Sleep and Pain Intervention for Chronic Insomnia Using Virtual Reality Pilot Study (iVR)
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Principal Investigator: ___Dr. Christina McCrae_____
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1. Abstract

a. Provide no more than a one page research abstract briefly stating the problem, the research hypothesis, and the importance of the research.

Sleep disturbances are common among chronic pain patients, with reports typically ranging from 50-70% of patients reporting sleep difficulties (Atkinson, Ancoli Israel, Slater, Garfin, & Gillin, 1988; Pilowsky, Crettenden, & Townley, 1985). It is well documented that, alongside a high comorbidity with chronic pain, chronic insomnia also has high comorbidity with, and is a risk factor for, developing an anxiety disorders (Neckelmann, Mykletun, & Dahl, 2077). Research has shown that Cognitive Behavioral Therapies (CBT) are efficacious in treating patient with comorbid insomnia and chronic pain (e.g., improvements in sleep parameters, normal sleep efficiency, reductions in pain severity; (Currie, Wilson, Pontefract, & deLaplante, 2000). CBT addresses a number of factors involved in the maintenance of patient sleep and health issues, and a key piece of CBT for insomnia and pain is the reduction of worrisome thoughts, or anxiety related to sleep and pain issues. A common evidence-based strategy used for reducing anxiety and worry is the practice of relaxation (Borkovec & Costello, 1993). The aim of this study is to investigate the benefits of replacing treatment as usual (TAU) relaxation practices, with Virtual Reality (VR) mediation environments within CBT treatment.

Virtual Reality Meditation for Anxiety

There are few studies in the literature demonstrating a relationship between Virtual Reality (VR) – a computer generated environment that presents the user with a realistic three-dimensional space – and reductions in anxious symptomology. However, the results of those studies are very encouraging. In a case study, Tarrant and Cope (Tarrant & Cope, 2018) treated 4 firefighters who had anxiety and anxiety-based disorders with a Positivity VR Experience. 3 of 4 treated patients exhibited increased left gamma symmetry, associated with approach behavior and increased mood (Sutton & Davidson, 1997), and 3 of 4 patients showed increases in State-Cheerfulness and Positive Affect. Tarrant and colleagues (Tarrant, Viczko, & Cope, 2018) also conducted a pilot study, where they treated 14 patients who had moderate or higher levels of generalized anxiety with a 5-minute Mindfulness in Nature experience. Patients in the VR meditation group showed both global and regional decreases in Beta activity (i.e., decrease in frequencies associated with qualitatively anxious states; Thompson and Thompson, 2007; Price and Budzynski, 2009; Olbrich et al., 2011) and decreased self-reported State Anxiety. Overall, these results seem promising, as they provide preliminary evidence supporting that VR interventions may be a useful and effective tool for the treatment of elevated anxiety symptoms.

In summary, this clinical trial will examine the effects of VR meditation environments on patients with pain- and insomnia-related anxiety. The proposed study design will yield important information about the efficacy of VR meditation practices. The purpose of this study is to examine the benefits of using VR meditation with patients with chronic pain and chronic sleep disturbance so that clinicians can more effectively treat core causes to symptoms and reduce counterproductive therapies.

Ultimately, this research targets two important public health concerns, namely insomnia and chronic pain. Insomnia in the context of chronic pain has been relatively understudied. Thus, the results of the present study will provide unique insights into sleep and chronic pain and will advance knowledge in the fields of both sleep and pain. Although the results of this study will be specific to chronic pain patients, they will have broader implications for other medical populations likely to suffer from chronic pain and insomnia (i.e., cancer patients, older adults). The information gained has the potential to make a significant contribution to behavioral healthcare practices for a wide variety of disorders, not just insomnia and pain. Thus, this research has implications not only for future sleep and pain research but also for other types of treatment-related research.

2. Objectives (include all primary and secondary objectives)

a. To examine the clinical and health characteristics, including sleep, pain, fatigue, cognitive abilities, and cardiovascular health in patients with chronic pain.
b. To examine changes in the primary clinical outcomes, including chronic pain, complaints of poor sleep, and fatigue.
c. To examine changes in the secondary clinical outcomes, including mood, daytime functioning, cognitive functioning, and cardiovascular health.
d. To examine the mechanistic variables, including arousal (heart rate variability, HRV) and CS (thermal response).

3. Background (briefly describe pre-clinical and clinical data, current experience with procedures, drug or device, and any other relevant information to justify the research)

We have assembled a multidisciplinary team with experience and expertise of direct relevance to the aims of the proposed study. Our relevant work includes studies examining: (1) sleep patterns, (2) sleep interventions, (3) pain processing and (4) VR mediated therapy.

Our multidisciplinary team has an established track record conducting sleep and pain research, including cognitive-behavioral interventions. The team also has considerable applied expertise in these areas, including successful clinical practices specializing in the behavioral treatment of insomnia and pain. We have conducted CBT-P as a routine treatment for the past 19 years. We have also served as a major training program for psychologists interested in chronic pain treatment with behavioral methods. We believe our collective expertise and experience will help to ensure successful completion of the project proposed herein. Furthermore, our expertise and publication history in the area of central sensitization of pain makes our center especially capable of conducting the proposed research. Our multidisciplinary team has considerable preliminary data in all facets of the proposed model and we are uniquely poised to bring this expertise together to examine the mechanisms of how sleep and chronic pain are related.

4. Study Procedures

a. Study design, including the sequence and timing of study procedures (distinguish research procedures from those that are part of routine care).

This is a pilot trial with one treatment condition (VR mediation).
The study will be carried out in two parts. For the first feasibility arm, we will recruit 10 subjects who have chronic insomnia. For the second arm of the study, a total of 60 participants will be recruited for the in-depth clinical interview to allow for a total of 20 participants to enter the study. Based on the PI's past experience in conducting similar research in this population, about 1/3 of the initially recruited participants will meet criteria for the study.

Summary of study procedures:

First Phase of Study:

4.1 Eligibility and baseline assessments

First visit (Day 1 of week 1) – MizZzou Sleep Research Lab (maximm of 1.5 hours)
Consent—conducted by Project Coordinator
To determine participant eligibility, participants will be screened for chronic insomnia via the PSQI+ Survey. If they do not qualify, they will be referred to their primary health care provider for further sleep disorder testing. Upon eligibility, participants will be given:

a) Baseline questionnaires
b) VR headset with instructions on how to use it.
c) 2 weeks of electronic sleep diaries
d) Actigraph watch
e) Computerized cognitive tasks

4.2 2-week treatment period

Week 1 to Week 2
All participants will complete electronic sleep diaries and wear actigraph watches throughout this phase. Participants will use the VR headset during this phase.

Second visit (Beginning of week 2) – MizZzou Sleep Research Lab (~5 minutes)
Participants will return their Actigraph watch and receive a new one.

Third visit (Beginning of Week 3) – MizZzou Sleep Research Lab (~45 mins)
Participants will return actigraph and VR headset. Partcipants will be given the following post-treatment assessments:

a) Post-treatment questionnaires
b) Computerized cognitive tasks
c) Feasibilty Survey
d) Patient Experience Survey

Second Phase of Study:

4.3 Screening and baseline assessments (1 week)

Day 1 of week 1 – MizZzou Sleep Research Lab/Remote
To determine participant eligibility, participants will be given an in-depth screening interview conducted online (via Qualtrics) by the Project Coordinator and screened for chronic insomnia via ISI scale (score 11 or higher), with consultation from Dr. McCrae (PI).

(1) If participants do not qualify based on the ISI, they will be referred to their primary health care provider for further sleep disorder testing.
(2) Upon eligibility, participants will be given (baseline measures):
    a) consent via zoom–conducted by Assessor/Interventionist (~20 mins)
    b) in-depth clinical interview conducted by Assessor/Interventionist via zoom, with consultation from PI (~20 mins)
    c) actigraph for objective sleep measures* (~2 mins)

d) daily electronic sleep diaries (~2 mins)
e) online computerized cognition tasks (~20 mins)
f) electronic questionnaires of other outcome measures (~25 mins; see Table 1&2)
g) participants with suspected sleep apnea will be given in-home heart rate variability (HRV) test and instructions for one-night of recording* (~5 mins)
h) compensation $25 upon completion*

Day 3 of Week 1 – MizZzou Sleep Research Lab/Remote (~5 mins)
Participants will:

a) return Holter monitor (if applicable)
b) continue to complete daily electronic sleep diaries

4.4. Eligibility and 4-week treatment period

After collecting one week of baseline assessments, participants will be admitted in the treatment phase of the study.

Week 2 to Week 5 – MizZzou Sleep Research Lab/Remote
If eligible for the treatment phase of the study, participants will:

a) Return actigraph and be given VR device (~5 mins)
b) continue to complete electronic sleep diaries (~2 mins)
c) Given VR instructions via Zoom with study interventionalist (~20 mins)
d) use the VR device daily per instructions
e) complete daily relaxation, stimulus control, and sleep hygiene logs (~2 mins)
f) have weekly check-ins with study interventionist via zoom (~10 mins)

4.5 Post Treatment Assessments (1 week)

Day 1 Week 6 – MizZzou Sleep Research Lab /Remote
Participants will be given:

a) actigraph for objective sleep measures* (~5 mins)
b) daily electronic sleep diaries (~ 2 mins)
c) online computerized cognition tasks (~20 mins)
a) electronic questionnaires of other outcome measures (~25 mins; see Table 2 & 3)
b) $35 compensation upon completion*

Day 1 Week 7 – MizZzou Sleep Research Lab/Remote
Participant will:

a) complete any remaining tasks (dairies, post treatment surveys, cognition games, etc.)
b) return actigraph* (~5 mins)

4.5 1 Month Follow up Assessments (1 week)

Day 1 Week 10 - MizZzou Sleep Research Lab/Remote
One month from the beginning of post-treatment period, participants will complete the same assessments they completed at baseline.
Participants will complete:

a) actigraph for objective sleep measures* (~5 mins)
b) daily electronic sleep diaries (~2 mins)
c) online computerized cognition tasks (~20 mins)
c) electronic questionnaires of other outcome measures (~25 mins; see Table 2 & 3)
d) return actigraph & VR headset upon study completion (~5 mins)
e) $35 compensation upon completion*

*Items labeled with an asterisk require in-person contact

5 Study duration and number of study visits required of research participants

For part one of the study, participants will be invited to come for a total of 3 visits over 2 weeks. For part two, the participants will be invited to come for a total of 4 visits over 6 weeks and a total of 2 visits over 1 week for a 1 month follow up.

6 Blinding, including justification for blinding or not blinding the trial, if applicable.

N/A

7 Justification of why participants will not receive routine care or will have current therapy stopped

N/A

8 Justification of inclusion of a placebo or non-treatment group

N/A

9 Definition of treatment failure or participant removal criteria

We do not expect to remove any participants who were included based on initial inclusion and exclusion criteria. We expect that some participants might drop out of treatment voluntarily. However, if we notice any unexpected negative effects in participants in the treatment group, we will stop the intervention.

10 Describe what happens to participants receiving therapy when study ends or if a participant's participation in the study ends prematurely

Participants will be encouraged to complete the treatment for the benefits of the treatment for them. However, they will be assured that the decision to continue treatment is entirely voluntary. They will also be offered the option to continue participating in the study (providing assessments) even after they drop out from the treatment.

11 Additional Information:

Virtual Reality Based Relaxation Therapy

Participants will combine the Virtual Reality technique with the Stimulus Control technique. When they go to bed at night, they will undergo the VR mediated Relaxation procedure first. If they do not fall asleep within 15-20 minutes, they get out of bed as described in the Stimulus Control Instructions. If they awake during the night, they run through the VR mediated relaxation procedure once. If they do not fall back asleep within 15-20 minutes, they should get out of bed. Their workbook will contain a handout that outlines the details. Participants will be encouraged to refer to it at home if they forget any part of the procedure.

Inclusion/Exclusion Criteria

Phase I of study:
Inclusion criteria: 1) 18+ years, 2) able to read and understand English, 3) self-reported insomnia complaints with scores of > 30 for sleep onset latency or >30 for wake after sleep onset on the PSQI+.

Exclusion criteria: 1) unable to provide informed consent, 2) unable to complete forms and implement treatment due to cognitive impairment (MMSE<26), 3) sleep disorder other than insomnia (i.e., sleep apnea [apnea/hypopnea index, AHI>15], Periodic Limb Movement Disorder-PLMD [myoclonus arousals per hour > 15]), 4) bipolar or seizure disorder (due to risk of sleep restriction treatment), 5) other major psychopathology except depression or anxiety (e.g., suicidal ideation/intent, psychotic disorders), 6) severe untreated psychiatric comorbidity, 7) psychotropic or other medications (e.g., beta-blockers) that alter pain or sleep, 8) participation in any nonpharmacological treatment (including CBT) for pain, sleep, fatigue or mood outside the current study

Phase II of study:
General inclusion criteria: 1) 18+ years, 2) able to read and understand English, 3) diagnosed with insomnia based on the criteria below:

Insomnia: 1) insomnia complaints for 6+ months that 2) occur despite adequate opportunity and circumstances for sleep, and 3) consist of 1 or more of the following: difficulty falling asleep, staying asleep, waking up too early, nonrestorative sleep, 4) daytime dysfunction (mood, cognitive, social, occupational) due to insomnia, and 5) screening ISI score ≥ 11

Exclusion criteria: 1) unable to provide informed consent, 2) sleep disorder other than insomnia (i.e., sleep apnea [apnea/hypopnea index, AHI>15], Periodic Limb Movement Disorder-PLMD [myoclonus arousals per hour > 15]), 3) bipolar or seizure disorder (due to risk of sleep restriction treatment), 4) other major psychopathology except depression or anxiety (e.g., suicidal ideation/intent, psychotic disorders), 5) severe untreated psychiatric comorbidity, 6) psychotropic or other medications (e.g., beta-blockers) that alter pain or sleep, 7) participation in any nonpharmacological treatment (including CBT) for pain, sleep, fatigue or mood outside the current study

Drugs/Substances/Devices

- *The rationale for choosing the drug and dose or for choosing the device to be used*
- *Justification and safety information if FDA approved drugs will be administered for non-FDA approved indications or if doses or routes of administration or participant populations are changed*
- *Justification and safety information if non-FDA approved drugs without an IND will be administered*

Phase I and Phase II Behavioral Sleep Measure (Actigraphy): Actiwatch-L (ACT-L; Mini Mitter, Inc.) will be used to obtain a behavioral measure of sleep outcome. ACT-L is a wristwatch-like device that provides long-term monitoring of ambient light exposure and gross motor activity in human subjects. ACT-L utilizes an omnidirectional accelerometer (minimum sensitivity of 0.01 g-force) to measure motion by producing an electrical current corresponding to the degree of activity. The light sensor's recording range is 0.1 to 150,000 lux. For each 30 second epoch, ACT-L samples data 32 times per second, recording the peak value for each second. The peak activity count for each epoch is then downloaded to a PC and analyzed by Actiware-Sleep v.3.3 software using a validated algorithm to identify the epoch as sleep or wake (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Our participants will wear an ACT-L continuously during baseline, treatment and posttreatment (phase I:14 days; phase II: 42 days and 7 days follow up). A 30 second sampling epoch will be used (consistent with traditional PSG scoring; Rechtschaffen & Kales, 1968). The Actiware-Sleep software provides behavioral estimates for several sleep variables provided by sleep diaries and PSG: (1) sleep onset latency-interval between bedtime and sleep start; (2) total sleep time – sum of all sleep epochs within the sleep period; (3) sleep efficiency percentage – ratio of total sleep time to total time spent in bed x 100; and (4) total wake time – sum of all wake epochs within the sleep period. Although not recommended for sleep disorder diagnosis, actigraphy's greatest potential lies in its ability to measure night-to-night changes within an individual, which has great value for assessing treatment effects and other factors that

affect the consistency of an individual's sleep (Ancoli-Israel et al., 2003). In previous research with older adults, PI has experience using actigraphy (n = 124) with a 0% device failure rate (McCrae et al., 2005b). Actigraphy is minimally invasive and generally well-tolerated by participants.

Physiological Sleep Measure: In phase I of the study, participants with suspected sleep apnea will be instructed to contact their primary care physician for a full evaluation. In phase II of the study, participants with suspected sleep apnea will undergo at-home overnight Holter Monitoring (Spacelabs WA). Given that apneas result in repeated autonomic arousals associated with cyclic variations in heart rate (CVHR), we will analyze the overnight heart rate tachograms derived for the Holter Monitoring to determine whether the participant has probable sleep apnea (Stein et al., 2003). Participants with probable sleep apnea will be excluded from the study and referred to an appropriate sleep medicine specialist. Because we are proposing to use 'at home' Holter Monitoring in the participant's usual sleep environment, we will use a single night of data collection.

Heart Rate Variability – Holter monitoring (SpaceLabs, WA) will provide time and frequency domain variables (Table 4). Analyses using Pathfinder (SpaceLabs, WA) and HRV Interactive will be performed.

12 Study Statistics

- *Primary Outcome Variable*
- *Secondary Outcome Variables*

Table 1. Measure	Domain(s)	Phase 1	Phase 2
Primary Outcomes			
Daily Electronic Sleep Diaries (EDD)	pain intensity & unpleasantness, sleep (latency, wake after onset, efficiency, quality, number of awakenings, total sleep time), fatigue; sleep and pain medication consumption (i.e., name, dosage, time taken)	✓	✓
Objective Daily Sleep - Actiwatch-2□□(Philips Respironics)	sleep latency, wake after sleep onset, efficiency	✓	✓
Insomnia Severity Index (ISI)	insomnia severity	✓	✓
Pittsburgh Sleep Quality Index (PSQI)	Sleep quality	✓	✓
Secondary Outcomes			
Patient-Centered Outcomes Questionnaire (PCOQ)	patient criteria for success	✓	✓
Computerized Cognitive Assessments (Stroop, Sternberg, WCST)	Cognitive Functioning	✓	✓
Cognitive Failures Questionnaire (CFQ)	Self-reported failures in perception, memory, and motor function	✓	✓
Beck Depression Inventory-2nd Edition	Depressive symptoms	✓	✓
State Trait Anxiety Inventory (STAI)	Anxiety symptoms	✓	✓
Fatigue Severity Scale (FSS)	Fatigue		✓
Mechanistic Outcomes			
Holter monitoring (Space Labs)– heart rate variability	arousal		✓
Treatment Integrity and Process Measures			
Withdrawal Questionnaire (WQ)	reasons for withdrawal	✓	✓
Patient Satisfaction & Experience Survey	study satisfaction rating & feedback	✓	✓
Treatment Integrity			
Daily Practice Logs	assessment of enactment	✓	✓
Treatment Quiz	assessment of receipt	✓	✓

Table 2 shows when the procedures and assessments will be administered.

Table 2. Schedule of measures.	**Base**	**Tx**	**Post**	**FU**
Weeks	**1**	**4**	**1**	**1**
Online screening & clinical interviews, consent, HRV	X			
ISI, PSQI, STAI, BDI-II, CFQ, FSS, PCOQ, Online Cognition Tasks: Stroop, Sternberg, WCST	X		X	X
Electronic Daily Diaries	X	X	X	X
Actigraph	X		X	X
Tx Integrity – Delivery & Receipt, Treatment Credibility		X		
Tx Integrity – Enactment		X		

13 Statistical plan including sample size justification and interim data analysis

We will use a series of latent growth curve analyses to model changes in primary outcomes throughout the study (baseline, treatment, post-treatment). The primary outcomes variables are pain sensitivity, pain unpleasantness, sleep onset latency, total sleep time, wake duration, sleep efficiency, and sleep quality derived from the daily diaries actigraphy. We will use multilevel modeling analysis to examine changes in secondary outcomes.

Note: We have considered both general linear modeling (GLM) and multi-level modeling (MLM) approaches to the analysis of these data. The MLM approach is often used because it may offer advantages with respect to nested designs, with non-independence of within subject variables, missing data handling, and particularly for testing of hypothesized predictors of subject level of variability or trajectory across time. Though we recognize these potential advantages, we have decided to use GLM because we do not yet have sufficient information to hypothesize random effects of individuals' patterns across time. Furthermore, our missing values approach is deemed sufficient to account for any influences associated with systematic effects attributable to differential attrition. Finally, the analytic approach for hypothesized non-linear patterns are better established and more easily interpreted in a GLM approach. We do not consider the potential advantages of MLM sufficient to warrant using that approach over a GLM approach. However, the proposed data will be amenable to either GLM or MLM approaches, and should the advantages of MLM increase as a result of unanticipated patterns of missing data, or should additional information become available to guide an analysis of the prediction of variability in subject-level patterns of response, the MLM approach could be applied to our data.

14 **Potential Risks**

The interviews, questionnaires, behavioral and physiological sleep measures, and behavioral treatment procedures in this study have no associated risks. All measures have been previously used in research without causing harm. The ambulatory polysomnographic equipment and the actigraphs are generally recognized as exceptionally safe and minimally medically invasive. The procedures included in the VR

based relaxation protocol do not require the participants to engage any physically demanding or medically challenging activities. Similarly, no risk to the psychological health of participants is anticipated as a result of their confidential disclosure of information pertaining to their chronic pain and sleep-related medical histories and behavioral practices. We have experience with every procedure in this application, either in our clinical experience or in prior research, and we have not encountered harm to participants. However, at the beginning of VR-based relaxation technique, some participants may experience a mild, temporary worsening of their insomnia as the sleep/wake cycle adjusts to changes in daily sleep habits and routines. When this occurs, it typically occurs early in the course of treatment and resolves within a few weeks. To minimize this risk, the PI is a licensed clinical psychologist who is board-certified in behavioral sleep medicine (C.B.S.M., American Academy of Sleep Medicine) and has experience with the proposed treatment in both clinical and research settings. Each participant will maintain a daily sleep diary of his or her daily sleep habits (bedtimes, wake times, how much time spent awake during the night) throughout treatment. Each participant's sleep will be monitored by reviewing their logs. In the unlikely event that a participant experiences severe and prolonged sleep deterioration (greater than 1 1⁄2 hour decrease in total sleep time from baseline that is maintained for 7 consecutive days), treatment will be discontinued and the participant will be referred to his or her primary care physician for evaluation. The participant will also be provided with a referral list of local sleep disorders centers. Study personnel will also be trained to deal with depression, and participants whose responses during the screening interviews or on the Beck Depression Inventory-II indicate severe depression will be assessed for suicidal thoughts and assisted to the emergency room if danger is imminent or referred to either their physician or a mental health professional. At the start of each behavioral treatment session, participants will be questioned about depressive and anxiety-related symptoms. When applicable, the procedures just described will be followed. Participants who are diagnosed with apnea or PLMD as well as individuals with insomnia who decline to participate in the intervention portion of the study will be debriefed and referred to a local Sleep Disorder Center or their primary care physician for follow-up.

There are minimal risks associated with the thermal stimulation used for the temporal summation procedure that include minor skin redness that resolves within a few minutes to hours. All thermal testing has been approved by the local IRB and has been employed in numerous standardized protocols. The device used is also employed in clinical testing situations and has FDA approval.

15 **Recruitment and Informed Consent**

Participants will be recruited through advertisement. A multi-stage screening process will be conducted by trained study personnel. Following initial contact, the Project Coordinator will conduct a brief screening interview with interested individuals. Before the screening begins, the Project Coordinator will explain the study to the potential participant and ask his or her permission to conduct the interview. If the individual reports sleep difficulties and has not been previously diagnosed with a sleep disorder, he or she will be asked to schedule an appointment for an in-depth clinical interview (stage 1) and if applicable, a single night of in home overnight Holter Monitoring evaluation (stage 2). Before stage 1 begins, study personnel will explain the study in more detail and have the consent form signed. All questions from potential participants will be answered. In addition to the oral presentation, individuals will receive the written study consent form (approved by the University of Missouri Institutional Review Board). The informed consent form for this study will contain a detailed description of (a) the study's purpose; (b) the participant's rights, including the right not to answer any questions or to withdraw from the study at any point in time; (c) a description of the reimbursement procedure. If an individual is interested in being involved in the study, he or she will sign two copies of the consent form. The participant will keep one copy of the consent form, and the other will be collected by study personnel and returned to the Project Coordinator.

16 **Protection Against Risk**

All project staff will be instructed as to the importance of protecting participants' confidentiality. Data presentation in scientific communications will conceal the identity of individual participants. All study records will be stored in locked file cabinets and archives solely available to the PI, Project Coordinator, and other project staff.

The Project Coordinator and study staff will be trained to deal with depression and other psychological disturbances (e.g., severe anxiety). Participants who experience severe depressive symptoms (DSM-IV; American Psychiatric Association, 1994) will be assessed for suicidal thoughts and assisted to the emergency room if the danger is imminent or referred to either their physician or a mental health professional. Participants who are diagnosed with sleep disorders other than insomnia (sleep apnea, PLMD) will be referred to a local Sleep Disorders Center or their primary care physician for follow-up. The PI, a licensed clinical psychologist who is also board-certified in behavioral sleep medicine (American Academy of Sleep Medicine) will be available for consultation during the treatment period.

17 Data and Safety Monitoring Board

Data monitoring and storage:

All data will be kept in locked cabinet in the MizZzou Sleep Research Lab (MUPC 3024). Only individuals of the research team will have access to the data. Each participant will be assigned a research ID. The linkage between identifying information and research ID (consent form) will be stored separately, in the PI's office (MU 3009).
Electronic data will be stored within the MU secure network.
PI is a licensed clinical psychologist. She will be monitoring the safety of participants throughout the study. For instance, if any unexpected and negative changes in sleep occur, PI may end the participant's participation and refer for appropriate care. If any unexpected negative emotional disturbances occur, PI and interventionists will conduct risk assessment and refer participant for appropriate care if needed.

18 Benefits

Description of the probable benefits for the participant and for society.

Potential Benefits of the Proposed Research to the Subjects and Others
Participants who complete the VR based relaxation technique are expected to show substantial improvement in sleep as well as improvements in pain. There may also be associated improvements in daytime functioning outcomes including depression, anxiety, fatigue, and insomnia impact. Thus, the potential benefits associated with participation appear to outweigh the small potential risk that some participants may experience a mild, temporary worsening of their insomnia as the sleep/wake cycle adjusts to changes in daily sleep habits and routines.

19 Payment and Remuneration

Detail compensation for participants including possible total compensation, proposed bonus, and any proposed reductions or penalties for not completing the protocol.

Participants will be compensated for their time and effort.

First Phase of Study:

Participants will receive $15 for baseline assessments and an additional $20 at the end of the study. They will be compensated an additional $5 for travel expenses ($5 x 3 = $15). The total amount a participant would receive upon completing the study would be $50.

Second Phase of the Study:
Participants will receive $25 for baseline assessments and an additional $35 at the end of the post treatment. Participants will also receive $35 for completion of follow up assessments. Participants will also be paid an additional $5 travel allowance for each study visit ($5 x 6 study visits = $30). The total amount a participant would receive upon completing the study would be $125.

20 Costs

Detail costs of study procedure(s) or drug (s) or substance(s) to participants and identify who will pay for them.

Participants will not be required to pay for any of the study procedures or devices involved. Internal funds of the PI, Dr. McCrae, from the Department of Psychiatry will be used to cover for all costs of this study.

References

List of references supporting research question.

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