IRB# 1749294

Title: Characterization of sleep with trauma nightmares using ambulatory sleep measurement

Funding Agency: VA Clinical Science Research & Development

Principal Investigator/Study Chair: Katherine E. Miller, PhD, DBSM

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Abstract

Objectives: This project has two primary aims: (1) to identify, with greater precision than previously possible, physiological parameters of sleep associated with trauma-related nightmares, employing one week of ambulatory mattress actigraphy and one night of minimal polysomnography assessment in Veterans' homes; and (2) to employ treatment for nightmares as interventional probes to determine whether changes in sleep physiological parameters covary with changes in subjective nightmare frequency and severity.

Design: This will be a prospective, longitudinal study using a multi-method assessment approach of sleep disturbances with trauma-exposed Veterans. We will account for 20% loss during study period. Therefore, we will aim to recruit 96 individuals, with the goal of randomizing 80 individuals for the treatment phase of the study. At the MVAHCS, we anticipate recruiting and enrolling 57 Veterans, with the goal of randomizing 41 individuals for the treatment phase of the study. Participation will occur in two phases. First, all initially eligible participants will complete one week of at-home sleep monitoring with a mattress actigraphy system, with event marking capability that can be activated by participants upon waking from a nightmare. During that week, participants will also complete one-night of home polysomnography sleep assessment to record sleep stage measures and patterns of arousals. Participants will be randomized to the receive active psychotherapy (Exposure, Relaxation, and Rescripting Therapy; ERRT) or to the comparison control psychotherapy (sleep and nightmare management). Treatment will occur once per week for 5 weeks. Participants will continue to sleep while monitored by the mattress actigraphy system during treatment and will complete assessments one week and three months following the end of treatment.

Significance: It is expected that results from this study will provide important information to facilitate increased understanding of the phenomenology, pathophysiology, and treatment of nightmares in trauma-exposed Veterans.

List of Abbreviations

AHI	Apnea Hypopnea Index
ANCOVA	Analysis of Covariance
ANOVA	Analysis of Variance
CAPS-5	Clinician-Administered PTSD Scale
CBOC	Community Based Outpatient Clinics
CPRS	Computerized Patient Record System
CSR&D	Clinical Science Research & Development
C-SSRS	Columbia-Suicide Severity Rating Scale
DMC	Data Monitoring Committee
DSI-SS	Depressive Symptom Index: Suicidality Subscale
DSM-5	Diagnostic and Statistical Manual of Mental Disorders-5
EBT	Evidence-Based Treatment
ECG	Electrocardiogram
EEG	Electroencephalography
EMG	Electromyogram
EOG	Electroculogram
ERRT	Exposure, Relaxation, and Rescripting Therapy
FoSI-SF	Fear of Sleep Inventory-Short Form
GLMM	Generalized Linear Mixed Modeling
HRV	Heart Rate Variability
Hz	Hertz
MEM	Micro-electro-mechanical
MHB	Mental Health and Behavioral Science
MINI	Mini International Neuropsychiatric Interview
MVAHCS	Minneapolis VA Health Care System
NDI	Nightmare Disorder Index
NES	Nightmare Effects Survey
PCL	PTSD Checklist
PHQ-9	Patient Health Questionnaire
PI	Principal Investigator
PMI	Prescription Medication Index
PSG	Polysomnography
PSQI	Pittsburgh Sleep Quality Index
PSQI-A	Pittsburgh Sleep Quality Index-Addendum
PTSD	Posttraumatic Stress Disorder
RCT	Randomized Controlled Trial
REDCap	Research Electronic Data Capture
REM	Rapid Eye Movement
RSA	Respiratory Sinus Arrhythmia
SNRI	Serotonin and Norepinephrine Reuptake Inhibitor
SpO_2	Oxygen Saturation
SRG	Scientific Review Group

SSRI	Serotonin Selection Reuptake Inhibitor
TRNS	Trauma-Related Nightmare Survey
VINCI	VA Informatics and Computing Infrastructure

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1.0 Study Personnel

- Principal Investigators/Study Chairs:
  - Katherine E. Miller, PhD
    - 612-467-3894
    - Minneapolis VA Health Care System
    - Licensed Psychologist (CA license), credentialed, board certified in Behavioral Sleep Medicine
    - VA Employee – full time 8/8ths
- Co-Investigators: None
- Collaborators:
  - Philip Gehrman, PhD
    - Michael J. Crescenz VA Medical Center, Philadelphia, PA
    - Licensed Psychologist
    - VA employee
    - Serves as primary mentor on this career development award.
  - Steve Woodward, PhD
    - National Center for PTSD, VA Palo Alto Health Care System, Palo Alto, CA
    - Licensed Psychologist
    - VA employee
    - Serves as secondary mentor on this career development award.
  - Richard Ross, MD, PhD
    - Emeritus at Michael J. Crescenz VA Medical Center, Philadelphia, PA
    - Physician
    - VA WOC
    - Serves as secondary mentor on this career development award.
- Study Coordinator: TBD, in process of hiring

- No additional participating sites.

2.0 Introduction

- Scientific background and rationale: Nearly 90% of Veterans diagnosed with posttraumatic stress disorder will report clinically significant sleep complaints, including insomnia and nightmares [1,2]. Added to the impact of PTSD, trauma-related nightmares have a significant negative effect on several domains of functioning, including perception of health, maintenance of employment, and suicidal behavior [4-6]. Due to the potential chronicity of nightmares, their cumulative impact on health domains, and their unique association with suicidal

behavior, there is a critical need for continued research to better understand this phenomenon with the goal of developing personalized treatment plans. In spite of an urgent need, the underlying mechanisms of trauma-related nightmares are poorly understood, and there are no unequivocally evidence-based treatments [7]. Limitations of current assessment procedures present a significant barrier to improved care.

The high rates of sleep disturbances in Veterans treated in the VHA are being addressed with the dissemination of cognitive-behavioral therapy for insomnia (CBT-I). Currently, CBT-I is the only recommended psychotherapy approach for sleep disturbances among PTSD-diagnosed Veterans. No clear recommendations have been provided regarding psychotherapeutic and pharmacological approaches for trauma-related nightmare treatment due to inconsistent evidence of their efficacy. Thus, there is significant room for improvement in the treatment of trauma-related nightmares. In this study, we will be randomizing subjects to two types of therapies that are used clinically at our VA with some modifications. We offer cognitive-behavioral therapy for nightmares, including Exposure Relaxation, and Rescripting Therapy (ERRT), in clinic. The sleep and nightmare management (control group) is similar to ERRT; however, we have taken out of that treatment what we believe to be “active” components (i.e., exposure to nightmare content, rescripting the content, and additional relaxation strategies). Therefore, the control group is similar to cognitive-behavioral therapy for insomnia and components of this treatment are also offered in clinic. A previous trial of similar nightmare treatments found that this control treatment was still beneficial for reducing nightmare frequency despite not containing the “active” ingredients.

- Gaps in current knowledge: In-laboratory sleep studies rarely capture nightmares, limiting our knowledge of phenotypic biomarkers to guide treatment. Additionally, conventional sleep studies, typically carried out over one or two nights, cannot assess physiological variables related to the response to nightmare treatments. Therefore, it is critical to assess sleep over multiple nights in the home environment, where nightmares occur. Such an approach will refine the detection of physiological variables associated with nightmares, and changes in these variables across the course of treatment. This project addresses these methodological shortcomings by employing zero-burden, multi-night, objective sleep measurement in Veterans’ usual sleeping environment, prior to and during an evidence-based cognitive-behavioral intervention for nightmares, Exposure, Relaxation, and Rescripting Therapy (ERRT) [8]. This project is positioned to advance the knowledge of the trauma-related nightmare field in these important ways:
    - In-home, low-burden objective assessment during sleep in Veterans reporting chronic nightmares will allow us to identify, with greater precision than previously possible, objective features of trauma-related nightmares.
    - No other published study examining the efficacy of a nightmare intervention has used objective sleep measurement through the treatment period. Findings from the proposed study could provide a clinically meaningful measurement of nightmare treatment response or non-response.

- The use of treatment as a probe to evaluate the longitudinal changes in nighttime physiology with trauma-related nightmare reports also provides an ideal opportunity to explore the effects of treatment on increasing respiratory sinus arrhythmia, a potential mechanism of change. Therefore, results from this study can being to elucidate the physiological conditions that may influence efficacy of nightmare treatments.

3.0 Objectives

- Aims:
  - Aim 1: To identify, with greater precision than previously possible, physiological parameters of sleep associated with trauma-related nightmares, employing one week of ambulatory mattress actigraphy and one night of minimal PSG assessment in Veterans' homes (n = 80).
  - Aim 2: To validate the physiological parameters identified in Aim 1, a five-week treatment for trauma-related nightmares (ERRT; n = 40) and a comparison control treatment (n = 40) will be employed as interventional probes to determine whether changes in sleep physiological parameters covary with changes in subjective nightmare frequency and severity.
- Hypotheses:
  - Hypothesis 1.1: Nights with nightmare reports, compared to nights without nightmare reports, will be predicted by lower actigraphic sleep efficiency and lower sleep RSA.
  - Exploratory hypothesis 1.2: Within nights with nightmare reports, the 90-minute time period directly preceding the onset of a nightmare, the latter signaled by the participant pressing an event button, will be marked by a decrease in sleep RSA.
  - Hypothesis 2.1: Veterans who receive ERRT, compared to those who receive a comparison control treatment, will evidence greater increases in actigraphic sleep efficiency and sleep RSA during the five-week treatment and through the one-week post-treatment follow-up assessment.
- Results from this CDA-2 will increase understanding of trauma-related nightmare pathophysiology, and advance strategies for personalizing symptom management in Veterans.

4.0 Resources and Personnel

- Primary Investigator – The PI will be directly responsible for all aspects of the research, including study design and implementation, development and execution of the study protocol, development of the hypotheses to be tested, research design, implementation, and monitoring, as well as presentation of the study results via publication and dissemination at scientific conferences. The PI will have access to PHI, be involved in recruitment, obtain informed consent, obtain clinical data, conduct mattress installation, and monitor data collection, conduct PSG administration, administer treatment protocols, supervise research staff, and conduct data analysis.

- Study Coordinator (to be hired) – The study coordinator will be hired. This individual will be responsible for the following: (1) participant recruitment and retention, (2) scheduling appointments, (3) conducting phone screening interviews, (4) data entry and processing, (5) participant tracking, and (6) maintaining records for the IRB. This individual will also assist in obtaining informed consent, documenting in charts, the administration of interviews, questionnaires, and the set-up and recording of objective sleep assessments. This individual will have access to PHI.
- Research staff (To be determined) - This individual(s) will be recruited to assist with the execution of the study. S/he (or they) will have access to PHI and be involved primarily in the set-up and recording of objective sleep assessments. These individuals may also be trained to conduct assessments at the end of treatment.
- Collaborators:
    - Philip Gehrman, PhD – Dr. Gehrman will serve as primary mentor on this career development award. This role will include oversight of the research plan, assist in inclusion/exclusion decisions, and serve as an on-site consultant for treatment questions. He will be involved in de-identified data analysis and preparation of manuscripts.
    - Richard Ross, MD, PhD - Dr. Ross will also provide mentorship on this study, specifically providing consultation on the execution of the study design and inclusion/exclusion decisions. He will be involved in preparation of manuscripts.
    - Steve Woodward, PhD – Dr. Woodward will also provide mentorship on this study. His role will focus on any technical issues with the measurement devices, interpretation of the ambulatory measurement data, and the integration of research findings future research study. He will have access to de-identified data and be involved in data analysis.
    - Joanne Davis, PhD (consultant) – Dr. Davis is an expert in nightmare treatment and developed the treatment protocol outlined in this protocol. She will provide monthly clinical consultation. This consultation will not involve PHI; and instead focus on the content of the protocol.
- There will be no contractors or applicable MOUs or DUAs.

5.0 Study Procedures

5.1 Study Design

- Study participation will occur in two parts to address the two aims of the study. First, a baseline eligibility screening visit will be conducted. Eligible participants will complete one week of at-home sleep monitoring with the mattress actigraphy system, with event marking capabilities that can be activated by participants upon waking from a nightmare. At the time of mattress installation, participants will also complete one night of home PSG sleep assessment to record sleep stage measures and patterns. If the PSG reveals that the participant likely has sleep apnea, they will be able to continue to participate but the research team will consult with a physician at the MVAHCS sleep center to place a referral to discuss follow-up and treatment options with the Veteran. Participants also will be

randomized to the active treatment (Exposure, Relaxation, and Rescripting Therapy; ERRT) or to the comparison control treatment (sleep and nightmare management). Participants will continue to sleep while monitored by the mattress actigraphy system during treatment and will complete assessments one week and three months following the end of treatment. The table below outlines the procedures for the active treatment and comparison groups.

	Baseline Assessment		***Treatment and Follow-up***		
Week	**1**	**2**	**3 - 7**	**8**	**20**
Visit	Screening Baseline Visit	Baseline Sleep Monitoring	Treatment Sessions	Time 2 Follow-up Assessment	Time 3 Follow-up Assessment
Activity	• Diagnostic Interviews • Self-Reports If eligible: • Receive Sleep/Nightmare Diary • Install Actigraphy Mattress *(30 mins.)* • In-home PSG	• Mattress collection for one week • Subjective sleep quality & nightmares on sleep diaries	If eligible*:* • Randomized to ERRT or Sleep & Nightmare Management • Continue in-home sleep monitoring	• Diagnostic interviews • Self-reports • Continue in-home sleep monitoring • Uninstall mattress at end of week *(10 mins.)*	• Self-reports

Pre consent Phone Screen: After an introductory letter is sent to potential subjects, the study team will call the potential subject. Also, Veterans who are interested in the study after reviewing recruitment material (e.g., flyers, brochures) can contact the study number for a telephone screen. All interested individuals will be administered a brief telephone screen (see telephone script in the appendix) to assess their appropriateness for the study. Individuals reporting no exclusionary criteria will be scheduled for consent followed by a baseline evaluation.

Post-consent Screening Baseline Evaluation Visit: Following initial telephone screening, Veterans will be invited to complete a baseline screening assessment either in-person or virtually. Before the baseline assessment, Veterans will provide written informed consent (and HIPAA authorization) in-person, or electronically through DocuSign.

- If in-person, Veterans will present to the MVAHCS to provide informed written consent (with embedded HIPAA authorization) and to participate in a baseline screening assessment.
- DocuSign - Veterans and study staff will electronically access the informed consent and HIPAA documents. For consenting, Veterans will receive the document, and access a virtual “room” via a videoconferencing platform to review the consent documents with study staff. Veterans will provide electronic consent and will have access to the signed document via the program. The signed consent document can be mailed to Veterans who prefer a paper copy.

Following the consent process, regardless of that procedure, Veterans will be screened for current sleep disturbances, PTSD symptoms, and exclusionary criteria with a diagnostic interview, interview- administered, and self-reported assessments. Veterans who meet eligibility criteria will be scheduled for a home visit to begin participation in the one week of sleep monitoring and one night of polysomnography. Participants who do not meet eligibility criteria from this baseline screening will be excluded from participation and referred for appropriate clinical care.

Baseline: Sleep Monitoring: Prior to installation, an equipment loan agreement will be presented to the participants to indicate the participants will take responsibility for the equipment and agree to return the items to the research staff when arranged. This loan agreement is the same that issued in routine clinical practice within the sleep center. Equipment malfunctions and typical wear and tear are expected from this agreement. Study participation will not continue if the Veterans are unwilling to sign these agreements.

Installation of mattress actigraphy system and one-night of an ambulatory PSG study: A home visit to the Veteran's usual sleeping environment will be scheduled. Trained research staff will travel to the Veteran's home to install the mattress actigraphy system and hard drive computer for data collection. The installation process takes approximately 15 minutes. Participants also will undergo one-night of ambulatory PSG study concurrent with mattress actigraphy in the home to record sleep stage measures and patterns of arousals, and to calibrate sleep efficiency derived from the mattress system. The hook-up process for the PSG takes approximately 30-45 minutes. The Veteran will also be provided instructions to complete a daily sleep and nightmare diary. Following the one night of PSG, the research staff will collect the PSG equipment. The Veterans will continue to sleep using the mattress actigraphy system and complete the sleep diary for a total of seven nights. Veterans determined to have moderate or severe apnea can still be randomized to treatment and participate in the study; however, they will also be referred for further evaluation through the sleep center.

Info about the actigraphy system: Mattress actigraphy data will be collected through a program on a password-protected data collection device (mini-PC). Data collected from this system and stored within the mini-PC include: Participant's IDs, dates, times, button presses, accelerometer data, per-30-second-epoch processed data (e.g., heart rate, respiration, number of movements), and an event record of individual movements, snores, bradycardias. No mental health, medical, demographic, or other patient identifying data are collected through this system. The way the data file is composed makes the data meaningless to anyone other than the research team.

Following completion of the mattress-actigraphy data collection, all data backed-up on the mini-PC will be transferred to the secure research server within the study folder that only approved research staff can access. Data will be transferred from the hard drive to the secure network by using an approved VA-method. These devices will never be connected to a VA computer. Once transferred, data will be deleted from the PC. When not in use, these mini-PCs will be stored within the locked Bldg 68 office (211).

Treatment: Cognitive behavioral therapy for nightmares, including ERRT, are offered within standard care. The sleep and nightmare management (control group) is like ERRT; however, it does not contain what we believe to be "active" components of the nightmare treatment (i.e., exposure to the nightmare content, rescripting the content and additional relaxation strategies). Therefore, the control group is more similar to cognitive

behavioral therapy for insomnia, another treatment offered in standard clinical care. The PI of this study will be providing treatment to participants. Additional credentialed psychologists or psychology-trainees (under supervision) may also serve as study therapists. In this case, an amendment with these details will be submitted for IRB approval.

While the treatment sessions are similar to treatment received outside of the study, they are considered a research procedure since participants are randomized to these treatments.

Randomization procedures: A simple randomization procedure will be used to randomize participants to the treatment groups in a 1:1 allocation ratio. This will be done using a random number generator. This method ensures complete randomness of the assignment of a participant to each group.

Audio recording: Only with participants' consent, in-person and virtual clinical interviews and treatment sessions will be audio-recorded for the purposes of training, and adherence to protocols. Subjects can decline and still participate in the study. These recordings will only use research code numbers. Recordings will be obtained using VA-approved video/audio platforms. Recordings will be uploaded and stored securely on the research server. Participants will be asked each time and can decline the recording at any point. They can still participate without any negative consequences or loss of benefits.

Follow-up Assessments: Upon completion of the treatment and sleep recording period, participants will complete a second in-person or virtual assessment with an assessor blind to group assignment (Time 2/post-treatment). Trained research staff will return to the Veteran's home to uninstall the mattress actigraphy system. A three-month post-treatment follow-up assessment also will be conducted with an assessor blind to group assignment (Time 2/follow-up assessment).

- Risks:
    1. Risks associated with self-report questionnaires, clinical interviews, and treatment:
        a. Some participants may be hesitant to record their symptoms on assessment forms.
        b. The current study will involve asking participants to report any previous traumatic events in their lives and to describe their trauma-related nightmares in detail. Some participants may be uncomfortable describing their symptoms and trauma history to a mental health professional. While stress or discomfort is possible, research documents that exposure-based techniques are well tolerated and provide benefit.
        c. Participants may need to travel to the VA for the baseline assessment, treatment sessions, and post-treatment assessment, which may create inconvenience.
    2. Risks of randomization:
        a. Participants will be randomized to one of two treatments with a 50/50 chance of being assigned to one treatment over the other. One consequence of participation is that the treatment to which the participant is assigned may be a less effective intervention.

b. It is hypothesized that Exposure, Relaxation, and Rescripting Therapy (ERRT) will be the more effective intervention because it contains the components that are suspected to be the mechanism of change. However, we still have uncertainty about treatment effects, given that both treatments have shown reduction in symptoms. To ensure equipoise during recruitment, research staff will follow a script that presents balanced descriptions of the two treatments, and will not include study predictions.

3. Risks associated with physiological assessment of sleep:
    a. Participants may experience slight discomfort associated with the attachment of electrodes, as well as slight restrictions in movement, during the polysomnography assessment. The sensors are unlikely to cause an allergic reaction; however, this cannot be completed ruled out. We have elected sleep assessment procedures that are as minimally invasive and as brief as possible. Therefore, mattress actigraphy will be used for most of the study period, which is a minimally invasive objective sleep assessment.
    b. It is possible that Veterans' regular sleep partners, if present, may not wish to have the device on their bed. In the event of this situation, these Veterans will not be included in the study.
    c. It is possible that results from the sleep assessment may provide evidence for an underlying sleep disorder (e.g., obstructive sleep apnea), which may increase participant distress. However, if identified, participants will be provided referral information for the Sleep Center to receive appropriate clinical care.
    d. Some participants may be hesitant to have VA staff come to their home for the installation and removal of the mattress system.
    e. There is potential risk of having a re-usable device placed on the bed. Although a standard cleaning procedure will be employed (cleaning washable fabric, spraying with disinfectant, wiping down all wires with disinfectant, and spraying with a flame retardant) between uses there is rare, but plausible, risk that bedbugs are detected. In this case, healthcare policy procedures will be used. Additionally, while rare, due t the forma inside the mattress system being a porous material, it is possible that it can absorb environmental odors that may be detectable to some users.
4. Risk of loss of confidentiality:
    a. There exists the small chance that a breach of confidentiality may occur; however, substantial procedures will be put in place to limit the possibility of such a breach in confidentiality or privacy. All personal data will be coded, stored on secure Minneapolis VA research servers, or stored in locked cabinets in building 68, room 211 of the Minneapolis VA, which requires key access for entry.
5. Except for travel to the VA for appointments, we do not anticipate any social or economic risks associated with this study.
6. No legal risks are anticipated with this study.

- Protection against risks:
    - Consent process. The consent process will include complete discussion and review of potential risks and benefits associated with participation. Veterans will be informed that both initial and continued participation is voluntary, and that withdrawal from study procedures at any point in the study is within their rights. They will be informed that their clinical care in the VA will in no way be negatively impacted by their decision to withdraw participation.
    - Continuity of care. Participants who choose to withdraw early will be referred for other treatments within the MVAHCS to address their trauma symptoms and nightmares, and the PI will communicate appropriately with the participants' providers to ensure adequate continuity of care and protect against adverse events.
    - Interviewer training and administration of interviews. All research staff will complete training in the protection of human subjects. Dr. Miller will coordinate, in the study set-up phase, a training session for the consenting process, diagnostic instruments, and determining general eligibility criteria. A portion of the training will include discussions on feeling comfortable discussing uncertainty about treatment effects, explaining that participants are suitable for both treatments, and explaining the rationale for randomization. All research staff also will complete training in the administration of the C-SSRS via an on-line web training created by the developer of the scale. A didactic training will include role-plays, and discussion of differential diagnosis. A discussion of procedures to manage participants that become distressed by the interview process will be included in the training. Specifically, should an individual become distressed during the interviews, staff will be trained in relaxation procedures and will be instructed to pause the interview and ask the participants permission to continue or if they would prefer to stop the interview. Staff will then contact the PI who will meet with the participant to assess for level of distress and provide cognitive behavioral strategies for anxiety reduction. To move through the training, the trainee will be required to (1) complete the on-line training for the C-SSRS, (2) review available didactic videos on these materials, (3) view two live administrations by senior interviewers with the comparison of the trainee's' ratings to those of the senior interviewer, and (4) administer two interviews in the presence of the senior interviewer, with the requirement that the trainees' assessment match those of the senior interviewer's. Throughout the study, all clinical interviews will be administered by trained interviewers.
    - Protection against risk associated with self-report questionnaires and clinical interview. Minimal risk is associated with completion of the clinical interviews and self-report questionnaires. In fact, this is information that they likely will have discussed with members of their VA treatment team. However, risk will be further minimized in several important ways. First, all research staff will be trained in cognitive-behavioral strategies to reduce distress if a participant becomes distressed during any of the procedures. Second, participants will be informed they may cease participation in the study at any time without impacting their previous compensation or participation in VA services. The study environment will be made as comfortable as possible and participants will be given breaks throughout the course of the procedures, if needed. Veterans will also be provided with the number for the Veterans Crisis Line.

- Protection against risk associated with physiological assessment of sleep. As outlined above, the potential risks from the physiological assessment of sleep are minimal. In fact, these procedures are frequently used in both research and clinical domains among individuals with sleep disturbances. Several procedures will be implemented to further reduce potential risk of the polysomnography (PSG) study and the use of the mattress actigraphy system. A trained researcher will complete the procedures to attach the physiological monitoring electrodes for the PSG portion of the study. This researcher will clearly describe all the procedures to ensure participants comfort. The mattress actigraphy monitoring was selected due to its zero-burden, minimally-invasive nature (time, mobility) compared to numerous lab-based polysomnography assessments and other ambulatory devices requiring user adherence. The system proposed in the present study will fit over the Veterans usual mattress and has been employed successfully in previous research studies. Reports from previous participants indicated that the accelerometers in the mattress topper were virtually undetectable. There is no contact between the participants and the accelerometers which are, themselves, hermetically-sealed and robustly cabled. In fact, there are at least four layers of fabric, the spandex "trampoline" positioning the accelerometers and their cabling, the topper ticking, the disinfectable (and water-proof) fluid barrier, and the participant's own sheet(s).

  Regarding electrical device safety standards, the following facts are pertinent. There are no electrical connections from the accelerometers to the patient, and electrical separation is provided by one grounded metallic shield (on the accelerometer) and three to four non-conductive fabric layers. No AC mains power is conducted to the accelerometers, which are instead powered by two 12-volt batteries. The power drawn by the accelerometers is very small – on the order of 40 milliamps per device - yielding a total draw of 160 milliamps per bed. Accordingly, very low amperage (300 milliamp) fast-blow fuses are inserted in both the +12 VDC and –12 VCD power supply lines to the accelerometers proximate to the batteries. In the rare circumstance, compromise of the insulation of a power and ground or signal line leading to a short circuit therefore causes immediate power shut off with minimal sparking. The wire bundle exiting each accelerometer is protected with a cut- and abrasion-resistant wire guard reducing the likelihood of shorts. The accelerometers are hermetically sealed, making internal shorts due to spilled liquid unlikely, even if that liquid could pass the top barrier. The batting and ticking near each accelerometer are sprayed with fire retardant. Wire bundles leading to and from the mattress are wire-guarded. The batteries are covered during operation. The computers used to collect accelerometric data are isolated from AC mains by circuit-breaker equipped power transformers yielding a maximum of +/- 12 VDC. This system is patent protected [US 6,485,441 B2]. In terms of protection of the data, the outputs of the accelerometer are fed directly to a data acquisition card hosted in a standard, password protected, encrypted hard drive. Data will be analyzed offline using various signal processing strategies. For cleanliness, the mattress topper is coated in a layer of non-absorbent, and tear-resistant nylon cloth. Prior to use with a new Veteran, this cover will washed and disinfected. In the rare, but plausible, situation that bedbugs were detected, healthcare policy procedures outlined by the medical center will be employed.

- Protection against risk of harm to self or others. Active suicidal or homicidal intent are exclusionary criteria for the current study. Based on this, it is expected

that incidence of such events will be rather low. All Veterans will complete a screening to assess for active intent of harm to self or others. In the event an individual reports active suicidal or homicidal intent to research staff, the mentoring team will be notified. Individuals with active intent for harm to self or others will be referred to a higher level of care within MVAHCS (in the case of harm to self), or the VA police will be contacted (in the case of active intent to harm others). Should an individual endorse intent to harm self or other during phone calls or while researchers are in the Veteran's home, staff will respond by following the system-wide Suicide/Crisis Flow chart. See study visit safety instructions in appendix for additional steps to ensure Veteran and research staff safety.

- Protections to maintain confidentiality. The risk of breaches in confidentiality are minimal as many protections will be put in place to protect participants' privacy. Research material obtained from participants will be interview assessments, self-report measures, and physiological measures. Breach of confidentiality is highly unlikely, as all data will be coded by arbitrary study number to ensure confidentiality and will be stored on a password protected VA computer. Consent forms with identifying information (names) will be filed separately from actual study data. A master list of names, phone numbers, and addresses will be kept in a separate location and used to facilitate the collection of data. Only the PI and the study coordinator will have access to this master list that links names and numbers. Audiotapes will be coded by study number and stored as an audio file on a password protected computer within the research study folder. These files will be maintained in this secure location and destroyed according to the VA Federal Records requirements in the VHA Record Control Schedule (RCS 10-1), currently at 6 fiscal years following the closure of the study. Only the PI, members of the collaboration team, and trained research staff will have access to these data. No identifiable information will be included in any published works or conference presentations that involve study data.

- Anticipated Benefits:

1. Societal benefits – The goals of the research plan are directly relevant to the VHA patient care mission, and have both short- and long-term implications for Veterans' mental health. Much of what is currently known about trauma-related nightmares is limited by in-laboratory sleep studies or cross-sectional designs, which cannot identify the changes that may occur from treatment or the potential factors associated with such changes. The proposed study will begin to directly address the current limitations and provide a basis for practical changes to treatment protocols.
2. Participant benefits –
    a. Participants will complete an ambulatory sleep assessment which will include screening for sleep apnea. This is typically a costly assessment and one that is often met with a substantial waitlist given the limited number of sleep laboratories. Participants may gain knowledge about their sleep disturbances and receive referral information for treatment, if needed.
    b. Participants eligible for the treatment portion of the study will receive five-session of a treatment directly targeting their nightmare complaints.

c. It is possible that participants may not experience any direct benefit from participation.

- Study population: All participants recruited for this study will be adult Veterans (Age 18 or older). There are no restrictions on the inclusion of racial or ethnic minorities or gender and sex for the present study. Care will be taken to ensure that the demographics of our sample closely approximate the demographic make-up of the MVAHCS. As some Veterans served in our facility are economically disadvantaged, employees, or students, there is a possibility that the participant population will include these categories of individuals. We plan to obtain complete data from 41 Veterans from the MVAHCS. To reach this number, we expect some Veterans following consent and enrollment will withdraw, be lost to follow-up, or be excluded. Therefore, we anticipate enrolling 57 Veterans.
    - Added protections: This study may include participants who are economically or educationally disadvantaged. Procedures to minimize risk, as outlined above, will be employed with all participants regardless of their socioeconomic or educational status. Payment is provided to ensure adequate compensation for the Veteran' involvement in the study. We also will ensure that the informed consent is at a 6th grade reading level.
    - No data and specimen banking will occur in this study.

5.2 Recruitment Methods

- Results from power calculations suggested that a total sample of 80 is needed for randomization. To account for likely 20% loss during the study period, we plan to recruit and enroll 96 Veterans, with the goal of randomizing 80 Veterans for the treatment phase of the study. Specifically at the MVAHCS, we need a sample of 41 Veterans for randomization. To account for anticipated loss during the study period, we plan to recruit and enroll 57 Veterans from MVAHCS.
- Potential participants will be identified and recruited through several methods:
    - **Clinician referrals**: The PI And study coordinator will provide information and give presentations about the study to providers at the MVAHCS, who serve Veterans who may be potentially eligible for the study. A clinician handout about the study and information sheet is included with the recruitment materials. If these providers believe their patients may be eligible or would be interested, they may provide the PI or study coordinators' contact information. Therefore, participants may be identified through referrals from providers in the sleep center, primary care clinic, and/or specialty mental health. Only after initial discussion of the study with the patient and the patients' agreement, the referring provider will provide the research team with the name and contact information of each Veteran. The study team will remind the provider that they must document this referral in the patient's chart.
    - **Flyers**: Flyers advertising this research study with contact information will be placed within MVAHCS and VA-sponsored social media with approval.

- **Letters**: We also will recruit Veterans through mail, based on clinical patient data extracted using the VA informatics and computing infrastructure (VINCI), which includes real SSN. Letters will be sent by the PI and study coordinator.

- As mentioned above, approved flyers will be posted at MVAHCS to advertise the study. Clinical providers may give an information sheet to their patients, and recruitment letters will be sent to potential participants. Interested participants can also contact the numbers listed on these documents. The PI will request to post IRB-approved flyers to VA-sponsored social media through the MVAHCS public affairs office.

- Each participant may be paid up to $330.00 for their participation in the different parts of the study, on the following payment schedule:
  - $30 for the completion of the baseline screening procedures
  - $100 for completing the baseline actigraphy sleep monitoring (1-week)
  - $75 for completing the baseline polysomnography study (1-night)
  - $50 for completing sleep monitoring during treatment
  - $50 for completing posttreatment assessment
  - $25 for completing a three-month follow-up assessment via telephone/video
  - Method: Payment will be in the form of a debit card or EFT/direct deposit.
  - No delay for receiving the payment is anticipated.

5.3 Informed Consent Procedures

- Written or electronic informed consent with an embedded HIPAA authorization will be obtained from all participants prior to the start of the baseline evaluation assessment. Participants will be provided with a copy of the signed informed consent. The consent will provide information about the purpose of the study, include a section discussing audio-recording of assessments and treatment sessions, a disclosure statement about consultation, a request to be able to speak with the Veterans' regular bed partner about the mattress topper (if the bed partner contacts the study team regarding questions about the system), and will include a section on contacting the participants via text (on an authorized VA-issued phone per ORD guidance documentation), email, and/or HealtheVet secure messaging. An information sheet will be provided to enrolled participants' regular bed partners (i.e., individuals who sleep in the Veteran's bed for a majority of the week) to inform them of the placement of the mattress device on the bed. The study team will only speak to Veterans' partners with the Veteran's consent, and will only discuss the topper and will not disclose treatment or symptom information.

- The PI and study coordinator will obtain informed consent. The inability to provide fully-informed written consent to participate is an exclusion criterion; therefore, no special circumstances will need to be addressed for this consenting process.

- All personnel who will obtain informed consent will complete the local necessary VA trainings related to privacy, data security, and human subjects' protections. The PI also will conduct in-person training of the consent process. This training will include role-plays and live supervision of the process.

5.4 Inclusion/Exclusion Criteria

- Inclusion: To be included, an individual must (1) be a Veteran aged 18 or older; (2) have stable housing for the duration of the study period; (3) have experienced any traumatic event meeting Criterion A for PTSD at least three months before the baseline assessment; (4) meet criteria for a current PTSD diagnosis (defined by the DSM-5 criteria) or subthreshold criteria, defined as follows: (a) The Majority definition – requiring participants to have met most PTSD diagnostic criterion (4 of the 5 symptom clusters); and/or (b) The 6-plus definition – requiring participants to have at least 6 total symptoms, but may not meet full criterion specifiers; (5) self-report experiencing trauma-related nightmares (dream imagery with dysphoric emotions that arise or worsen following a traumatic event), at least once per week for the past month, that are mostly-remembered; (6) self-report global sleep disturbance indicated by a score of 5 or greater on the Pittsburgh Sleep Quality Index (PSQI); (7) be stable on medications.
- Exclusion: The following will serve as exclusion criteria: (1) inability to provide fully informed consent to participate; (2) a bed partner does not agree to mattress recording during the in-home portion of the study; (3) a medical condition that limits ability to apply the treatment (e.g., needing a health aide or caregiver to record sleep diaries, unable to get out of bed without assistance); (4) current pregnancy and/or birth of a child within the past 6 months; (5) current alcohol or illicit substance use disorders or early remission; (6) active suicidal ideation or homicidal ideation; (7) a history of any bipolar disorder spectrum disorder or psychotic disorder; (8) hospitalization for a mental health disorder in the past 2 months; (8) enrolled in a current manualized PTSD-focused treatment (e.g., Cognitive Processing Therapy or Prolonged Exposure), (9) current nightmare treatment or a history of treatment failure with cognitive-behavioral therapy for nightmare intervention. Veterans may also be excluded from participation if they have been identified by local VA disruptive behavior committee to have displayed disruptive, threatening and/or violent behavior.

5.5 Study Evaluations

- Before being enrolled in the study, all potential participants will go through a phone screening process to assess their appropriateness for the current study. The criteria assessed in the phone screen consist of the following: the participant must (1) be 18 years of age or older at the time of the intake; (2) have experienced a traumatic event, as defined by the DSM-5; (3) have approximately one nightmare each week for the past month. A brief screener of past month PTSD symptoms will be conducted to assess for a probable PTSD diagnosis. Questions regarding psychological disorders and untreated substance dependence will be used to assess exclusion criteria. Participants who meet the criteria for inclusion based on the phone screen, and if interested, will be scheduled for an in-person evaluation. Screenings will take approximately 5 - 10 minutes. See appendix for telephone screening script.

- A demographic questionnaire will obtain standard background information about the participants: age, gender, race and ethnicity, sexual orientation, marital status, educational achievement, military branch of service, highest rank of service, eras of service, vocational status, household income, and living/housing situation.
- Pharmacotherapy and OTC/Substance Use –The use of pharmacotherapy will be assessed at each session and will be corroborated with review of the electronic medical chart. These methods will assess class of medication (SSRI/SNRI, benzodiazepine, non-benzodiazepine drug that acts at the benzodiazepine receptor, trazodone, prazosin, atypical anti-psychotic), dosage, schedule, and use since the previous assessment.
- Clinician Administered PTSD Scale (CAPS-5) –The CAPS-5 is a structured clinical interview to assess full and subthreshold PTSD diagnosis and is the gold standard for PTSD assessment. The CAPS-5 assesses current and lifetime PTSD and allows for the assessment of the frequency and intensity of PTSD symptoms, the impact of the symptoms on social and occupational functioning, the overall severity of symptoms, global improvement since baseline, and the validity of ratings obtained.
- Mini International Neuropsychiatric Interview (MINI) – The MINI, is a brief, structured diagnostic interview that will be used to assess current mental disorders. The most recent version (7.0.2 for DSM-5) will be used. Because it is important to the current application that individuals with any history of bipolar disorder, manic symptoms, and/or psychotic symptoms be excluded from participation, the bipolar and psychotic disorder modules of the MINI will also be used to assess for lifetime symptoms. The substance use sections will be used to assess for alcohol and substance use disorders in the last 12 months. The MINI has been well validated and shown to be a comparable instrument to other established diagnostic interviews, with the advantage of being brief and easily administered by clinicians or research assistants.
- Columbia-Suicide Severity Rating Scale (C-SSRS) - The C-SSRS will be used to screen for suicidal ideation and behavior. The C-SSRS assesses these two categories: 1) Level of suicidal ideation (scores range 0 – 5, with a score of 0 indicating no suicidal ideation, and scores 4 and 5 indicating current serious suicidal ideation). If suicidal ideation is present, follow-up questions about the most severe thought are asked to determine the intensity of the ideation. These questions include: frequency, duration, controllability, deterrents, and reasons for that thought. 2) Suicidal behavior, with those reporting recent attempts and preparatory behaviors within the past three months at the highest risk. Participants who are deemed to be at high risk on the C-SSRS (a score of 4 or 5 on suicidal ideation, and/or report active suicidal behavior, including recent attempt or preparatory behaviors, within the last three months) will be assessed further for risk and safety. Imminently suicidal Veterans will be escorted to the Emergency Department for further evaluation. Veterans determined to be a high risk but not in need of emergency care will receive MVAHCS standard procedures, including creating a safety plan and follow-up by the Suicide Prevention

Coordinator. He/she will be compensated for the baseline and excluded from study participation.

- Depressive symptom inventory suicidality subscale (DSI-SS) – The DSI-SS is a self-report measured used to detect and prevent suicidal ideation. This will be used in conjunction with the C-SSRS at the baseline, and used at post-treatment assessments.
- Epworth Sleepiness Scale (ESS) – The ESS is a 8-item self-report measure used to assess daytime sleepiness.
- PTSD Checklist for the DSM 5 (PCL-5) –The PCL-5 is a 20-item self-report measure widely used in the VA that assesses the 20 DSM-5 symptoms of PTSD.
- Patient Health Questionnaire (PHQ-9) –The PHQ-9 is a 9-item self-report instrument used widely in the VHA to assess depression symptoms in Veterans.
- Trauma-Related Nightmare Scale (TRNS) –The TRNS is a self-report measure developed by the ERRT developers for the assessment of trauma-related nightmares and related sleep disturbance. This measure will be used for nightmare frequency and related severity: the number of nights with nightmares per unit of time (e.g., per week), number of nightmares per unit of time, and severity associated with those nightmares.
- Nightmare Effects Survey (NES) –The NES is an 11 item Likert-type questionnaire designed to assess the impact of nightmares on 11 areas of life including work, social, and leisure activities. Total scores range from 0 to 44, with higher scores indicating greater level of nightmare-related impairment.
- Nightmare Disorder Index (NDI) – The NDI is a 5-item questionnaire designed to assess the presence of nightmare disorder.
- Pittsburgh Sleep Quality Index (PSQI) –The PSQI is a self-report measure designed to assess certain qualities and problems associated with sleep. Participants rate their quality of sleep and the degree of sleep difficulties for the month preceding the assessment.
- Pittsburgh Sleep Quality Index—Addendum for PTSD (PSQI-A) –The PSQI-A is a self-report instrument used in conjunction with the PSQI for use with trauma-exposed participants and assesses the presence of seven trauma-related sleep disturbances.
- Fear of Sleep Inventory-Short Form (FoSI-SF) —The FoSI-SF is a 23-item self-report measure that assesses trauma-related thoughts and activities associated with sleep and the occurrence of traumas associated with the bedroom or sleep.
- Sleep and Nightmare Diary - This diary is used to monitor self-reported sleep/wake behaviors and nightmare frequency and severity. Participants record their subjective estimates of important sleep parameters such as sleep time, wake time, number of awakenings, length of awakenings, naps, and subjective sleep quality every night. Additionally, they will

report nightmare frequency and severity, other dream frequency, daytime nightmare-related distress, and daily homework compliance (i.e., yes/no-did they practice relaxation and rescripting procedures).

- Homework Effort question- One question will be administered prior to the start of treatment sessions inquiring about the participant's level of effort they exerted in working on changes between sessions.
- Treatment Credibility & Expectancy Questionnaire—Following the first session, participants will be administered the 6-item self-report measure that assesses individuals' perceptions of the credibility of and expectations about the treatment.
- Treatment session standard operating procedures and checklists – Following each treatment session, the study therapist will complete a checklist to ensure they completed the tasks outlined for the session and to rate the participant's completion of homework tasks.

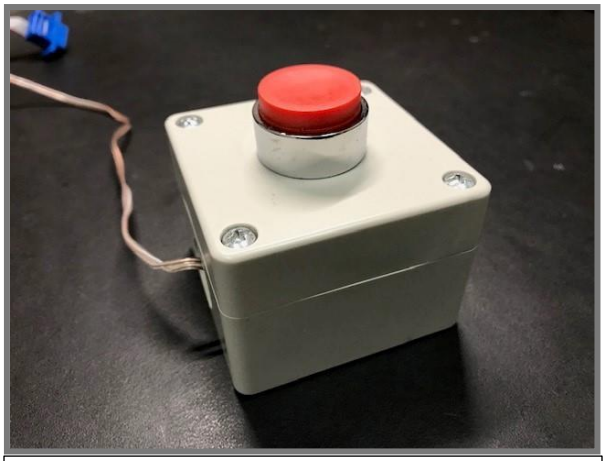
Objective Sleep Assessment:

- Mattress Actigraphy in Veterans' Homes –To obtain an objective measurement of sleep in the Veterans' usual sleep environment participants will sleep while monitored by a mattress actigraphy system each night for one week during the baseline phase of the study, Veterans randomized to ERRT or to the comparison treatment will continue to sleep while monitored by the mattress system during the five-week treatment period and one week following the last treatment session. The mattress actigraphy system uses four sensitive, low-noise, micro-electro-mechanical (MEMS) accelerometers (Silicon Designs, Issaquah, Washington, Model 2210 2 g, bandwidth: 0–300 Hz) embedded in the thorax region of a mattress topper that will be placed on top of the participant's regular mattress, and under a regular bedsheets. Accelerometers will be connected to a 12-volt medical grade power supply and signals will be routed to a bedside hard-drive data acquisition card (Kiethley KPCI-3807, sampling rate, 600 Hz), and custom software managing the nighttime collection and daytime preprocessing of accelerometer signals into 30-second epochs with heart rate; RSA; respiratory parameters, including rate, rate variability, and amplitude variability; and body movement parameters. Of great importance for this proposal, assessing RSA during sleep offers additional protection from sources of artifact such as movement and speech, and allows long recording periods promoting reliable estimates. An event marker (a button connected to the mattress system), which can be activated by the participant to mark nightmare occurrences during the night, will be placed near the bed and linked to the sleep record. Participants will be requested to activate the button upon waking from a nightmare. An instruction sheet is included in the appendix. Overall, the mattress actigraphy system has been employed successfully over 40,000 nights by the study collaborator, Dr. Woodward [9-11], as part of research at the VA Palo Alto Healthcare System.

- Home-based polysomnography (PSG): A home-based overnight polysomnography (PSG) study will be conducted using a Nox A1 portable polysomnography system (Nox Medical) to record sleep stage measures and patterns of arousal. This system acquires the following signals: electroencephalogram (EEG), horizontal electrooculogram (EOG), chin electromyogram (EMG), electrocardiogram (ECG),

chest circumference (impedance plethysmography), abdominal circumference, nasal pressure, left and right leg movement (via accelerometry), oxygen saturation (SpO2), and body position (right lateral, left lateral, prone, and supine). Based on these signals, data on sleep staging, body position, total sleep time, and sleep efficiency will be obtained.

Picture: Mattress topper that shows the thickness and how it fits over a standard mattress.A standard fitted sheet goes over it. The Sensorbed is the size of a standard twin mattress 39"x"75", allowing it to be placed on any size mattress and positioned where the Veteran typically sleeps.



Picture: shows the event marker (thebutton connected to the Sensorbed system). When pressed by the participant, it will create a mark in the participant's data. Participants will be requested to press this button upon waking from a nightmare.

- **Schedule of assessments.**

	Baseline		***Treatment and Follow-up***		
	Baseline Screening Evaluation	***Baseline Sleep Monitoring (1 week)***	***Treatment Visits (5 weeks)***	***Time 2 Follow-up1 week post-treatment***	***Time 3 Follow-up3 months post-treatment***
MINI	*X*				
CAPS-5	*X*			*X*	*X*
C-SSRS	*X*			*X*	*X*
DSI-SS	*X*			*X*	*X*
ESS	*X*			*X*	*X*
NDI	*X*			*X*	*X*
PCL-5	*X*		*X*	*X*	*X*
PHQ-9	*X*		*X*	*X*	*X*
PSQI	*X*		*X*	*X*	*X*
PSQI-A	*X*			*X*	*X*
TRNS	*X*		*X*	*X*	*X*

CEQ			*X (1st visit only)*		
NES	*X*			*X*	*X*
FOSI-SF	*X*			*X*	*X*
Demographics	*X*				
PMI	*X*		*X*	*X*	*X*
Sleep Diary		*X*	*X*	*X*	*X*
Polysomnography(1 night)		*X*			
Mattress Actigraphy (nightly)		*X*	*X*	*X*	
Treatment Checklist			*X*		

5.6 Data Analysis

- Results from a power calculation suggested that a sample of 80 is needed for randomization to detect smaller effects in terms of the primary aims. This sample size will also allow for adequate power to detect group differences between ERRT (n = 40) and the comparison group (n = 40). We will account for approximately 20% loss during the study period. Therefore, we aim to recruit and enroll 96 individuals, with the goal of randomizing 80 individuals for the treatment phase of the study. At the MVAHCS, we anticipate recruiting and enrolling 57 Veterans, with the goal of randomizing 41 individuals for the treatment phase of the study.
- Data analysis will occur using MATLAB and R Studio. The general analytical plan is as follows; however, the specifics may be adjusted as new methodology emerges over the study period:
    - Regarding Aim 1: Mixed-effects binary logistic regressions, a version of generalized linear mixed modeling (GLMM) will be used to model the binary outcome (nightmare versus non-nightmare night) from predictor variables. This method accommodates the daily values derived from the mattress actigraphy system and self-report diary data, and missing data, in the potential event of mattress or PSG system errors, and/or missing diary data. For the exploratory hypothesis: change point analysis will be used as it is designed to detect significant changes in time series data [12]. This method can be used to detect a sustained change in physiological measure that may trigger a psychological phenomenon (e.g., a decrease in sleep RSA may precipitate a nightmare).
    - Regarding Aim 2: A combination of GLMM and growth analysis will be used for this aim. GLMM provides the most parsimonious test of our hypotheses based on the following considerations. First, this method accommodates attrition and missing data, in the potential event of mattress system errors, missed assessments, and study dropout. Second, GLMM allows for modeling sleep and change over time. Importantly, this approach allows model change

in nightmare frequency, sleep RSA, and actigraphic sleep efficiency over the course of short-term (weekly) and long-term (post-assessments), while also allowing the modeling of any unpredicted change in sleep disturbances during the treatment phase.

5.7 Withdrawal of Subjects

- It is possible that, based on information gained from this study, the researchers may have serious concerns (related to matters such as life-threatening events, physical abuse, etc.) about the participants' health and safety, in such a case, the researchers may withdraw participants from the study, and/or contact them to provide a referral for additional care. In addition, the PI may withdraw participants from the study for one or more of the following reasons:
    - It is determined that continuing participation would be harmful to the participant.
    - It is determined during the study that the participant needs treatment not provided in this study.
    - The participant becomes pregnant during the study.
    - The participant verbally or physically threatens the safety of the research staff.
    - The participant dos not follow study procedures (e.g., not attending treatment sessions, not regularly sleeping in their bed with the mattress topper, unplugging equipment).
    - The study is cancelled.
- Participants can withdraw from the study at any time without penalty or loss of benefits they may be entitled. We will call participants to complete a final assessment and arrange a time to pick-up any study equipment in the home. Although, it is preferable for subjects to utilize the HIPAA Revocation form if withdrawing from the study.

6 Reporting

- All protocol deviations, adverse events, serious adverse events, breaches of confidentiality, UADE's, unanticipated or unexpected problems will be reported by the PI to the IRB in writing within 5 business days of discovery.
- These reports also will be sent to the CSR&D Data Monitoring Committee. All SAEs and UPIRTSOs must be reported to the DMC within 3 business days of the time of discovery.

7 Privacy and Confidentiality

- PHI collected from this study will not be disclosed. Any PHI collected will be coded with a unique participant ID that will be used as identification on all study documents except the informed consent form.
- Questionnaire data will be collected via paper, or electronically via REDCAP (if the Veteran is within the VA firewall, for example completing a visit on site) or Qualtrics (if the Veteran is off-site). REDCap is a service on the VA Informatics & Computing Infrastructure (VINCI) server maintained by VINCI and VA information Resource CENTER (VIReC). The servicer is located behind the VA firewall. Clinical interview data will be entered directly onto computers at the research site. Qualtrics also will be used for data collection throughout the study. Qualtrics is approved in the Digital VA Product Marketplace and is housed in the FedRAMP environment. Qualtrics has a FedRAMP Security Certification, a gold standard for security certifications. Qualtrics is approved for “moderate” level data security, which includes PHI/PII. Data from REDCap and Qualtrics will be periodically downloaded and stored within the secure MVAHCS research server, in the study folder that only approved research staff can access.
- Mattress actigraphy and the polysomnography data will be coded with a Study ID. These data will be stored within the secure MVAHCS research server, with access limited to only approved research staff.
- Identifiable information obtained from the research coordinator and/or collected via phone screen will be name, phone number, dates, email address, mailing and home address, and last 4 of SSN. This information will be kept separate from all study data.

8 Communication Plan

- Study recruitment will only occur at the Minneapolis VA Health Care System. The PI will routinely be in touch with the career development award mentors and consultants to discuss any study-related concerns.
- The research coordinator will be trained to adhere to all stipulations of the IRB-approved protocol. Within the first month of recruitment, a random spot-check will be conducted to ensure that all procedures are being followed according to the protocol.

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