Fostering Resilience to Race-Based Stress: A Pilot Study

NCT05422638

February 17, 2022

2a. Research Plan

Background and Significance

In the United States, health disparities between White people and individuals who are Black, Indigenous and People of Color (BIPOC) are well documented. BIPOC evidence poorer health outcomes and access to health care (Bazargan, Cobb, & Assari, 2021; Lee, Ayers, & Kronenfeld, 2009) and lower educational and occupational attainment (Levy, Heissel, Richeson, & Adam, 2016). The situation in the population at large is mirrored in military and Veteran populations. For example, military officers are disproportionately White, whereas enlisted personnel are disproportionately BIPOC (US Government, 2021), and BIPOC service members historically have shouldered an inordinate share of high-risk duties (Frueh, Brady & de Arellano, 1998). Veterans of Color (VOC) are more likely to suffer from posttraumatic stress disorder (PTSD; McClendon et al., 2019) and are less likely to receive minimally adequate care for their mental health concerns (Lu, Duckart, O'Malley, & Dobscha, 2011; Spoont, Nelson, van Ryn, & Alegriam, 2017), perhaps because of perceptions of racial discrimination within VA healthcare settings (Hausmann et al., 2009). Allostatic load (AL), which is a measurable index of wear-and-tear on the body due to chronic stress exposure that is associated with increased disease burden and mortality (Beckie, 2012), has been demonstrated to be higher among BIPOC than White Americans (Moore, Bevel, Aslibekyan & Akinyemiju, 2017), partially explaining health disparities.

Race-based discrimination likely is an important contributor to health disparities. A meta-analysis of 192 studies demonstrates the association between perceived discrimination and mental health concerns (Pascoe & Smart Richman, 2009). Discrimination has been identified as a mediator of the relationship between minority status and mental health (Cokley, Hall-Clark & Hicks, 2011), even after controlling for personality traits (Mekawi et al., 2021) or combat exposure and military rank (Loo et al., 2001). Pervasive discrimination also predicts increased AL above and beyond other risk factors (Van Dyke et al., 2020). Perceived discrimination may impact health directly; a longitudinal study of Black Americans showed that increased frequency of racial discrimination predicted greater nonspecific psychological distress, depression symptoms, and days with poor mental health (Kwate & Goodman, 2015). Perceived discrimination also contributes indirectly to health status via medical mistrust, poorer health behavior, and decreased health care utilization (Bazargan, Cobb, & Assari, 2021; Lee, Ayers, & Kronenfeld, 2009; McClendon, Chang, et al., 2021). VOC show poorer control of clinical outcomes such as blood pressure, cholesterol and glucose (Trivedi, Grebla, Wright & Washington, 2011). **The rationale for the proposed intervention is to reverse the negative direct (e.g., chronic stress) and indirect (e.g., poorer health behavior) factors that sustain health disparities.**

The Race-based Stress/Trauma and Empowerment (RBSTE) intervention (Carlson, Endsley, Motley, Shawahin, & Williams, 2018) was developed to help VOC process and cope with experiences of perceived discrimination. **RBSTE, which can be a stand-alone or adjunctive intervention, is theorized to reduce shame and hopelessness and provide emotional validation by facilitating sharing of experiences of discrimination; provide emotional validation; facilitate cognitive restructuring of maladaptive beliefs related to discrimination; foster healthy coping and reduce stress-related physiological arousal via mindfulness, and encourage proactive behavior (Carlson et al., 2018). The intervention is briefly outlined in Interventions, and the manual is provided as Appendix 14.** RBSTE thereby addresses processes that are linked to educational and occupational functioning (Levy, Heissel, Richeson, & Adam, 2016), providing a strong conceptual rationale for the rehabilitative benefits of RBSTE. Further, AL is modifiable through mental health intervention (Berger et al., 2018) and negatively associated with active coping (Misiak et al., 2018), suggesting the mutability of this risk factor with RBSTE. There is a high demand for this type of programming within VA; the RBSTE group is being offered in 25 VA healthcare systems, yet no systematic quantitative data are yet available to determine whether or not RBSTE is achieving its goals. Thus, the goal of the proposed project is to preliminarily evaluate the feasibility, acceptability and appropriateness of RBSTE via a pilot randomized controlled trial (RCT) and to optimize the evaluation strategy. This will prepare us to evaluate its efficacy and ultimately inform implementation.

Ultimately empirically supporting RBSTE will require demonstrating its benefit above and beyond nonspecific psychotherapeutic effects. For BIPOC, provider attitudes are both a predictor of retention in VA care (Spoont et al., 2017) and are associated with better mental health (Sohn & Harada, 2008). Further, multicultural training/experience and culturally-adapted treatments are preferred by clients of color and are seen as more important than ethnic/racial matching (Swift et al., 2015). Thus, provision of culturally competent care is critical to serving this population. There is also some evidence for the benefit of all-BIPOC treatment

groups. For example, participants in a group program for African-American Veterans with PTSD articulated several benefits of restricted enrollment, including facilitating open communication, providing a place to discuss coping with racism and increasing social support (Jones et al., 2000). A recent qualitative study found that situational cues in clinical encounters, such as lack of diversity among staff, may be perceived by Black Veterans as identity threatening and negatively impact patient engagement; identity-safe environments such as BIPOC-only groups may encourage greater healthcare engagement and communication (Eliacin, Matthias, Cunningham, & Burgess, 2020). Thus, this trial will compare RBSTE to an intervention that is matched for these important therapeutic effects not specific to RBSTE. Present Centered Therapy (PCT; Frost, Laska & Wampold, 2014), which is a facilitated problem-focused approach **with no specific race-based material**. PCT will be matched in length to RBSTE and delivered to minority-only groups by trained therapists.

Innovation

The impact of identity-based discrimination and its remediation is poorly studied, and there is no clear evidence base to guide treatment for this population. This project, therefore, will address an important yet understudied and traditionally-underfunded area. In addition, the use of holistic evaluation of markers of mental and physical health, including assessment of allostatic load, is innovative with no existing such findings, to our knowledge is innovative.

Preliminary Studies

Recent work at our facility affirms the need to address health disparities within the VA. Based on data from 1106 Veterans (57.8% White, 24.5% LatinX, 17.4% Black, 14.4% Asian) seeking care at the VA San Diego Healthcare System (VASDHS), VOC reported significantly poorer mental/emotional well-being $t(975) = 2.82$, $p < .01$, and daily life, $t(975) = 2.29$, $p < .01$, than their White counterparts. VOC also had lower scores on the VA Circle of Health and Well-being domains of “professional care,” $t(955) = 3.04$, $p < .01$, “surroundings,” $t(955) = 5.50$, $p < .001$, and “spirit/soul,” $t(946) = 3.20$, $p < .001$.

RBSTE has been applied clinically in multiple facilities. To date, enrollees have been largely Black and male (Carlson et al., 2018). Qualitative evidence from these initial applications suggests its promise. Specifically, Veterans expressed appreciation for the information provided during the group, camaraderie among group members and the freedom to discuss experiences of racism. In their view, the group helped them to develop greater self-efficacy for managing racism as well as better coping and emotion regulation (Carlson et al., 2018). An adaptation of RBSTE was applied for Black women at risk of cardiovascular disease (CVD; $n = 22$; Conway-Phillips et al., 2020). On average, these women felt that the program was very helpful for management of chronic stress (8 on a scale of 0-10). Ninety-five percent said that they would recommend the program to a friend, and 81% were actively applying the skills they had learned. Further, the women reported that the group increased their awareness of and coping with race-related stressors and increased both emotion regulation and a sense of empowerment. A preliminary RCT of the adaptation as compared to a no-intervention control condition ($n = 74$) less avoidant coping in the experimental group but no differences from control in terms of depression, stress, anxiety or inflammatory markers, although small reductions in both inflammatory marker levels tumor necrosis factor alpha (TNFa) and high sensitivity C-reactive Protein (hsCRP) were detected (Saban et al., 2021). It is possible that the very low baseline levels of emotional distress in this group that was recruited based on medical factors, as opposed to stress related to experiences of discrimination, may be creating a floor effect that is potentially obscuring change in mental health outcomes. In addition to enrolling BIPOC veterans who report a defined level of experienced discrimination and stress (see inclusion criteria), we believe that our approach to assess its biological impact in a more comprehensive and integrated manner using an AL index calculated from ten biomarkers would lead to a rigorous investigation of biological impact of both race-based trauma/stress and the RBSTE intervention. We anticipate that AL would demonstrate high sensitivity in detecting such impacts/effects beyond that of a single biomarker.

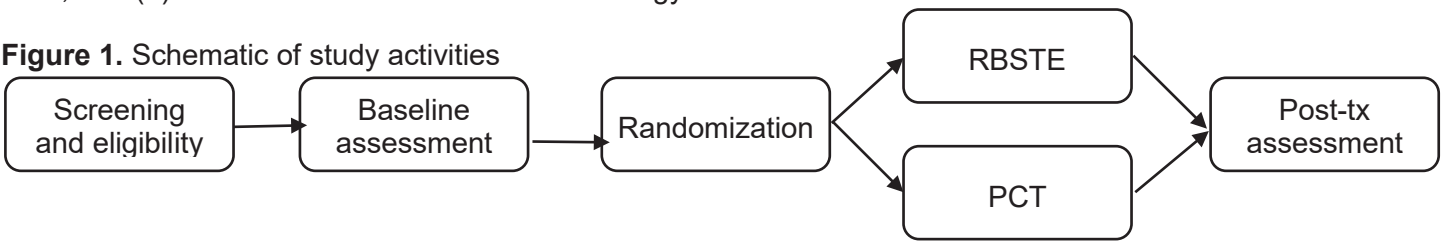
In a recent pilot investigation among 93 community dwelling older adults (60-90 years) of diverse races, Dr. Hong’s group uncovered that the AL index was significantly associated with Framingham10-year CVD risk scores as well as a small association with cognitive function, which support our proposal that AL indices are a valid indicator of ‘wear and tear’, eventually manifests in multiple health outcomes.

The RBSTE group is currently running in three different VA San Diego clinics, with a total of 16 groups involving a total of 98 Veterans attending more than 4 sessions. Thus, our planned enrollment rate appears to be feasible.

Research Design and Methods

The proposed study is a pilot RCT with multi-method longitudinal assessment (refer to **Figure 1** for an overview of study activities). The study has three primary aims: (1) to assess the feasibility of recruiting Veterans of color into an RCT of RBSTE, (2) to understand Veterans' views of the acceptability and appropriateness of intervention content and provider behavior and the feasibility of participation in a future RCT; and (3) to refine a holistic assessment strategy.

Figure 1. Schematic of study activities



Veterans who express interest in study participation will be contacted by study staff and provided with general information about the study. Those who continue to be interested will engage in the informed consent process in person or using remote procedures (e.g., VA Docusign), depending on personal and health considerations. Veterans who provide written consent will go on to complete the baseline assessment (refer to **Assessment approach**). Randomization will occur at the group level: once a cohort of 4-10 Veterans has enrolled and completed the baseline assessment, the cohort will be randomized by the study statistician. Although group randomization has disadvantages as compared to individual randomization (e.g., dependence among group members, lack of blinding of the final 1-2 groups), these can be managed and are outweighed in our experience by facilitating recruitment because groups can begin more quickly. Groups will meet in **weekly 90-minute sessions for 8 weeks**. Videoconferencing will be used to minimize barriers to participation, including transportation and public health concerns. The assessment battery will be repeated at the end of the group. Participants will be compensated $50 for each assessment point for total compensation of $100.

Participants. Veterans (*n* ≈48, potential range 24-60) will be recruited from medical (e.g., primary care) and mental health programs throughout the facility and from the community. Given the feasibility aim of this project, ability to participate is intentionally broad to demonstrate demand and maintain ecological validity. Thus, inclusionary criteria are as follows: (1) self-identified as a BIPOC, (2) Veteran, (3) age 18 or older, (4) able to consent to study activities, and (5) endorsing one or more perceived discrimination experiences on the *Everyday Discrimination Form* (short version) or the *Major Experiences of Discrimination Scale* (abbreviated version; Sternthal, Slopen & Williams, 2011) "a few times a year" or more frequently and endorsing stress on a validated single-item measure (Elo, Leppanen, & Jahkola, 2003). Exclusionary criteria include: (1) serious mental illness, alcohol/substance use disorders, or cognitive impairment that may interfere with the ability to benefit from group (e.g., severe depression, psychotic illness, mania, dementia, **untreated** alcohol/substance dependence); and (2) serious suicidality or homicidality (e.g., ideation with plan/intent) that is likely to require urgent/emergent intervention within the study period.

Interventions. Therapists in both conditions will be VA mental health providers with training in culturally sensitive care **via attending a webinar provided by the Cohen Veterans Network. Dr. Wang will be responsible for training and providing regular supervision to RBSTE therapists, and they will attend a monthly national consultation call with subject matter experts. Fidelity will be monitored by Drs. Endsley and Ross using standard fidelity forms, adapted from Dr. Lang's previous trial involving PCT (Lang et al., 2017)**. The experimental condition is *RBSTE* (refer to **Appendix 14 for the RBSTE manual**). **RBSTE** begins with "Conocimento," an introductory exercise focused on normalizing Veterans' experiences with race and reflecting on how their identity formation has been affected by both positive and negative experiences with race. Each session includes psychoeducation about various forms of racism and its adverse mental and physical effects, based on Carter's (2007) race-based traumatic stress model. This process also creates a shared language for communicating about these concerns and for self-advocacy. The concept of advocacy is then used to build resilience and combat messages and experiences of hopelessness and helplessness. Cultural sharing is incorporated weekly to engender pride in one's racial/ethnic identity, combat negative messages regarding racial/ethnic identity, and promote positive and empowering cultural identification. A weekly Empowerment Process Journal is assigned to aid in buffering the oppressive effects of racial trauma and discrimination.

PCT is a manualized, supportive, present-focused psychotherapy. **Dr. Lang will provide training and ongoing supervision in PCT, and Dr. Minassian will monitor fidelity.** Therapists focus on current

challenges in participants' lives. Therapists do not teach specific skills but rather draw on the wisdom and experience of group members to address stressors. Common therapeutic techniques include mirroring participants' experiences and non-directive problem-solving. Homework involves keeping a daily record of stressful events to discuss in group.

Assessment approach. Because of the history of human rights violations and misconduct in medical and psychological research, many people of color mistrust research activities (Suite, La Bril, Primm, & Harrison-Ross, 2007). This is an important reason to study the feasibility of the proposed data collection strategy and motivation to prioritize brevity of our assessment battery. A record of study participation will be gathered following CONSORT guidelines to quantify enrollment and retention. Assessments will be completed within 1 month prior to the beginning of group and within 1 month after the end of group. The sample will be characterized at the baseline assessment. Participant characteristics including age, gender, race/ethnicity, education, work status and financial and housing stability, will be gathered using a demographic questionnaire. Adherence to group will be quantified based on attendance at sessions and proportion of homework completed **(coded as none/partial/complete as judged by the therapist)**.

Recruitment feasibility. Aim 1 of this study involves evaluating strategies for recruiting VOC for this type of study. *Enrollment rate*, defined as the number of contacts per enrollment, will be used to optimize the future approach to accrual. There is no target enrollment rate as many can be acceptable; this metric will serve to guide resource allocation. **Gathering information from Veterans and providers about reasons for declining participation or referral, however, will be important in determining the representativeness of the sample.** *Number of enrollments per month* will be viewed as successful if at least four individuals are enrolled per month as that level of recruitment represents a reasonable period (average 2-3 weeks) for a Veteran to wait for a group to begin. *Initiation rate* will be defined as the proportion of Veterans who initiate the intervention among all consented participants. This will inform recruitment strategies (i.e., which strategies lead to the highest proportion of treatment initiation) but also may help to identify areas of improvement in terms of connecting Veterans to the project. As these behaviors are recorded prior to the first session, we do not expect group differences.

Acceptability, appropriateness and feasibility. Relevant to aim 2, participant behavior is one important marker of participants' perceptions of the project and their ability to comply with research procedures. *Retention rate* will be defined as the percent of enrolled sample completing all assessment time points; at least 80% completion will be considered successful. *Per protocol completion rate* will be defined as the proportion of subjects who complete 6 or more sessions among those who initiate treatment; at least 90% completion will be considered successful. *Intent-to-treat completion rate* will be defined as the proportion of subjects who complete 6 or more sessions of intervention among all randomized subjects; at least 80% is the target. *Compliance with homework* will be assessed with a goal of at least 80% moderately or fully complete (refer to **Assessment approach**). In addition, Veterans will be directly queried about their experience using the *Acceptability of Intervention Measure (AIM)*, *Intervention Appropriateness Measure (IAM)*, and *Feasibility of Intervention Measure (FIM)*. The 5-item measures have strong content validity, test-retest reliability and sensitivity to change (Weiner et al., 2017). The psychotherapy version of the *Provider Rating Scales*, which were previously used to assess perceptions of VA mental health providers (Spoont et al., 2017), will be used to assess Veterans' perceptions of the group leader. Between-group differences on these measures would likely reflect the difference in content between the two groups.

Holistic evaluation. In accordance with aim 3, we will employ an assessment battery to assess Veteran wellness and functioning. **To assess Whole Health, Veterans will complete the 21-item *Brief Personal Health Inventory (Brief PHI;* Department of Veterans Affairs, 2019), which includes self-appraisal of physical and mental/emotional well-being and daily life (1-5 scale) as well as ratings of one's current and ideal state for each of the nine areas in the VA Circle of Health and Well-being.** To assess mental health, participants will complete the *21-item Depression Anxiety and Stress Scales (DASS-21*; Lovibond & Lovibond, 1995), which were developed to efficiently differentiate depression and anxiety in clinical and research settings and has well-established validity. The DASS-21 shows consistency in means, internal consistency and factor structure across racial groups (Norton, 2007). The *Trauma Symptoms of Discrimination Scale (TSDS*; Williams, Prinz, & DeLapp, 2018) will be used to measure uncontrollable distress and hyperarousal, alienation from others, worry about safety and the future, and being keyed up and on guard in relation to experiences of discrimination. The scale has 21 items and can be completed in approximately 5 minutes. It has excellent reliability (Cronbach's $\alpha = 0.94$) and good concurrent and discriminant validity. Coping will be measured using the 25-item *Coping with Discrimination Scale (CDS*; Wei et al., 2010). The CDS has

been shown to have good reliability (Cronbach's α range 0.72-0.90) and validity, and it is relatively invariant across genders and racial/ethnic groups. Insomnia is a discrimination-related condition that disproportionally affects BIPOC. **The *Multigroup Ethnic Identity Measure – Revised* (Brown et al., 2014) is a 12-item measure with good psychometric properties and established invariance across multiple racial groups. It will be used to assess affiliation with one's racial group, which has been shown to moderate the relationship between discrimination and mental health (Woo, Fan, Tran & Takeuchi, 2019)**. Insomnia severity over the past week will be assessed with the *Insomnia Severity Index (ISI*; Bastien, Vallieres, & Morin, 2001). The ISI consists of seven items, assessing severity of insomnia, satisfaction with sleep, effect of sleep on daytime and social functioning, and concern about current sleep. The ISI ranges from 0-28, with higher scores indicating more severe insomnia symptoms (Morin, Belleville, Belanger, & Ivers, 2011).

Allostatic load will be assessed pre and post intervention by measuring 10 markers of interest, specifically hemoglobin (Hb) A1c, systolic and diastolic blood pressure (SBP, DBP), high density lipoprotein (HDL), triglycerides, urine epinephrine (Epi) and norepinephrine (NE), waking salivary cortisol, interleukin (IL)-6, and hsCRP. **Venous blood will be drawn via vena puncture between 8-10 AM after overnight fasting and sent to the VA clinical chemistry lab to measure Hb A1c and the lipid panel (for HDL and triglycerides). Plasma from 5mL of blood will be collected and frozen at -80 C until assayed to measure IL-6 and hsCRP using electrochemiluminescence assay (Mesoscale Discovery). Spot urine will be collected for Epi and NE and frozen at -80 C until assayed using ELISA-based immunoassay and adjusted for creatinine levels, which are well representative of general sympathetic output of an individual. Salivary cortisol levels will be measured in saliva collected the morning of the blood draw visit upon wakening. Saliva samples will be frozen at -80 C until assayed using immunoassay (Salimetrics). Both pre and post samples from a given participant will be assayed together using reagents from a single lot number by one technician who is blinded to the condition. All biomarker assays will be done in Dr. Hong's lab where they are routinely performed, and the intra- and inter-assay CV's of these proposed markers are <10%. Seated SBP and DBP will be measured after a 5-min of rest, and the average from 3 readings will be used.** The AL index for each participant will be calculated by assigning 1 to the highest quartile values vs. the rest 0 for each marker and summing them (Rosemberg, Granner, Li & Seng, 2020). Thus, a possible range of 0 to 10 would emerge, indicating the lowest to highest AL across the participants. We acknowledge that there have been differing ways for AL index calculation as well as included markers. Our proposed methods and the markers are based on the best consensus from a number of studies and reviews that also demonstrated evidence of AL reflecting chronic stress and eventual health outcomes including all-cause mortality (Duong et al., 2017; Guidi, Lucente, Sonino, & Fava, 2021; Juster, McEwen & Lupien, 2010).

Sample size. As a feasibility study, the decision about sample size is not about establishing sufficient power to detect change in clinical outcomes but rather about demonstrating the viability of a future larger-scale study. The sample size was determined based on practical and quantitative considerations. We will aim for enrollment of 4 groups of each type of intervention, each with approximately 6 Veterans (average 6, range 4-10), leading to a total sample size of approximately 48 (24/cell) in the 15-month recruitment period. This rate of enrollment would demonstrate feasibility of a larger future study in that we would demonstrate that a steady flow of adequately sized intervention groups can be recruited. Given that this is a pilot and feasibility study, we are looking for clinical signal and feasibility rather than examining efficacy. All sample size analyses were performed using statistical package R. A two-sided type I error of 0.05 was assumed.

The sample size assessment was conducted for assessing the enrollment and completion rates. First, we assessed the precision of estimates based on projected sample size. We considered a range of target rate from 0.60 to 0.90 and estimated the width of the 95% exact binomial confidence interval for enrollment and completion rates for overall and for each intervention group (see **Table 1**).

Table 1. *The width of 95% confidence intervals for enrollment and completion rates*

	Estimated rate						
Sample size	0.60	0.65	0.70	0.75	0.80	0.85	0.90
48	0.267	0.261	0.251	0.239	0.222	0.201	0.174
24	0.365	0.357	0.345	0.329	0.308	0.282	0.249

From **Table 1**, if an estimated intervention initiation rate is 0.80, a sample size of 48 (total) and 24 (per intervention group) will produce a two-sided 95% confidence interval with a width of 0.222 and 0.308,

respectively. If an estimated intervention initiation rate is 0.90, the width of the 95% CI is reduced (becomes more precise, see **Table 1**) with the same sample size projected above.

As a feasibility study, the sample size was not projected to ensure enough study power for hypothesis testing. We assessed the effect size of the outcome (such as Brief PHI, DASS-21, TSDS) that can be detected with the planned sample size and 80% power. The effect size for change in outcome from baseline to post treatment in each intervention group and overall was estimated based on a paired t-test. With a sample size of 24 per group and 48 in total, we could detect an effect size of 0.60 and 0.41, which are moderate effect sizes. To compare the outcome change between the RBSTE and PCT groups, with 24 per group, we could detect a moderate effect size of 0.83 for the difference with 24 subjects per group. This effect size would be clinically meaningful thus signaling the need for additional study.

Analyses. The study has the goals of evaluating the viability and methodology of an RCT comparing two approaches to addressing race-based stress and trauma in VOC. Kraemer and colleagues (2006) have highlighted important limitations of effect sizes generated by pilot studies due to the large standard error. As a result, we will focus our analyses on examining feasibility and generating hypotheses for further examination. Descriptive statistics will be used to summarize the variables as well as to detect outliers, manage missing data and identify data entry errors. Wilcoxon rank sum test and Fisher's exact test will be used to assess the effectiveness of the randomization procedures by comparing baseline variables for participants between two intervention conditions. The primary analysis will be conducted for overall, and for each intervention group, respectively. The comparison of outcomes between intervention groups will be performed when it is necessary and appropriate. Multivariable analysis (logistic regression and linear regression) will be performed when it is appropriate. The associations between patient characteristics and other clinically important baseline variables with the study outcomes will also be assessed using univariate tests. Variables that are significantly associated with the study outcome (assessed by univariate test) or significantly different between study groups with $p<0.15$ will be included as potential covariates in the multivariable model. Backward elimination will be used to select the variables, and variables with $p<0.10$ will be retained in the final model. For the linear regression model, the outcome variable will be transformed if normal assumption of residuals is not satisfied.

Aim 1: *To examine the feasibility of recruiting VOC for an RCT comparing RBSTE and Present Centered Therapy (PCT) for management of stress related to discrimination experiences.*

We will assess four outcome measures for enrollment and retention: 1) *enrollment rate* defined as the proportion of consented subjects among all screened and eligible patients; 2) *initiation rate* defined as the proportion of subjects who initiate the intervention among all consented subjects; 3) *per protocol completion rate* defined as the proportion of subjects who complete 5 or 6 sessions of intervention among those who start the intervention; 4) *intent-to-treat completion rate* defined as the proportion of subjects who complete 5 or 6 sessions of intervention among all randomized subjects. The 95% CI (based on normal approximation or exact binomial test when appropriate) will be estimated for all these rates for overall and by each intervention group. The rates for the RBSTE and PCT groups will be compared by Fisher's exact test. Multivariable analysis will be also performed to examine the difference in outcomes between intervention groups using logistic regression.

Aim 2: *To understand Veterans' views of the acceptability and appropriateness of treatment content, the feasibility of participation, and perceptions of provider behavior and attitudes.*

The AIM, IAM, FIM and Provider Rating Scales will be estimated by mean, *SD* and 95% CI. Intervention groups will be compared by Wilcoxon rank sum test. Multivariable analysis will be also performed to examine the difference in outcomes between intervention groups using linear regression.

Aim 3: *To optimize the strategy for holistic evaluation of intervention effects.*

As aforementioned, we will include a comprehensive list of cardiometabolic, neuroendocrine, and inflammatory markers that had been shown as reliable markers of AL in the literature to derive an AL index for each participant. We hypothesize that AL index at baseline will be associated with perceived discrimination as well as other psychosocial outcomes and that pre to post-intervention changes of AL index will differ between the two groups. We will perform regression analysis and variable selection using LASSO (Tibshiran 1996) to identify a smaller subset of the AL markers at baseline that show significant associations with psychosocial outcome measures. The effect size for pre and post change in AL markers will be estimated. This will inform future efficacy and effectiveness studies in potential reduction of a list of biomarkers to enhance feasibility, efficiency and reduce participant burden.