and offers numerous workshops and events that are often free to KU staff members. As a part of a different grant mechanism, all DoD team members have also had the opportunity to attend a series of panel discussions organized by Dr. Forbush on ways to promote DEIA principles in interventions for EDs.

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?

We are currently recruiting participants to achieve Aim 2 goals. We plan to initiate analyses and publication of exploratory aims, which will involve testing linear mixed models to identify temporal relationships among ED symptoms and mood, anxiety, trauma-related, and externalizing symptoms. Our second exploratory aim, to conduct qualitative interviews to identify barriers to accessing ED and trauma-related mental-healthcare, is currently in progress.

We plan to present our work at VA mental-health conferences, such as the VA Health Service Research and Development conference, and locally at our KU-VA Networking events. The KU-VA Networking events are two-hour programs to introduce VA researchers/clinicians to KU faculty researchers and feature research presentations and discussions to facilitate introductions and provide a useful exchange of research interests and resources. To ensure that our work is accessible to the public, we will collaborate with our press offices to create press releases to disseminate our work as results become available. We will also submit results to the Eating Disorders Research Society and/or the International Conference on Eating Disorders.

Finally, we will post the de-identified Aim 1 related data to The Open Science Framework (OSF) in Spring 2023 and data for Aim 2 will be posted as soon as possible after data are cleaned and a code book is created. We also will publish a paper detailing the methods and procedures for Aim 2 and plan to begin work on this paper once data collection for Aim 2 is complete.

4. IMPACT:

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

Nothing to Report.

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?

Between 2018-2019, costs of EDs in the U.S. were $64.7 billion annually, including costs to hospital systems, individuals and families, government, employers, and society. If left untreated, EDs result in significantly greater healthcare utilization and physical and psychiatric morbidity and mortality. Due to the effects of EDs on general physical health, individuals with EDs incur additional healthcare costs associated with medical events (e.g., myocardial infarction) or due to comorbid health conditions, such as obesity, which is more common among people with EDs than the general population. Similar to non-veteran civilians, **veterans with an ED incurred one-year total healthcare costs that were $18,152 higher than matched veterans without an ED, suggesting a *critical need* to identify and treat EDs in military-relevant populations.**

The results from the current research are highly significant and impactful because our team successfully developed the first ED screening for use in veterans and we are poised to take the next step toward implementation of our screen within the DoD and VA through additional testing in active duty servicemembers. Given that our screening tool is better able to identify EDs in men, an important source of impact is the ability to recognize veteran men with an ED earlier in their illness trajectory, which we expect will save healthcare costs and prevent morbidity and mortality.

5. 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

Approximately 39 % (n=2,874) of participants had invalid addresses, resulting in several survey invitations to be returned to our lab. We compensated for the large number of returned addresses when we calculated our desired sample size; thus, this issue did not ultimately affect our progress toward completing project aims. As previously mentioned, we also had a lower enrollment rate than in Study 1, which was unexpected. We believe the lower interest in enrollment could be related to inflation, which has caused our Study 2 financial incentive for participation to be less attractive, and stressors related to the ongoing COVID endemic, which has led to lower participation in all types of research in the U.S.

To account for the large number of incorrect addresses and lower-than-expected Aim 2 enrollment, we sent additional mailings to a new wave of eligible participants; specifically, we plan to send invitations to individuals recruited from VADIR (N=15,645) to reach our desired recruitment milestone of 400 completed interviews and surveys. We also received approval for a year-long no-cost extension, which provides the research team sufficient time to achieve these goals.

Finally, we are training additional undergraduate RAs to conduct qualitative interviews to expand our research testing capacity. Currently only graduate students conduct qualitative interviews. Allowing advanced undergraduate RAs to assist with qualitative testing will double the number of available qualitative interviewers we currently and accelerate our progress toward our final study goals.

Changes that had a significant impact on expenditures

Current problems or issues: (**Aim 2)** One issue is recruiting and testing veterans for Aim 2 within the grant period, given that we will need to recruit and test 400 individuals prior to the end of the no-cost extension period.

Issues encountered and steps to mitigate these issues: **(Aim 2)** The study team submitted a no-cost extension to provide additional time to meet our final milestones, which was approved. We have also hired additional interviewers and staff so that we can complete testing for Aim 2 as soon as possible. In addition, we will recruit an additional 15,645 veterans from VADIR, which will help us achieve our final recruitment goals within the no-cost period. These efforts are made to make sure we meet our desired recruitment numbers for the survey and diagnostic interview (N=400) as well as the subsequent qualitative/supplemental interview (N=50).

SALARIES - KEY PERSONNEL	10,676.45
SALARIES - UNCLASSIFIED	88,255.81
SALARIES - STUDENT	30,587.99
FRINGE	35,100.57
SUPPLIES AND EXPENSE	737.41
OTHER EXPENSES	97,542.75
DOMESTIC TRAVEL	718.01
SUBRECIPIENT WITH F&A	3,108.64
SUBCONTRACTS NO F&A	149,471.70
FACILITIES AND ADMINISTRATION	136,170.15
Total	**552,369.48**

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use of biohazards and/or select agents

Nothing to report.

6. PRODUCTS:

- **Publications, conference papers, and presentations Journal publications.**

Recently Published Manuscripts:

Forbush, K. T., Swanson, T. J., Gaddy, M., Oehlert, M., Doan, A., Morgan, R. W., O'Brien, C., Christian, K., Song, Q. C., Watson, D., & Wiese, J. (in press). Design and methods of the Longitudinal Eating Disorders Assessment Project (LEAP) research consortium for veterans. *International Journal of Methods in Psychiatric Research*.

Forbush, K. T., Swanson, T. J., Richson, B. N., Thomeczek, M. L., Negi, S., Johnson, S. N., Chapa, D. A. N., Morgan, R. W., O'Brien, C. J., Gould, S. R., Christensen, K. A., & Chen, Y. (in press). Screening for Eating Disorders: Initial Validation of the Brief Assessment of Stress and Eating (BASE). *International Journal of Eating Disorders.*

Published Software Programs:

We created an R package called 'sampleVADIR' that has been released by the Comprehensive R Archive Network (CRAN) and contains code for all the stratification methods used in this project. The code is open-source and freely available, such that future researchers who wish to draw nationally representative samples from the VADIR database will be able to do so easily and with a high degree of accuracy. The code has been designed to function with a variety of unique specifications, such that researchers will be able to draw stratified samples from VADIR based on any number of demographic variables recorded for that population. We released this code to contribute to open-science practices, and hope that it will be useful in aiding future research on U.S. veterans. The code can be found on the CRAN website at the following link: CRAN - Package sampleVADIR (r-project.org)

Books or other non-periodical, one-time publications.

Nothing to report.

Other publications, conference papers and presentations.

Conference Paper:

Forbush, K. T., Swanson, T. J., Richson, B. N., Thomeczek, M. L., Negi, S., Johnson, S. N., Chapa, D. A. N., Morgan, R. W., O'Brien, C. J., Gould, S. R., Christensen, K. A., & Chen, Y. (in press). Screening for Eating Disorders: Initial Validation of the Brief Assessment of Stress and Eating (BASE). Invited talk at the 2021 International Conference on Eating Disorders, Online. This paper won the 2021 Scientific Contribution Award from the Academy for Eating Disorders Assessment and Diagnosis Special Interest Group.

- **Website(s) or other Internet site(s)**

Nothing to report.

- **Technologies or techniques**

Swanson, T., & Forbush, K. (2021). SampleVADIR: Draw Stratified Samples from the VADIR Database (R package version 1.0.0) [Computer software]. https://CRAN.R-project.org/package=sampleVADIR

- **Inventions, patent applications, and/or licenses**

Nothing to report.

- **Other Products**

Nothing to report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Name:	Kelsie Forbush, PhD
Project Role:	Principal Investigator
Principal Investigator	
Researcher Identifier (e.g. ORCID ID):	https://orcid.org/0000-0002-5900-4204
Nearest person month worked:	1
Contribution to Project:	No change.
Name:	Alesha Doan, PhD
Project Role:	Co-Investigator
Researcher Identifier (e.g. ORCID ID):	https://orcid.org/0000-0002-1348-9023
Nearest person month worked:	1
Contribution to Project:	No change
Name:	Qianqi (Chelsea) Song, PhD
Project Role:	Co-Investigator
Researcher Identifier (e.g. ORCID ID):	https://orcid.org/0000-0002-4368-2940
Nearest person month worked:	1
Contribution to Project:	No change.
Name:	David Watson, PhD
Project Role:	Co-Investigator
Researcher Identifier (e.g. ORCID ID):	https://orcid.org/0000-0001-9632-2159
Nearest person month worked:	2
Contribution to Project:	No change.
Name:	Mary Oehlert, PhD
Project Role:	Co-Investigator
Researcher Identifier (e.g. ORCID ID): N/A	
Nearest person month worked:	1
Contribution to Project:	No change.
Name:	Joanna Wiese, PhD
Project Role:	Consultant
Identifier (e.g. ORCID ID):	N/A
Nearest person month worked:	1
Contribution to Project:	No change.
Name:	Trevor Swanson, PhD
Project Role:	Post-Doctoral Fellow
Researcher Identifier (e.g. ORCID ID): N/A	
Nearest person month worked:	5
Contribution to Project:	Dr. Swanson was a post-doctoral fellow on the project who recently took a position in industry.
Name:	Dani Chapa
Project Role:	Project Lead Identifier
(e.g. ORCID ID): N/A	
Nearest person month worked:	1
Contribution to Project:	Dani served as a project lead to help manage the study Personnel, supervise RA tasks, recruit participants, and Oversee weekly lab check-ins. She is currently on clinical internship.

Name:	Joe Ayres
Project Role:	Project Manager
Researcher Identifier (e.g. ORCID ID):	N/A
Nearest person month worked:	5
Contribution to Project:	Joe Ayres assisted with setting up our interview protocol And relevant software. Joe was also a consultant on Acuity Scheduling.
Name:	Colin O'Brien
Project Role:	Project Coordinator
Researcher Identifier (e.g. ORCID ID):	N/A
Nearest person month worked:	12
Contribution to Project:	Mr. O'Brien attended planning meetings and monthly team meetings. He has monitored study participation, assisted in mailing of recruitment materials and in completing IRB modifications, and completed the study 2 database. He has also assisted in the training of new research assistants.
Name:	Will Morgan
Project Role:	Project Coordinator
Researcher Identifier (e.g., ORCID ID):	https://orcid.org/0000-0002-0188-2709
Nearest person month worked:	12
Contribution to Project:	Mr. Morgan coordinated and attended planning meetings and monthly team meetings. He has overseen mailing recruitment materials and monitored study participation as well as assisted with IRB modifications. He has also assisted in the training of new research assistants.
Name:	Melinda Gaddy, PhD
Project Role:	Co-Investigator
Researcher Identifier (e.g. ORCID ID):	N/A
Nearest person month worked:	1
Contribution to Project:	Dr. Gaddy attended planning meetings and facilitated communications between KU and the VA. She collaborated with Drs. Oehlert and Swanson for the stratification analysis.
Funding Support:	VA Eastern Kansas Healthcare System
Name:	Mari Thomeczek
Project Role:	Graduate Research Assistant
Researcher Identifier (e.g. ORCID ID):	N/A
Nearest person month worked:	8
Contribution to Project:	Mari has assisted with conducting clinical interviews, Helped with DoD data entry, and assisted in supervising the RAs.
Name:	Sarah Johnson
Project Role:	Graduate Research Assistant
Researcher Identifier (e.g. ORCID ID):	N/A
Nearest person month worked:	1
Contribution to Project:	Sarah has led the clinical interview training, which teaches Trainees how to conduct the SCID-5-RV, the EPSI-CRV And foundational clinical research skills. Sarah has administrated clinical interviews and supervised RA

Name	Yiyang Chen
Project Role:	Statistician/Postdoctoral Fellow
Research Identifier	https://orcid.org/0000-0002-6589-3028
Nearest person month worked	6
Contribution to Project:	Dr. Chen has taken over tasks from Dr. Swanson, since he took an industry job following his post-doctoral fellowship. Dr. Chen leads team meetings, assists with protocol implementation and oversight, and leads statistical analyses.
Funding Support:	University of Kansas Endowment Association funds to support Dr. Forbush's research

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

Nothing to report.

What other organizations were involved as partners?

Organization Name: VA Eastern Kansas Healthcare System
Location of Organization: Leavenworth, KS
Partner's contribution to the project: Collaboration

Organization Name: University of Notre Dame
Location of Organization: (if foreign location list country): Notre Dame, Indiana
Partner's contribution to the project (identify one or more): Collaboration

Organization Name: Purdue University
Location of Organization: (if foreign location list country): West Lafayette, Indiana
Partner's contribution to the project (identify one or more): Collaboration

8. SPECIAL REPORTING REQUIREMENTS

COLLABORATIVE AWARDS: Not applicable.

QUAD CHARTS: Not applicable.

9. APPENDICES: Not applicable.