PROTOCOL

Study Title: A Closer Look at Yoga Nidra: Sleep Lab Analyses

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A.0 ABSTRACT: Extended sleep onset latency (SOL), more simply described as difficulty falling asleep or "sleep onset insomnia" can increase risk for a variety of health conditions. Regular early start times for work in industrialized nations lead to shortened total sleep time for those who have trouble falling asleep at night. This shortened sleep duration leads to increased risk of: death from coronary heart disease (48% for those sleeping less than 5 hrs per night as compared to 6-8hrs); fatal and non-fatal strokes (15%); and all-cause mortality (12%), [1]. Sleep disorders persist in the US, despite existing pharmaceutical and behavioral remedies, with 10-15% of our total population suffering from insomnia symptoms and 6-10% having clinically diagnosable insomnia [1, 2]. Mind/body therapies offer additional solutions to this problem. Select studies have correlated meditation with decreased SOL[3], however there is a need for more research on the use of such techniques as possible therapeutic alternatives or supplements to the standard of care. The guided meditation practice of yoga nidra (literally translating as "yogic sleep") is a promising intervention for treatment of sleep disorders, due to its purported ability to induce a deep state of mental, physical and emotional relaxation. Reputed to be four times more restful than sleep, this practice has effects on the brain and body that are thus worthy of exploration. In this pilot study we address feasibility questions including: acceptability of our intervention conditions, credibility of yoga nidra as a possible treatment for insomnia, and appropriateness of our selected measurement systems to monitor effects of yoga nidra on the brain and body. We further aim to investigate the impact of yoga nidra on autonomic nervous system (ANS) tone as a potential mechanism through which SOL may be reduced. Changes in ANS tone will be measured via heart rate variability (HRV) parameters and respiratory rate. Changes in brainwave activity associated with yoga nidra and sleep onset will be measured using electroencephalography (EEG). Our study sample includes twenty-two adults between the ages of 18 and45 who report difficulty falling asleep. Our study sample includes twenty-two adults between the ages of 18 and 45 who report difficulty falling asleep but do not reach criteria for "severe" clinical insomnia and do not take sleep medications. Each participant will visit our clinic twice: the first visit will include "lying quietly" for 30 minutes followed by 1 additional hour of continued monitoring in case sleep onset occurs. The second visit will include randomization into one of two groups: (1) intervention: 30 minutes of listening to a standardized recording of yoga nidra and 1 additional hour of continued monitoring in case sleep onset occurs; or (2) "lying quietly" for 90 minutes (baseline control). Feasibility outcomes as well as changes in parameters associated with SOL detected herein will be used to inform the design of future clinical studies of yoga nidra and its impact on SOL.

B.0 SPECIFIC AIMS

B.1 Specific Aim 1: to measure patterns of electrical brain activity via electroencephalography (EEG) (Thought Technologies® EEG device attached to frontal lobe, central lobe, occipital lobe, eyes and chin sites) before, during, and after the practice of yoga nidra, compared to a control condition of lying quietly, in order to determine:

B.1.a: If yoga nidra induces changes in brainwave activity measurable by our EEG system

H0: There are no differences in patterns of brain electrical activity between yoga nidra and control, indicating that (a) the EEG system we have selected is not sensitive enough for use in this intervention, (b) changes produced do not occur in the electrode sites we have selected, or (c) yoga nidra does not induce changes in brainwave activity

H1: There are mean differences in EEG power in alpha, theta, beta and/or delta bands originating in the frontal, occipital and/or central lobes between yoga nidra/control.

B.1.b: If sleep can be detected using our EEG measurement system and analysis of raw data by registered sleep study scoring technologists at Sleep Strategies™

H0: Sleep is not detected, indicating (a) our system is not capable of detecting sleep, or (b) our intervention does not induce sleep.

H1: Sleep is detected in the intervention group and/or the control condition

B.1.c: If time to sleep onset (sleep onset latency SOL: minutes from the start of the intervention to when a persistent NREM 2 brainwave pattern begins) differs between intervention and control

H0: There is not a significant difference in mean SOL between intervention and control

H1: Mean SOL is decreased with the intervention, relative to the control.

B.2 Specific Aim 2: to measure patterns of respiratory rate (RR) via the wireless Spire® device; and heart rate variability (HRV) via the wireless Bodyguard 2® electrocardiogram (ECG) device before, during, and after yoga nidra, compared to a control condition of lying quietly, in order to determine:

B.2.a: If yoga nidra induces changes in HRV and RR that are measurable by our selected system

H0: There are no differences in patterns of RR or HRV between yoga nidra and control indicating that (a) yoga nidra produces no changes to RR or HRV, or (b) our measurement system is not sensitive enough.

H1: Mean RR decreases, high frequency (HF) HRV parameters increase and/or root mean square of successive differences (RMSSD) in HRV parameters increase with intervention vs. control

B.2.b: If it is feasible to use these devices in our clinic, to measure changes in HRV and RR during and after yoga nidra; and if data from these devices can be successfully extracted and analyzed.

H0: One or both of these devices pose challenges that cause them to be impossible to use for collection of data; or impossible to use due to challenges in retrieving or analyzing the data gathered.

H1: Both devices can be successfully applied and used for measurement during this study; and our study team is able to retrieve and analyze relevant data from these devices.

B.3. Specific Aim 3: to assess feasibility of our intervention, in order to determine:

B3.a: If our intervention is viewed as credible for supporting healthy sleep within our population, indicated in the Post-Intervention Survey by experience of benefit ratings on a slider scale (range: not beneficial to very beneficial)

H0: The intervention is not credible for the proposed use, indicated as all ratings below 50%

H1: The intervention is viewed as credible for use in decreasing SOL in our selected population, indicated through 1 or more ratings above 50%

B3.b: If intervention conditions are acceptable, as indicated by recruitment and retention rates.

H0: Conditions are not acceptable, as indicated by an inability to recruit twenty-two participants for our proposed study within one three months and/or a dropout rate greater than 50%.

H1: Conditions are acceptable, indicated by a dropout rate below 50% and ability to recruit twenty-two participants within three months.

C.0 BACKGROUND AND SIGNIFICANCE: Up to 15% of the US population has difficulty falling asleep at night [2]. This disorder, known as "sleep onset insomnia", combined with early work start times in industrialized nations can lead to significantly shortened nightly sleep durations. Short sleep durations lead to increased risk of: death from coronary heart disease (48%), fatal and non-fatal strokes (15%), and all-cause mortality (12%)[1]. Current approaches to decreasing sleep onset latency (SOL), or the time it takes to fall sleep, include prescription drugs, supplements, and behavioral change. Hypnotic sleeping pills (*e.g.* benzodiazepine, Z hypnotic or barbiturate) which offer little benefit [4, 5]can be costly, and carry risks including death from overdose (with hypnotics causing thousands of deaths per year and increasing risk of opioid overdose), depression (respiratory and mood: causing cardiac arrest and suicide), and automobile crashes (with hypnotics involved in over half of reported intoxication/dangerous driving deaths)[4, 6, 7]. Melatonin supplements, which are not recommended for pregnant/breastfeeding women, carry unknown long-term side effects (especially for children and adolescents), may interact with drugs (*e.g.* caffeine and birth control) processed by the CYP liver enzyme that increase plasma melatonin, and additionally interact with hypnotics to cause psychomotor and memory impairment[8]. Behavioral approaches, which include diet and lifestyle change (*e.g.* modifying caffeine and alcohol consumption, practicing sleep hygiene, and increasing exercise) [9, 10], require significant will power, commitment, and time-investment [11, 12]. Mind/ body techniques such as yoga, may offer additional remedies [11, 13-15], yet few of these methods have been subjected to formal research[2].A meditative practice that is seemingly most appropriate for addressing insomnia but which has yet to be studied, is yoga nidra (literally translated to mean "yogic sleep"); a practice that naturally induces a hypnogogic state without use of hypnotics.

Yoga nidra is a scripted and reproducible, guided relaxation technique that facilitates the transition between waking and sleeping. It is estimated that the average person actually sleeps during 10-50% of a yoga nidra practice [6]. Traditionally, yoga nidra has been used to treat insomnia by practicing before bed. Treatment includes basic sleep hygiene [16], and physical postures (called asanas) before yoga nidra, in order to reduce restlessness, pain, stiffness and tension that could prevent focus during the practice. In similarity to other meditative and progressive relaxation techniques, the practice of yoga nidra is said to produce significant physical relaxation (clinically characterized by increased parasympathetic (PNS) response[17-19] and decreased muscle tension [19]). Unique to yoga nidra, however, is the additional release of mental and emotional tensions. During yoga nidra, mental tension is released by rotating awareness throughout the body, following the mapping of the motor homunculus [6, 20, 21]. It is proposed that by sending a signal from body to brain, following the same pattern as this neuronal map, the mind is progressively relaxed [6]. Emotional release is then evoked through systematic arousal of feeling, sensation and experience. Further mental relaxation is achieved during a guided visualization practice to follow. Yoga nidra additionally involves techniques such as sense withdrawal, breath awareness, and the creation of a resolve; all practices with may encourage physical relaxation and decrease anxieties before sleep. Practitioners of yoga nidra state that although everyone sleeps, many of us hold onto anxieties, pain, and emotions throughout the night that cause us to wake feeling unrested. Yoga nidra creates a period of true restfulness: free of mental, physical and emotional tension. Performed while lying down, this practice is described as "sleep after throwing off the burdens". Little formal research on yoga nidra has been done in the US and most claims are anecdotal. However, unpublished studies from India have shown that during yoga nidra, alpha brainwave activity increases: a change that also occurs during the process of falling asleep[6]. Increased alpha brainwave activity has been reported during other forms of meditation as well in studies that also note decreased respiratory rate (RR) [3, 22-25]. One study has shown yoga nidra to increase heart rate variability (HRV) when practiced after hatha yoga,

but also when practiced without hatha yoga movements beforehand[26]. Individuals with insomnia have chronically elevated RR[27], as well as sympathetic nervous system (SNS) activity [18, 27], both of which may contribute to their difficulties falling asleep. It is possible that yoga nidra may decrease SOL by lowering both RR and SNS activity while also facilitating the transition into an alpha brainwave state that immediately precedes sleep.

The goal of our proposed research is to investigate the effects of yoga nidra on brainwave patterns, heart rate variability (HRV), and respiratory rate (RR) as possible indicators of the ability of this practice to induce sleep onset. We also address feasibility questions including: acceptability of our intervention conditions, credibility of yoga nidra as a possible technique to support healthy sleep and reduce symptoms of sleep onset insomnia, and appropriateness of our selected measurement systems to monitor effects of yoga nidra on the brain and body. Our population includes 22 adults between the ages of 18 and 45 who suffer from insomnia and do not take sleeping medications. Each participant will visit our clinic twice. At each visit we will take two hours of measurements: capturing the yoga nidra practice as well as a resting period afterwards. The first visit will involve lying quietly as a baseline control to replace yoga nidra. At the second visit, half of the population will participate in yoga nidra and the other half will continue to practice the baseline control of lying quietly. This design will unveil and account for any "first night" effects, wherein a participant may feel more comfortable at the second visit, due to familiarization with the environment. Feasibility outcomes and physiological changes detected during this study will be used to inform future research designs related to yoga nidra and sleep onset.

D.0 PERSONNEL AND PRELIMINARY DATA

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D.2 Preliminary Data: The purpose of this intervention is to gather preliminary data for our future clinical pilot study on yoga nidra and insomnia in adults.

E.0 RESEARCH DESIGN AND METHODS STUDY FLOW

E.1. Overview: In this intervention we will explore the physiological effects of yoga nidra. We will measure patterns in brainwave activity, respiration and heart rate variability using EEG, and two wireless devices: the Spire® breath monitor and the Bodyguard® HRV monitor. We also address feasibility questions related to credibility and acceptability, using self-report surveys, drop-out rates, and participant feedback. Twenty-two participants will be recruited using digital and paper advertisements throughout Portland and NUNM. Interested individuals will call or email our clinic. Our study coordinator will set up a screening call with all potential participants. She will ask general questions and use standardized surveys to exclude participants based on criteria described below. Those who pass the telephone screening will then be invited for two visits to our clinic where they will undergo two hours of measurements each. Each visit will involve completion of a consent form and a few intake surveys. The measurement periods will involve: 10 minutes of baseline data collection, thirty minutes of lying quietly or listening to a recording of yoga nidra, and then 1 hour of resting comfortably. Participants will be allowed to fall asleep during this time and they will be left alone in the room with the lights out during the entire intervention (after baseline data collection). When finished, participants will complete a few short questionnaires before their departure. The first visit will involve lying quietly as a baseline control At the second visit, half of the population will be randomly selected to do yoga nidra and half will complete the baseline control measurements again. See **Tables 1-3** for a detailed description.

Table 1. Recruitment/Screening. If potential participants pass all surveys shown in this table, they will be scheduled for two clinic visits.

	Telephone Screening Surveys	
	Insomnia Severity Index (ISI)	**Baseline-Intake**
Requirements to pass	8-21 (subclinical insomnia to clinical insomnia, moderate severity)	Age 18-45, limited substance use, no diagnosed fibromyalgia, no use of sleeping pills. See **Table 4** for more.

Table 2. Intervention Outline

	Schedule	Consent	Arrival Surveys	Physiological Measurements			Exit Surveys		
		CF	***STOP-BANG, PreI, *PHQ-2 to PHQ-9, , *GAD-7, *PSQI, *PROMIS-29, PANAS, STAIY-6**	**RR**	**EEG**	**ECG**	**PANAS**	**STAIY-6**	**PE**
Clinic Visits **Visit 1: V1** **Visit 2: V2**	Check-In	V1 only	*V1 only. Exclude participants and give medical referral if PHQ-9 score is 10 or more, and/or if they answer "yes" 3 or more times on STOP-BANG survey.						
	Pre-Practice Baseline: 5 min eyes open 5 min eyes closed								
	#During Practice: Visit 1: 30 min lying quietly ^Visit 2: 30 min yoga nidra or 30 min lying quietly								
	Nap-time: 1 hour of rest or sleep								
	Check-out								

#Study Coordinator will turn out the lights and leave the room for the practice and nap time. A sound monitor will be in the room, in case there is need for assistance.
^ Participants will be randomized using the attached randomization plan, generated using the website: www.randomization.com, one block and 22 subjects.

Table 2 Abbreviations: Consent Form (CF), Pre-Intervention Survey (PreI), Positive Negative Affect Schedule (PANAS), State Trait Anxiety Inventory (STAI Y-6), Patient Health Questionnaire (PHQ-9), Sleep Apnea Survey (Snoring, Tiredness, Observations, Pressure, BMI, Age, Neck, Gender (STOP-BANG), Generalized Anxiety Disorder (GAD-7) Survey, Pittsburgh Sleep Quality Index (PSQI), Patient Reported Outcome Measurement Information System Tool-29 (PROMIS-29), Respiratory Rate (RR), electroencephalogram (EEG), electrocardiogram (ECG), Post Intervention Exit Survey (PE).

Table 3. Measurement Tools/Forms and their Purpose

Name of measurement tool	Abbreviation	Standardized	Recall Period	Purpose
Patient Health Questionnaire	PHQ2/ PHQ9	Y	2 weeks	Depression screener used in recruitment.
Insomnia Severity Index	ISI	Y	14 days	Insomnia assessment
Baseline Intake	-	N (in house)	General	To gather: contact information; demographics (age, gender, menopause, ethnicity, language, ability to hear); and information on substance use (alcohol, stimulants, sleeping pills, cannabis), lifestyle (disruptions to sleep, shift work, mind/body practice), and comorbidities(a diagnosis for any of the following: fibromyalgia, sleep apnea, insomnia or depression)
Sleep Apnea Screener	STOP-BANG	Y	General	To predict sleep apnea based on: **S**noring, **T**iredness, **O**bservations of interrupted breathing, blood **P**ressure, **B**MI, **A**ge, **N**eck circumference, **G**ender (STOP-BANG)
Positive/Negative Affect Schedule	PANAS	Y	Moment	Assessment of mood (20Q's) before/after visit.
State Trait Anxiety Inventory Y-6	STAI Y-6	Y	Moment	Anxiety measurement (7 Q's) before/after visit
Consent Form	CF	N (in house)	General	To confirm participant willingness to participate in the study
Pre-Intervention Survey	PreI	N (in house)	Moment	Assessment of participant perceptions about the intervention before they experience it.
			One day	Documentation of behavior and substance use in the last 24 hours (exercise, alcohol, caffeine intake, sleep quality, tiredness and restedness)
Generalized Anxiety Disorder Survey	GAD-7	Y	2 weeks	Anxiety assessment (7 Q's) used in recruitment
Pittsburgh Sleep Quality Index	PSQI	Y	30 days	Sleep quality assessment
Patient-Reported Outcomes Measurement Information System	PROMIS-29	Y	7 days	Assessment of disturbed sleep, depression, anxiety, pain, and other health outcomes
Respiratory Rate Monitor, Spire®	RR	-	Real-Time	To gather data on breathing rate
Electroenchephalograph, ProComp Infiniti,	EEG	-	"	To gather data on brainwave patterns
Electrocardiograph, BodyGuard2®	ECG	-	"	To gather data on heart rate variability (HRV)
Post-Intervention Exit Survey	PE	Y	2 hours	Documentation of participant perceptions of the intervention after experiencing it, and feedback about intervention conditions

E.1.1 Subjective Outcome Questionnaires:

Patient Heath Questionnaire (PHQ-2 and PHQ-9): Validated surveys used during Visit 1 to determine depression as perceived over the past two weeks. Individuals with scores indicating possible depression (3 or more points on the two-question PHQ-2 survey), will be asked the remaining 7 questions on the PHQ-9 survey. Those with scores indicating moderate depression (10 or more on the PHQ-9) will be excluded from the study. This survey correlates well (r=0.75) [28]to the popular 21-question Beck Depression Index, which assesses depression in the present moment, however the PHQ-9 provides a more general assessment of depression during the past two weeks, using just nine questions. Cronbach's alpha score: 0.89 ([29]. If participants indicate moderate depression (score of 10 or more), they will be advised to contact their primary care physician. They will also be provided with a resource list of affordable options for care. If suicidality is perceived, they will immediately be given the number for a help-line.

Insomnia Severity Index (ISI): Validated survey used during the phone screening to determine insomnia severity. Here, we ask participants to recall sleep during the past two weeks, to determine if they may have insomnia. Individuals with scores indicating insomnia in the range of sub-clinical to moderately severe clinical insomnia as measured by the Insomnia Severity Index (score between 8 and 21). will be included. Cronbach's alpha score: 0.90 [30]. Those who score above 21 on the phone screening will be read a medical referral.

Baseline Intake: In-house survey used during the phone screening, to gather information on gender, age, socioeconomic status, education, languages spoken and ethnicity. We will assess use of cigarettes, cannabis, sleeping pills, stimulants, and other drugs. Participants will also be asked if they do shift work, have a regular mind/body practice within the last six months, or have any clinically diagnosed comorbidities including: fibromyalgia, sleep apnea, deafness or depression; all of which are exclusion criteria.

STOP-BANG: Validated survey used at Visit 1 to determine likelihood of having sleep apnea. Participants will be excluded for the likelihood of having sleep apnea, if they answer yes to 3 or more questions (involving: snoring, tiredness, observed interrupted breathing, blood pressure, BMI, age, neck circumference and gender). Analysis of this instrument revealed that with minimal information requested, it is adequate for use in informal diagnosis. Chronbach's alpha score of 0.74[31].

Positive/Negative Affect Schedule (PANAS): Validated survey used to determine mood as perceived in the moment. This survey will be used before and after each visit to determine if the practice has any effect on positive or negative affect, which are independent of one another and may also affect sleep. Cronbach's alpha score: NA of 0.87 and PA of 0.88[32].

State Trait Anxiety (STAI): Validated survey used to determine anxiety as perceived in the moment. This survey will be used before and after each visit to determine if the practice has any effect on anxiety, which may also affect sleep. Cronbach's alpha score: 0.89 for total scores [33]

Pre-Intervention Survey (PrI): In-house survey taken before each visit. Participants will use a slider scale to indicate how credible they view the upcoming intervention to be, as a method for reducing symptoms of insomnia and as a relaxation technique (mental, physical and emotional). They will also be asked about exercise, caffeine intake and alcohol/substance use during the 24 hours prior to the intervention, as well as about their sleep quality the night before and how they feel at the moment (how tired or rested they are).

Generalized Anxiety Disorder (GAD-7) Survey: Validated survey administered at the start of the first visit, to determine anxiety as perceived over the past two weeks. This survey correlates moderately with the widely used Penn State Worry Questionnaire (r=0.51-0.71). Cronbach's alpha score: 0.79-0.91 [34].

Pittsburgh Sleep Quality Index (PSQI): Validated survey administered at the start of the first visit, asking to recall sleep during the past month, to determine the quality of sleep. Scores of 5 or more indicate poor sleep quality. This survey correlates with other surveys used herein: the PHQ-9 (0.49), and the GAD-7 (0.46). Cronbach's alpha score: 0.57[35].

Patient-Reported Outcome Measurement Information System Tool (PROMIS-29): Validated survey administered at the start of the first visit, asking to recall the past 7 days to assess sleep quality, anxiety, depression, pain, and more. Cronbach's alpha score: 0.87-0.97[36].

Post Intervention Exit Survey (PE): In-house survey. Participants will use a slider scale to indicate how credible they now view this intervention to be, as a method for reducing symptoms of insomnia and as a relaxation technique. They will also be asked about intervention acceptability/tolerability (comfort, challenges, comments, etc.), and about how they feel (rested or tired).

E.1.2 Objective Outcomes:

Respiratory Rate (RR): respiratory rate will be measured using a portable device (the Spire®) worn on the belt. This device is popularly used and attracting research interest[37].

Electroencephalogram (EEG): brainwave patterns will be measured using a Thought Technologies ProComp Infiniti System® for EEG measures, with electrodes attached to one frontal lobe location (F3), a central lobe location (C3), an occipital lobe location (O1), both eyes (EOD), and the chin. A grounding electrode will be attached to the ears, and a reference will be placed on one mastoid bone (M2, behind the ear).This device has been used in research for measurement of various physiological parameters [38, 39]. For our study, we will look at mean EEG power, calculated from frequency and amplitude of brainwaves originating from the frontal, central and occipital lobes of the brain. Electrodes for brainwave monitoring will be placed on detection sites for frontal, central and occipital lobes. One electrode will be placed on the chin for assessment of muscle tone during REM sleep. Electrodes placed near the eyes will be used to detect slow eye rolling during sleep onset. This EEG set-up or "montage" complies with the American Academy of Sleep Medicine guidelines for detecting sleep using EEG[40].

Electrocardiogram (ECG): heart rate variability will be measured using a portable wire-less device called the FirstBeat Bodyguard 2 ®. This device has been validated against a clinical ECG with off-line R-wave detection. It was found that the Bodyguard 2 has a high beat detection rate and provides accurate HRV analysis in many conditions (*i.e.* siting, lying, standing, walking, etc.)[41]. For our study, we will focus on detection of high frequency (HF) HRV parameters, as well as root mean square of successive differences (RMSSD) in HRV values, to determine parasympathetic response, or more simply, relaxation[42].

E.2 Recruitment: Twenty-two study participants will be recruited using online advertising, flyers, and newspapers distributed throughout the NUNM campus and the city of Portland. Other advertising methods will be used as needed. A telephone screening will be used to select the most appropriate participants for our study. We also have a list of individuals who expressed interest in a recent NUNM Study (the PYAMA study), and who stated that they would be willing to be contacted again for future studies. Our study coordinator will send the attached email to them, asking if they would like to participate in our study.

E.2.1 Sample Size Calculation: We have calculated our sample size considering changes in EEG power for alpha frequency bands measured by other researchers studying meditation and brainwave activity. In one study of thirty-four novice meditators exposed to mindfulness meditation and then a non-meditative condition, a 10% increase in alpha power was observed in the occipital lobe (29 $(\mu V)^2/Hz$ with a 6% pooled standard deviation of 19$(\mu V)^2/Hz$)[22] during meditation as compared to the control condition. This increase in alpha activity during meditation and yoga nidra agrees with previous reports [6, 22, 23]. Assuming our intervention will at least match the power observed by Ahani (29 $(\mu V)^2/Hz$), and allowing for the same measurement error (6%), a 90% power, and a 5% alpha, our sample size equation is as follows: $N= 2((1.96 + 1.2816)^2(19)^2)/(29)^2$. This yields a sample size of 9 individuals per study arm. With a predicted 20% dropout rate, we plan to recruit 11 individuals into each of two study arms, requiring 22 participants. Visit 1 will be the same for all 22 participants, and involve lying quietly and getting adjusted to the environment. At Visit 2, the participants will be randomized into two groups (lying quietly vs. yoga nidra). It should be noted that change in theta power has also been largely observed during meditation [3, 23, 43]. The above referenced study [22]detected a 70% increase in theta power during mindfulness meditation in novice meditators. Using our proposed sample size of 11 per arm, and the pooled standard deviation for theta values found by Ahani, *et.al.* 2014 (13%, [22]), a change as low as 66% theta power could be detected using an 80% power. With this sample size, we are well powered to detect clinically significant, previously observed changes in EEG power in the alpha and theta bands generated from the occipital lobe during meditation and yoga nidra.

E.3 Description of Participant Population:

E.3.1 Inclusion Criteria Participants must be between the ages of 18-45. They must speak English and be able to listen to a recording while resting comfortably. Participants must report disrupted sleep that indicates insomnia in the range of sub-clinical to moderately severe clinical insomnia as measured by the Insomnia Severity Index (score between 8 and 21).

E.3.2 Exclusion Criteria If a participant does not speak English or cannot hear they must be excluded from this intervention. We will exclude candidates with co-morbidities including sleep apnea (clinically diagnosed or classified using a STOP-BANG survey score of 3 or more), and moderatedepression (indicated by a score of 10 or more on the Patient Health Questionnaire (PHQ-9). See **Table 4**, Exclusion Criteria for other exclusions, and **Table 1** for surveys used in recruitment.

E.3.3 Considerations: Participants who are unable to lie on their back can assume another comfortable position. General anxiety will be documented in our population using the Generalized Anxiety Disorder (GAD-7) survey, upon intake. Comorbidities including any diagnosed disease/disorder will be documented, along with any regular substance use that is not grounds for exclusion from this study (alcohol use, caffeine use, medications, etc.).

Table 4. Exclusion criterion and rationale

Exclusion	**Rationale**
Regular Mind/ Body Practice (within last 6 months)	My affect response to yoga nidra
Younger than 18 or older than 45	Non-minors and pre-menopausal women
Sleep Apnea (STOP-BANG survey)	Interference with sleep quality
Sleeping pills	Possible masking of intervention effect
Moderate Depression (PHQ-9)	Interference with sleep
Unavoidable disruptions to sleep (*e.g.* new baby, pet or other dependent)	Insomnia may not be the issue
Stimulant use	Disrupted sleep
Opioid/illegal drug use	Disrupted sleep
Cannabis use within the last 30 days	Possible masking of intervention effect
Shift work	Irregular sleep patterns/ disturbed circadian rhythms/insomnia may not be the issue
Alcohol (> 14 drinks per week)	Interference with REM sleep
Smoke cigarettes	May interfere with relaxation effects of yoga nidra

E.4 Screening for Eligibility: Prospective participants will call or email our study coordinator using information advertised on the flyer, on the NUNM webpage, and using other available advertising methods (online, newspaper, TV, etc.). Our study coordinator will them set up a phone call with them. She will use screening tools that inquire about age, demographics, comorbidities, lifestyle and more (as seen in **Tables1-4)** to determine eligibility for our study. Two additional surveys will be administered at Visit 1, to confirm eligibility. One of these two surveys requires the study coordinator to take measurements such as neck circumference and blood pressure, and thus must be completed in person.

E.5 Screening Visit: The telephone screening is our first requirement to join the study. Once individuals pass the phone screening they will be scheduled for two clinic visits. See **Tables1-** Further screening will occur using two additional questionnaires, as well as measurements taken by the study coordinator, at the beginning of Visit 1.

E.5.1 Procedures during the telephone screening: The following surveys and questions will be used for determining eligibility. All surveys and questions are built directly into Redcap. The study coordinator will enter all information into this secure server during the phone screening.

Insomnia Severity Index (ISI): This survey score will be used as our exclusion criteria for insomnia. It will be scored using the instructions found on the survey footer. Poor sleep) will be identified using a score of 8-21, indicating a range of insomnia symptoms that correlate with subclinical to moderately severe clinical insomnia . Only those participants who score in this range during the telephone screening will be invited to schedule their clinic visits. Participants with scores of 22 or more will be referred to see a medical professional.

Baseline Intake Survey: Demographic data will be analyzed by gender, ethnicity, socioeconomic status, and education. All parameters will be presented as percentages. Age will be used as a recruitment filter, with only those individuals ages 18-45 being included in our study. Additionally, we will ask if potential participants can understand English and if they can hear. Answering yes to both questions will be required for inclusion, as our intervention is a recording in English. Substance Use and Lifestyle: Individuals who do any of the following will be excluded: consume more than 14 alcoholic drinks per week; regularly use cannabis (within past 30 days); regularly use restricted substances, or abuse drugs (stimulants, depressants/opioids, etc.); use sleeping pills; have a regular mind/body practice (within past 6 months). Comorbidities: Participants will be excluded if they answer yes to having fibromyalgia. Sleep apnea, and depression will be screened for at visit 1 as sleep may be affected by these conditions.

In order to determine if prospective participants have un-diagnosed depression or sleep apnea, we will ask them to complete the two surveys below at Visit 1. These surveys will be completed after signing the consent form and completing the pre-intervention expectancy survey. Once these two surveys are complete, the study coordinator will make a decision to continue the visit or exclude the participant based on these results.

Patient Heath Questionnaire (PHQ-9): This survey score will be used as our exclusion criteria for depression. It will be scored using the instructions found in the PHQ-9 instructions from the Stable Resource Toolkit. Individuals with moderatedepression (indicated by a score of 10 or higher) will be excluded from the study. Participants with a score below 10 will be allowed to continue on with their two scheduled clinic visits.

STOP-BANG: Using this questionnaire, the likelihood of having sleep apnea will be determined, based on **s**noring, **t**iredness, **o**bservation of apnea, blood **p**ressure, **B**MI, **a**ge, **n**eck circumference, and **g**ender. The study coordinator will complete the survey by asking the participant questions as well as taking measurements at the beginning of Visit 1.Measurements taken by the study coordinator at this time will include: blood pressure, height, weight, BMI, and neck circumference. Scoring will be accomplished using directions on the survey itself. If the answer is "yes" for three or more criteria, they are high-risk for having sleep apnea, and they will be excluded. These participants with scores indicating likely sleep apnea will be referred to see a medical professional.

E.6 Experimental Groups (or Cohorts)

E.6.1 Control Condition: Participants will act as their own baseline control by lying quietly for 90 minutes during Visit 1.

E.6.2 Experimental Condition: Half of the participants will be part of the experimental group by listening to a yoga nidra recording during the first 30 minutes of the 90 minute measurements taken Visit 2. Participants will be randomized according to the Randomization Plan (in Appendix 1) upon their arrival at Visit 2.

Note: In all cases and at all visits, before the 90 minute measurement period, an impedance check will be performed and sensors will be adjusted as needed to insure that all EEG electrodes are collecting high quality data. Then baseline measurements (5 minutes eyes open and 5 minutes eyes closed) will be taken. Accounting for these activities, participants will be prepared for two hour measurement periods.

E.7 Informed Consent: At the beginning of Visit 1, participants will be given a consent form that outlines the research and the information we aim to gain from this study. They will be given ample time to read this form and offer their signature if they wish to participate. The study coordinator or a PI, to the best of their abilities, will answer any questions. Further questions about participant data or safety will be forwarded to the IRB.

E.8 Data Collection and Sources

5.8.1 Confidentiality and Data Storage: All participants will be assigned a number when they join the study. This number will be used on all forms and all electronic data. Names, assigned numbers, and contact information will be stored in an Excel sheet, saved only by the study coordinator on an encrypted computer. All paper surveys, questionnaires, and PHI will be stored in a secure location at the Helfgott Research Institute. All digital surveys will be administered through the secure RedCap server.

5.8.2 Data Integrity: Every effort will be made to ensure confidentiality and to keep any shared personal health information confidential. We will protect PHI by limiting use of identifying data. Names will be replaced by numerical codes on all study documents. We will make an effort to ensure confidentiality by limiting where names and identifiers are stored. Identifiers will only be recorded in necessary locations such as our file matching names to numerical codes used in the study.

The first time the "Participant ID" (the code that will replace the name) appears is on the telephone survey. The study coordinator will assign the code at the very end, once the participant passes the screening. This document will thus contain the only connection between identifying information and the ID code. It will not be shared outside of our study team, and will only be accessed on a case-by-case basis; for withdrawals for example. We have additionally added "Participant ID" boxes to the beginning of each RedCap survey. This ID will be used to organize surveys for analysis without use of identifiers.

E.9 Risks and Benefits:

E.9.1 Risks: Although we will make every effort to protect your identity, there is a minimal risk of loss of confidentiality. Yoga nidra is a mind/body meditative practice, which involves mental, physical and emotional release and relaxation. Risks may include bringing up possibly upsetting memories, or emotions. If suddenly woken, participants may become startled, dizzy upon standing, and/or disoriented. Measurements will involve the placement of EEG sensors on the participants' heads using gel as an adhesive. There may be minimal discomfort from the gel and electrodes, worn on the top and back of head, the eyes, and the chin, with a grounding electrode on the ear, and a reference electrode behind the ear. HRV will be monitored using an adhesive sensor on the chest. Though this sensor is small and wireless, there may be minimal discomfort or distraction from wearing the device or from the adhesive used. There could be additional risks that we are unaware of at the time of the study. If you experience any side effects while participating in the study, please contact Erica Sharpe at esharpe@nunm.edu as soon as possible.

E.9.2 Benefits: There is no guarantee that participants will receive any benefit from this study. However, participation will help us learn more about yoga nidra as a possible intervention to address insomnia in adults, and will also be useful for assessing feasibility of this intervention as a whole. It is possible participants may receive benefit from the practice of yoga nidra. These practices may have mental, physical and emotional benefits including relaxation, emotional release, and mental relaxation.

E.10 Data Analysis: Quantitative data collected from all digital and paper surveys will be analyzed by our biostatistician. Digital RedCap surveys will be exported as de-identified data (using numbers instead of names) to Excel, analyzed and stored in an encrypted computer at Helfgott. Information attained from the telephone screening visits will be documented by the study coordinator and stored on an encrypted Helfgott computer. Objective measurements of RR, EEG, and ECG will be exported to a local, encrypted computer, de-identified and analyzed.

E.10.1 Specific Aim 1: Electroencephalogram (EEG) Analysis: All EEG data will be exported and sent to Sleep Strategies for detailed analysis. This company will be able to determine time to sleep onset, as well as other aspects of sleep architecture (stages of sleep including NREM1-3 and REM, waking after sleep onset, and sleep duration).

Data Pre-Processing: For each frequency band (beta: 13-35 *Hz*; alpha: 8-12 *Hz*; theta: 4-7.5 *Hz*, and delta: 0.5-3.5 *Hz*) the amplitude of all waves in that category are automatically averaged by our ProComp Infinity software during each of several steps in the yoga nidra practice (*i.e.:* introduction and resolve, rotation of consciousness, awareness of breath, feelings and sensations, visualization, repetition of resolve and end of practice). The instrument will output mean EEG amplitude for each frequency band (alpha, beta, theta, and delta) for each step of the practice, and for each matched time interval during the baseline control of lying quietly. All amplitude measurements will then be converted to power by squaring the amplitude and dividing by the median frequency of the brainwave band we are interested in (alpha, beta, theta or delta).Artifact removal will be performed by eliminating data points above a 200uV threshold (representing high voltage durations) and below 2uV (representing flat channel effects)[22].These EEG power values will be used for the following analyses.

Specific Aim 1, Outcome 1: We will determine the change in EEG power in the alpha, beta, theta, and delta bands for the (1) frontal lobe, (2) central lobe and (3) occipital lobe, during the practice of yoga nidra, and afterward, as compared to a baseline control (lying quietly). To measure this change, collected EEG frequency and amplitude (Hertz, *Hz* and microvolts, μV, respectively) values will be analyzed for our intervention as compared to our baseline control condition, where each subject serves as their own control in Visit 1.

The following procedure will be applied for analysis of the alpha theta, beta and delta bands originating from each of three locations: the frontal, central and occipital lobes. Thus, in total, the process described below will be carried out twelve times (once for each of four frequency bands (alpha, theta, beta, delta) coming from three locations (frontal, central and occipital lobes)). In this description, analysis of EEG power in the alpha frequency band is described. The same methods will be applied to the other bands.

Whole Practice Comparison (Primary Outcome): the mean alpha EEG power throughout the entire yoga nidra practice will be compared to that of the baseline

control period. We will compare all alpha EEG power values recorded during the entire 30 minute baseline of lying quietly (visit 1) to those values recorded during the entire yoga nidra practice(visit 2), in a paired two-sided t-test. Our study is powered to be capable of determining at least a 9% change in mean alpha EEG power during the practice, using a 90% power and 5% alpha.

Step by Step Comparison: For the two baseline steps (5 min eyes open; 5 min eyes closed), and for each step of yoga nidra, all participant alpha EEG power values will be compared in a paired, two-tailed t-test to the alpha EEG power for matched time intervals taking place during the baseline control period of lying quietly. With this analysis, we will determine if there was a significant change in EEG power in the alpha band during any step of yoga nidra. We will also determine if there were any significant changes in the participant's brainwave patterns at baseline for visits 1 and 2.

Post Practice (Exploratory Outcome): To determine sustained effects of the yoga nidra practice during the hour following the intervention, measurements will continue, and alpha EEG power will be automatically averaged by the instrument during 12 regular 5-minute intervals. A similar **Step-by-Step** comparison will be made between baseline and intervention groups, wherein the mean alpha EEG power for each 5-minute interval during the hour following yoga nidra will be compared to that of matched 5-minute intervals during the hour following the baseline control of lying quietly. Additionally, the mean alpha EEG power representing the **entire hour following yoga nidra** will be compared the mean alpha EEG power representing the hour following the baseline control (using the same method described above). In this way, we will determine if the mean alpha EEG power during the hour following yoga nidra was significantly higher than that determined during the baseline control. We will also be able to see which 5-minute time intervals, if any, displayed particularly increased EEG power.

Ultimately, we will report changes seen in each brainwave frequency originating from the frontal, central and occipital lobes throughout the practice of yoga nidra and the hour following, as compared to a baseline control. Changes reported will detail the differences seen in each frequency band during each step of yoga nidra and the hour following; and also as an average throughout the entire practice and during the hour after.

All measures will be assessed for normality and transformed prior to analysis as required. If any extreme outliers are detected, we will attempt to determine whether these might have been due to measurement errors or movement artefacts, and discard the outlier if this is the case. If no cause for the outlier can be detected, then we will compare the main analysis with a sensitivity analysis conducted without the outlier.

Specific Aim 1, Outcome 2: We will document whether or not each participant fell asleep during each visit. Sleep and sleep stages (NREM and REM) will be identified by Sleep Strategies experts, following analysis of our raw EEG data. We will calculate percentage of participants who fell asleep during any point of their measurement period for each visit (baseline and intervention). Using only those individuals who fell asleep, we will also calculate: (1) average percent time spent in REM, NREM 1, NREM 2 and NREM 3 for each visit, and (2) percentage of people who first fell asleep during the intervention (yoga nidra or lying quietly) vs. during the hour afterwards. Mean (SD) total sleep time will be also be computed for each of two visits, for those who fell asleep.

Specific Aim 1, Outcome 3: We will compare time to sleep onset (*i.e.* sleep onset latency, SOL) for baseline and intervention. SOL is measured from the start of the measurement period to persistent NREM 2 sleep (as determined using our raw EEG data, by experts at Sleep Strategies). SOL is measured in minutes and will be presented in terms of mean and standard deviation for each visit (baseline vs. intervention). To determine statistical significance of differences between groups, a paired, two-tailed t-test will be performed. This outcome will be examined more closely in a larger future clinical trial investigating the effects of yoga nidra on sleep latency.

E.10.2 Specific Aim 2: Respiratory Rate and Heart Rate Variability

Respiratory Rate (RR): Respiratory rate data will be attained by contacting the Spire® Company to retrieve raw data attained by one device, used by all twentytwo participants throughout the course of our trial. Clinic visit times (including start time for each measurement) will be carefully noted in an Excel sheet, in order to accurately extract RR data for each step of our intervention. Mean respiratory rate will be determined for each time interval measured during the yoga nidra practice and each matched time interval measured during the control. It will also be determined for each 5-minute interval during the hour of measurements occurring post-intervention/control. Intervention and baseline values will be compared, in a statistically similar manner to EEG power data, wherein average RR for each time interval during and after yoga nidra will be compared to average RR for each matched time interval during and after the baseline control. A paired, two-tailed t-test will be used for this analysis. This comparison will reveal whether or not a significant decrease in respiratory rate can be detected at any point during yoga nidra, or during the hour afterwards. Similar to the EEG data, mean RR throughout the entire 30 minute yoga practice will be compared using the same two tailed, paired t-test to the mean RR throughout the entire 30 minutes baseline period. This analysis will tell us if RR significantly decreased when comparing the entire yoga nidra experience to the entire baseline experience. The same grouped statistical analysis will be done for the entire hour following the intervention vs. the hour

following the baseline control. Our analysis will determine whether or not there is a statistically detectable decrease in RR during the whole of the hour following yoga nidra as compared to control. The primary outcome here is mean RR changes during yoga nidra. Comparison of changes in RR during the hour post-practice, and during each time interval of intervention/control will be exploratory. The same comparison described above will also be made for measurements taken during the 10 minutes prior to the intervention (eyes open/eyes closed baseline) for intervention and baseline control groups. This comparison will determine if there are any significant changes in RR at baseline between visit 1 and 2.

Electrocardiogram (ECG): Autonomic tone will be assessed using HRV data attained from the portable, wireless Bodyguard 2® device. Raw data will be uploaded using FirstBeat Uploader and then processed and analyzed using with Kubios, MatLab and Excel as our data analysis software. High frequency (HF) HRV parameters, and root mean square of successive differences in HRV (RMSSD) will be our primary measurements extracted from our HRV data. Generally, these values directly correlate with increased parasympathetic nervous system (PNS) response, or more simply, physical relaxation [42]. For our analysis, the mean HF and RMSSD during each indicated time interval representing steps in yoga nidra and 5-min increments of the hour following will be determined for each participant. All values from each time increment at Visit 2 (intervention) will be compared (using a paired, two-tailed t-test where p is less than 5%) to those values attained during the matched time intervals occurring during Visit 1(baseline). This analysis will determine whether or not there is significant increase in parasympathetic response (indicating relaxation) during any point of the yoga nidra practice or the hour afterwards, as compared to baseline control of lying quietly. The same comparison will be made for measurements taken during the 10 minutes prior to the intervention (eyes open/eyes closed baseline). This comparison will determine if there are any significant changes in HRV at baseline between visit 1 and 2. As described in analysis of EEG and RR data, mean HF and RMSSD HRV values representing the entire yoga nidra practice will be compared again to those values representing the entire baseline control of lying quietly (using the same statistical method). This comparison will also be made for the entire 1-hour period following yoga nidra vs. the entire 1-hour period following baseline control. These last two analyses will tell us if there was a significant change in PNS response during yoga nidra as a whole, or the hour post-yoga nidra as whole, compared to our baseline controls. The primary outcome here is mean changes in HRV parameters during yoga nidra. Comparison of changes during the hour post-practice, and during each time interval of intervention/control will be exploratory.

E.10.3Specific Aim 3: Feasibility (Credibility and Intervention Conditions)

Specific Aim 3, Outcome 1: Feedback given using the continuous slider scale questions on the pre/post intervention surveys will be converted to a quantifiable value between 1 and 100 automatically, by Redcap. Results will reveal how positive our population was that they would experience mental, physical or emotional relaxation and whether it could help them fall asleep. Results will be presented using average and standard deviation values of % positive expectancy before and after each visit. A graphical representation of results of expectancy analysis will be presented using a bar graph that shows % positive expectancy before our intervention vs. afterwards. Four bars will appear, representing expectancy for mental, physical and emotional relaxation, as well as for ability of the practice to help them fall asleep at night.

Specific Aim 3, Outcome 2: In addition to expectancy, intervention acceptability will be assessed using recruitment and retention outcomes. If we can recruit our target sample size within three months, we will conclude that our proposed intervention is perceived as acceptable to potential participants. Dropouts will also be monitored to measure acceptability of the intervention. If more than 50% of our participants drop out, we will conclude that the intervention was not acceptable, and changes should be made. Participants will also be asked about tolerability as part of their post-intervention questionnaire. Slider scales will be used to assess comfort level during the intervention, as well as intervention tolerability. Slider scale questions will be scored and reported in the same way as the expectancy questions above (SA 3, Outcome 1). Multiple choice options are provided for questions inquiring about challenges and distractions appearing during each visit. Results will be presented as % of the sample that answered in each way. An open-ended comment box is also included in the post-intervention survey. These responses will be analyzed using qualitative approaches to determine trends and take into consideration any areas that could be improved in our future study designs.

Expectancy and Outcomes (Exploratory): In order to track how conscious expectancy correlates with outcomes, we will look at participants who report a expectancy of 50% or more on one or more slider scales used in the pre-intervention expectancy survey. For these participants, we will report results from our primary outcome (mean differences in EEG power originating in the frontal, occipital and central lobes during yoga nidra as compared to control). We will report the same analysis for those who report less than 50% expectancy on all scales in their pre-intervention survey. We will additionally look at the relationship between expectancy and sleep. We will report the percentage of high-expectancy individuals who fell asleep, as compared to the percentage of low-expectancy individuals who fell asleep.

E.10.4 Acute Changes at Each Visit:

Pre/Post Intervention State Trait Anxiety (STAI Y-6): Momentary anxiety will be analyzed before and after the measurement period of each visit. We will use the six question version of the STAI survey, found to be reliable and valid[44]. Data will be analyzed using directions on the survey. The normal range is between 34-36 points. Mean pre-intervention STAI Y-6 scores will be compared to mean post-intervention STAI Y-6 scores using a two tailed paired t-test.

Generalized Anxiety Disorder (GAD-7) – Visit 1 only: This survey (recalling anxiety symptoms during the past two weeks) will be scored using the instructions found in the survey instructions. Scores will describe our sample at entry and help us to understand changes seen in the pre/post analysis of momentary STAI responses. This data will be presented as a score (mean and standard deviation) representing our entire sample at Visit 1.

Pre/Post Intervention Positive/Negative Affect Schedule (PANAS): Momentary mood (positive and negative affect) will be analyzed using PANAS survey. This survey will only be administered during visit 2. Responses will be scored using directions on the survey. Mean pre-intervention positive affect scores will be compared to mean post-intervention positive affect scores using a two tailed paired t-test. The same analysis will be done for the negative affect scores. This analysis will determine whether or not yoga nidra is capable of increasing positive affect and/or decreasing negative affect.

E.10.5 Sample Statistics:

At each visit, statistics will be gathered using a **Pre-Visit** Survey, asking participants how they feel about the intervention they are about to experience, as well as about their behaviors within the past 24 hours. Using results from this survey, the following descriptions of our sample will be calculated and presented.
Exercise: % of participants who exercised within 2 hours of the intervention
Alcohol: % of participants who consumed alcohol within 24 hours.
Caffeine: % of participants who consumed caffeine that day.
A sub-analysis of caffeine intake will also include a rough estimate of milligrams (mg) of caffeine consumed by our sample within 7 hours of the intervention. Caffeine quantity will be determined by asking participants how many cups they consumed and what type of caffeinated beverage(s) they had. The average concentration of caffeine in coffee or tea (mg/cup) made available by the Mayo Clinic, will be multiplied by number of cups consumed of each, to determine a rough estimate of caffeine consumed for each participant. All values will be averaged together to represent our entire sample. These results will be presented as an independent bar graph showing average and standard deviation of mg caffeine consumed by our sample group per visit (baseline vs. intervention). We expect there to be no significant difference between visits. Ref, Mayo Clinic caffeine resource: (https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/caffeine/art-20049372).
Sleep Quality:% of participants reporting better than average sleep the night before (indicated by assigning their own sleep quality a score above 50 on a slider scale). Additionally, Mean reported sleep quality will be compared for Visits 1 and 2 using a paired, two-tailed t-test to determine if there was a significant difference in our sample from visit to visit. We do not expect there to be a difference.

Tiredness: as part of the pre/post intervention surveys, participants will be asked about their degree of tiredness, using a slider scale in Redcap. Mean and SD will be calculated in order to determine average day-time sleepiness from our sample population before and after the intervention and control. Mean tiredness before the intervention for visits 1 and 2, and after the intervention for visits 1 and 2 will also be compared using a t-test, to define our sample.

Rested-ness: as part of the pre/post intervention surveys, participants will be asked about how rested they feel, using a slider scale in Redcap. Mean and SD will be calculated in order to determine how rested our sample population is before the intervention/control and afterwards. Mean restedness before the intervention for visits 1 and 2, will also be compared, along with mean restedness after the intervention for visits 1 and 2. Paired, two-tailed t-tests will be applied to determine if these differences are statistically significant.

E.10.6: Exploratory Data Analysis: Correlation of PROMIS tool with the popular ISI and PSQI for sleep; the GAD-7 for anxiety, and the PHQ-9 for depression. This is an exercise in methods of validation to prepare us for validation of the PROMIS tool in a larger future clinical trial.

Procedures used in other papers validating the PSQI and ISI surveys [45], [46] as well as the PROMIS-29 tool [47] (for systemic sclerosis) will be considered as guidelines for validating the PROMIS-29 instrument as a tool for assessment of sleep, depression and anxiety. Each scale used here in this comparison provides a "cut-off point" differentiating mild or non-existing sleep disturbance, anxiety or depression from moderate symptoms that may require medical attention. For this reason, a dichotomous value of yes or no will be the final outcome for these scales, based on **Table 5**. Scoring information for the PSQI and PROMIS-29 is seen below. Details about the ISI and PHQ-9 can be seen in the recruitment section, and details about the GAD-7 are seen in the acute changes section.

Table 5. Yes/No Thresholds for Survey Tools

	Y/N Threshold: Moderate Depression	Y/N Threshold: Moderate Anxiety	Y/N Threshold: Poor Sleep Quality
PROMIS-29	>60	>60	>50
PSQI			>5
ISI			>8
GAD-7		≥10	
PHQ-9	≥10		

If 50-70% of participants identified as having a particular disorder using our primary exclusion criteria survey (*e.g.* PHQ-9 for depression) are also identified by the PROMIS-29 tool as having the particular disorder, the PROMIS tool for that disorder will be considered to correlate moderately with our reference survey. If this survey agreement is above 70%, high correlation will be established. It should be noted that all participants in the study will have already been identified as having poor sleep, according to the ISI.

Patient-Reported Outcome Measurement Information System Tool (PROMIS-29) – Visit 1 only: Scoring will be done using the PROMIS adult profile instruments scoring manual from the PROMIS Assessment Center. Depression and anxiety domains will both be classified here using a score above 60. This value is selected because it is one standard deviation (sd=10) from the mean of 50, which represents average level of depression and/or anxiety in the general population. Poor sleep will be classified by a score above 50, as the PROMIS scoring manual

indicates that for this survey, the average score of 50 represents slightly poorer than average sleep[48].

Pittsburgh Sleep Quality Index (PSQI) – Visit 1 only: This survey will be scored using the instructions found on the survey footer. Poor sleep quality will be identified as having a score above 5 points.

E.10.7 Blinding: our biostatistician, Doug Hanes, PhD, will analyze the data after the trial is complete, without knowledge of which visit (1 or 2: baseline or yoga nidra) that data came from.

F.0 Conclusion, Summary and/or Benefits of the Knowledge Gained: With this study we will gain useful information that will help inform our study design for larger pilot studies that will investigate the effects of yoga nidra on sleep. Information gleaned will include: the effects of yoga nidra on brainwave patterns, respiratory rate and heart rate variability during and after the practice, as compared to a baseline control of laying quietly. This will be novel information, as no published studies in the US have simultaneously measured brainwave patterns, respiration rate, and heart rate variability during the practice of yoga nidra. Appropriate groundwork has been set, however, with several studies reporting other forms of meditation to affect brainwave activity, RR, and HRV[23]. One study reported brainwave changes during yoga nidra[43], and one other study reported HRV increase during yoga nidra[26]. Our study will expand upon research into the effects of mind/body practices on brainwave activity and respiration, while also looking closely at HRV as an indicator of ANS response. For our population, ability of this intervention to increase PNS response could be highly therapeutic. Other researchers have shown that throughout all wake and sleep stages, individual with insomnia exhibit elevated sympathetic nervous system (SNS) activity (observed as increased LF and decreased HF components of HRV [18, 27]) which is associated with their increased risk of coronary artery disease. Increasing PNS response may help them sleep, but may also help balance underlying ANS imbalances that maybe causing insomnia. Aside from physiological measurements, this study will also give us valuable information on the feasibility of this study (with respect to instrument selection, intervention acceptability and credibility). We will use these findings to inform future study designs. Moving forward, we aim to carry out a larger trial involving the practice of yoga nidra before bed as a potentially self-administered treatment for insomnia. This future study will evaluate yoga nidra and the feasibility of testing our yoga nidra intervention and its impact on SOL utilizing actigraphy, sleep journals, and self-report surveys. The mind/ body practice of yoga nidra is an approachable technique, with a history of use in reducing sleep onset latency. We propose that this practice can be easily integrated into a sleep routine to produce immediate and measurable effects in the general American population.

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