INSOMNIA AND SUICIDE PREVENTION: LEVERAGING TECHNOLOGY TO MITIGATE RISK

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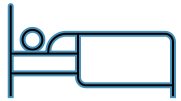
OVERVIEW

- Insomnia
- Insomnia and Suicide Risk
  - Evidence Base
  - Mechanisms of Risk
- Cognitive-Behavioral Therapy for Insomnia (CBT-I)
  - Evidence Base
  - CBT-I and Suicide Risk
- Sleep Healthy Using the Internet (SHUTi) RCT
- Questions



LEARNING OBJECTIVES

- Recognize that insomnia is an evidence-based risk factor for suicide.
- Describe potential mechanisms whereby insomnia may increase risk for suicide.
- Explain how interventions for insomnia are essential to suicide prevention.
- Summarize the findings from a RCT that examined the efficacy of a computerized cognitive behavioral therapy for insomnia (cCBT-I) in a Veteran population.

INSOMNIA

I can't sleep

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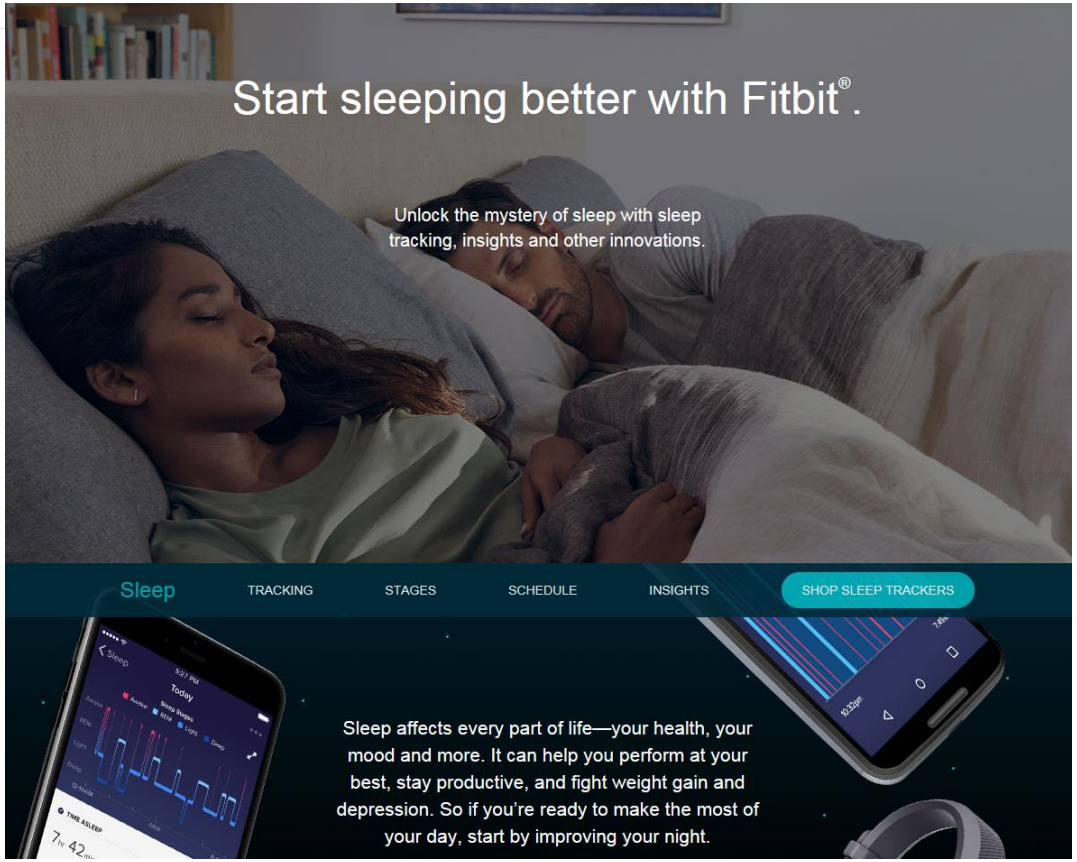
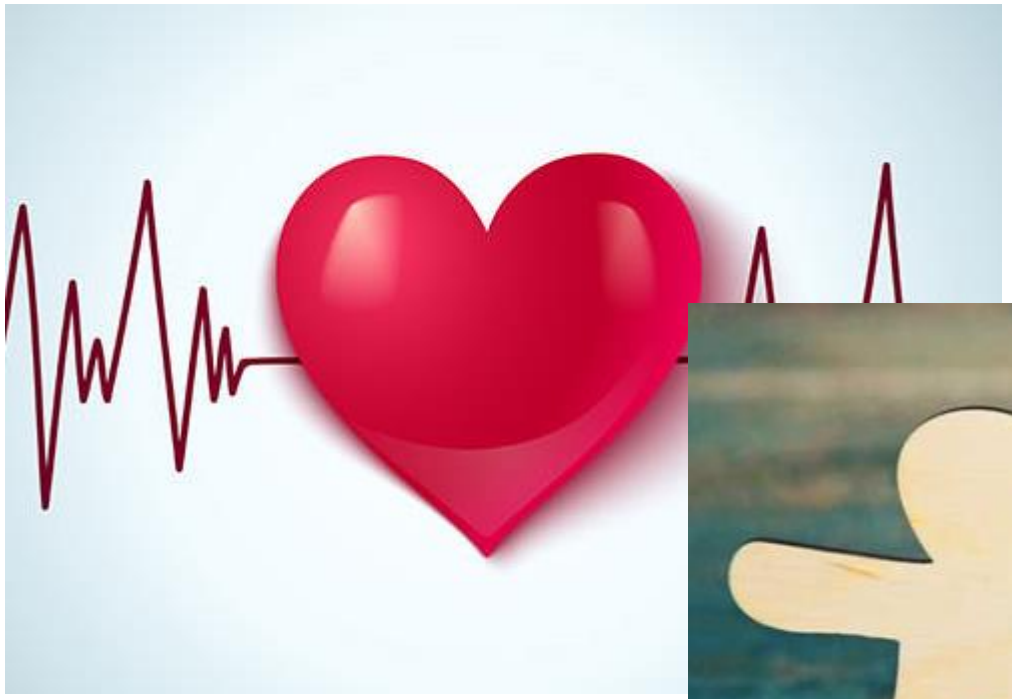
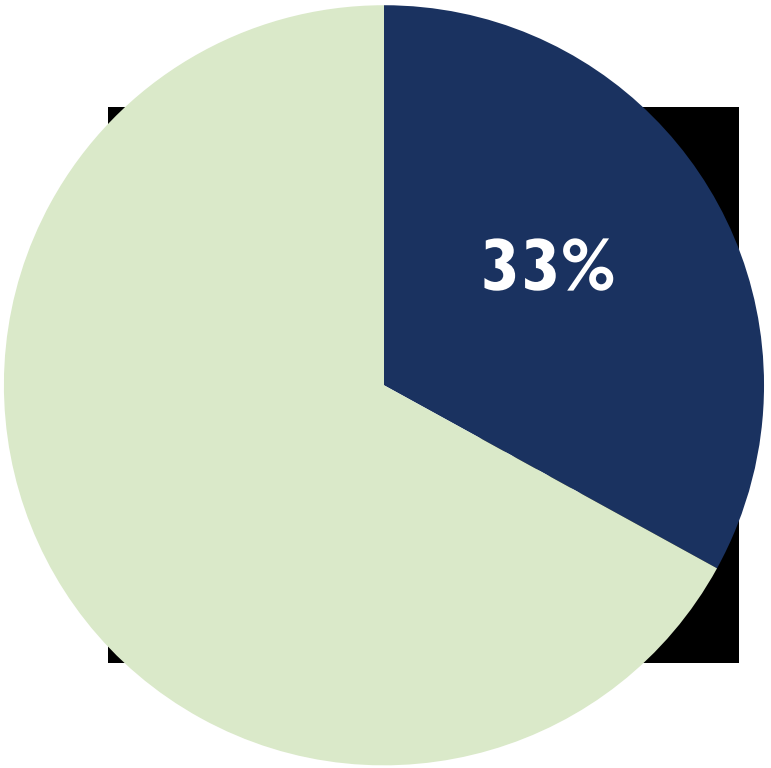
21 Weird Ways to Fall Asleep That Actually Work





Images: sleephealth.org; thejobnetwork.com; healthstreet.program.ufl.edu; marketwatch.com

US General Population

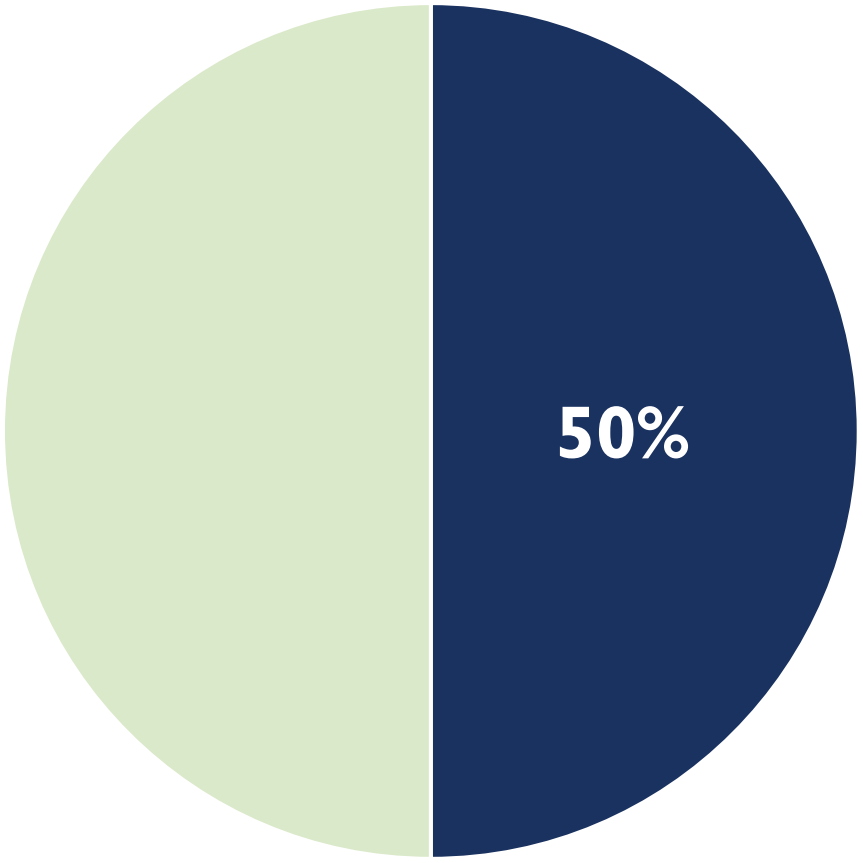


6-10%

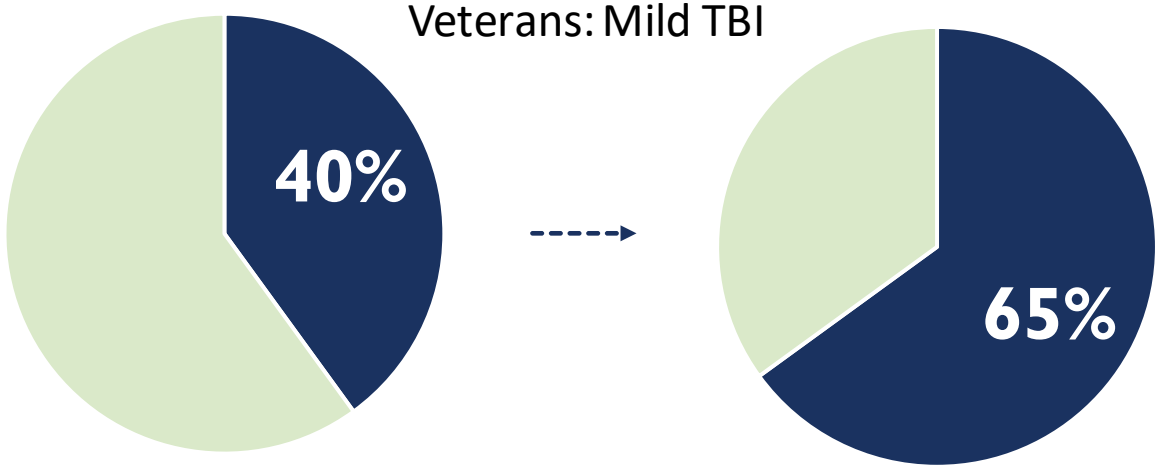
Alexander et al., 2016; Lew et al., 2010; Image: filmfreeway.com

INSOMNIA: COMORBID PARTNER IN DISTRESS

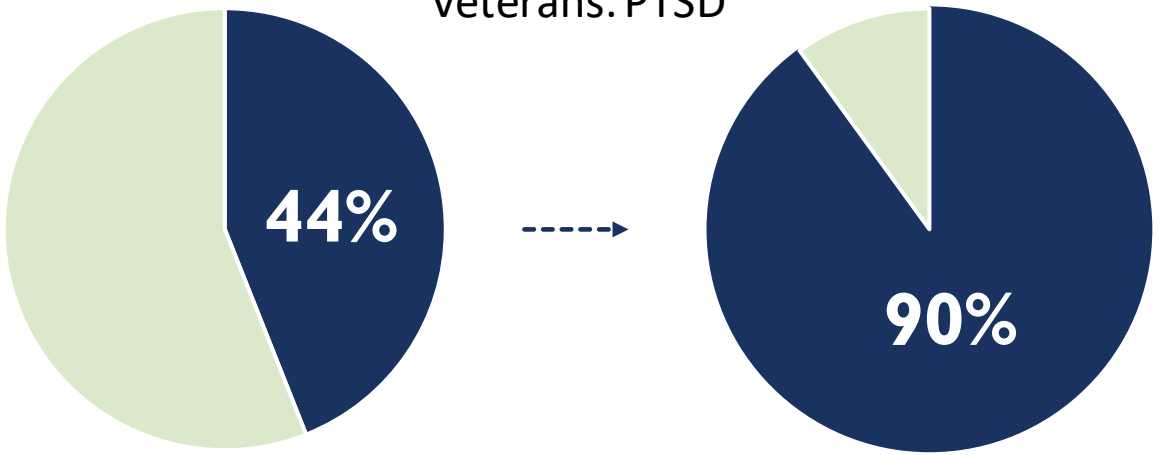
US General Population



Veterans: Mild TBI



Veterans: PTSD



Gilbert et al., 2015; Lang et al., 2014; Pigeon et al., 2013

INSOMNIA AND SUICIDE RISK

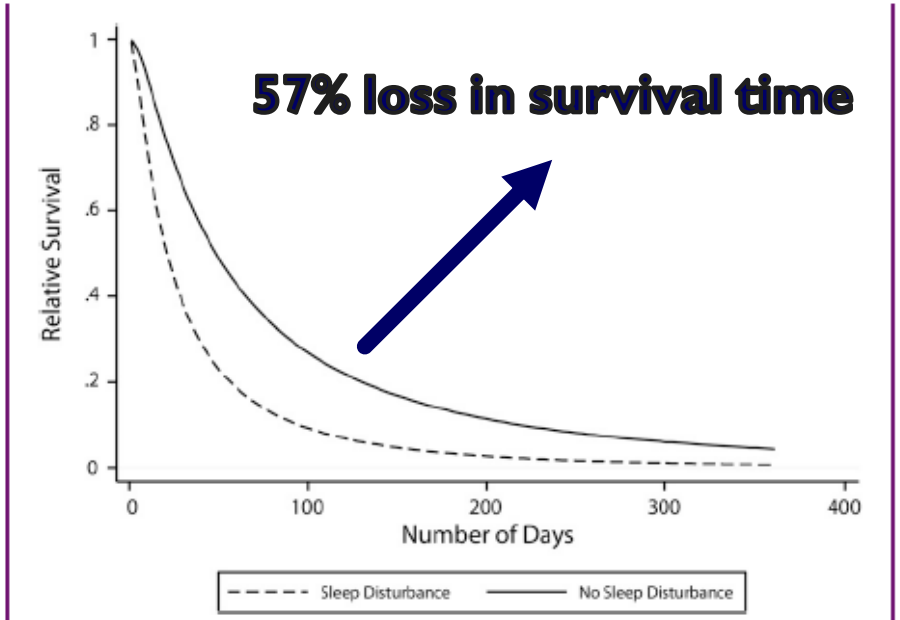
INSOMNIA: EMPIRICAL RISK FACTOR

- Who?
  - Community, college, clinical samples
- Type of study?
  - Cross-sectional, prospective, longitudinal
- Meta-analyses
  - 2.84x increased risk for SI, attempt, or death by suicide
    - 1.98x increased risk after adjustment for co-morbid psychiatric diagnoses
- Insomnia + Co-Morbid Psychiatric Diagnosis
  - 2.66x more likely to endorse SI and engage in SDV
- Persistent symptoms
  - Increased odds of depression and SI

Bernert et al., 2015; Bernert & Nadorff, 2015; Bishop et al., 2019; Britton et al., 2019; Liu et al., 2020; Malik et al., 2014; Pigeon et al., 2012; Suh et al., 2013

INSOMNIA: EMPIRICAL RISK FACTOR – SERVICE MEMBERS & VETS

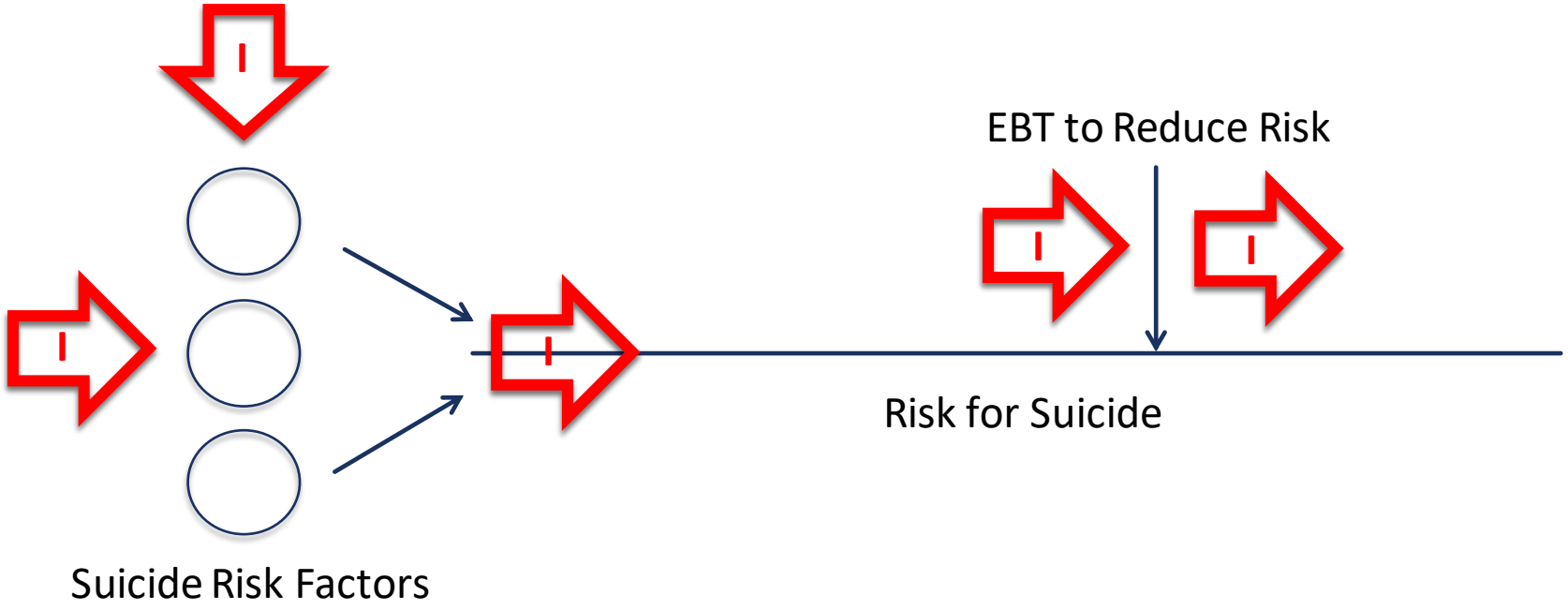
- Robust independent suicide risk factor
  - Depression, hopelessness, PTSD diagnosis, anxiety symptoms, drug and alcohol use
- Predictive of future suicide attempts
  - One month after baseline
  - Model included baseline insomnia symptoms, depressive symptoms, and hopelessness
- VHA utilizing Veterans
  - Sleep disturbance died by suicide sooner (75 day average) after last VHA visit than Veterans without sleep disturbance who died by suicide (174 day average)

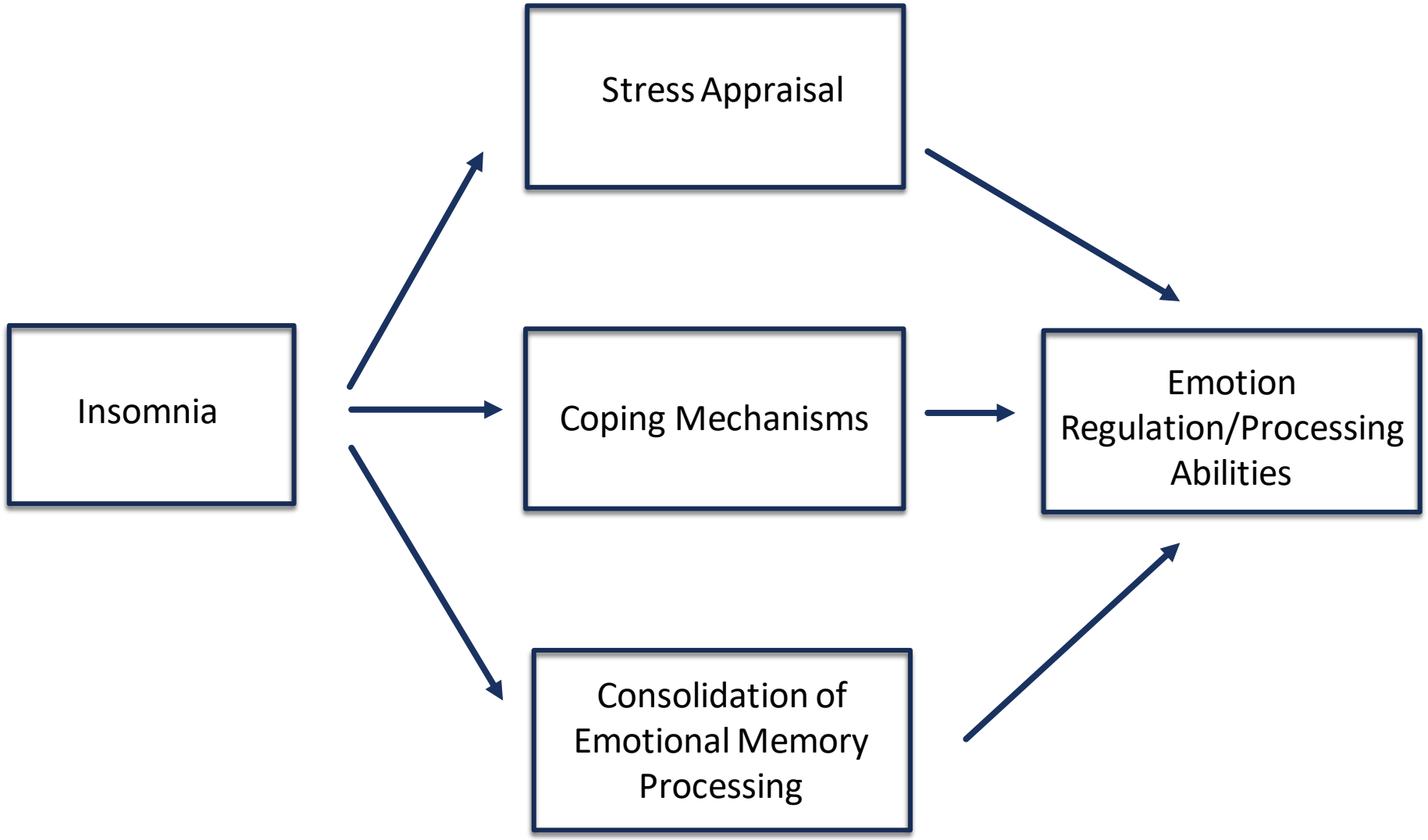


Note. VISN = Veterans Integrated Service Network. The dashed line is sleep disturbance in the year preceding death; the solid line represents no sleep disturbance in the year preceding death.

FIGURE 1—Survival time preceding suicide among veterans with and without sleep disturbance: VISN 2 and VISN 11, Fiscal Year 2000–2006.

Pigeon et al., 2012; Ribeiro et al., 2012


EBT to Reduce Risk
Risk for Suicide
Suicide Risk Factors



Livingston et al., 2015; Winsper & Tang, 2014; Woosley et al., 2014; Woznica et al., 2015; Wright et al., 2011

SLEEPJ, 2019, 1–8

doi: 10.1093/sleep/zsz094
Advance Access Publication Date: 10 June 2019
Original article

ORIGINAL ARTICLE

Sleep and timing of death by suicide among U.S. Veterans 2006–2015: analysis of the American Time Use Survey and the National Violent Death Reporting System

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Abstract

Study Objectives: Suicide is a top public health priority, and U.S. Veterans are recognized to be at particularly elevated risk. Sleep disturbances are an independent risk factor for suicide; recent empirical data suggest that nocturnal wakefulness may be a key mechanism underlying this association. Given higher rates of sleep disturbances among U.S. Veterans compared with civilians, we examined associations between nocturnal wakefulness and timing of death by suicide in U.S. Veterans and civilians to determine whether temporal suicide patterns differed.

Methods: The American Time Use Survey and the National Violent Death Reporting System were analyzed (2006–2015) to determine whether sleep and temporal suicide patterns differed between age-stratified groups (18–39, 40–64, and ≥65) of U.S. Veterans and civilians. Observed temporal suicide patterns were reported and standardized incidence ratios (SIRs) calculated to compare the percentage of suicides observed with those expected, given the proportion of the population awake, across clock hours.

Results: The raw proportion of Veteran suicides peaks between the hours of 1000–1200; however, the peak prevalence of suicide after accounting for the population awake is between 0000 and 0300 hr ($p < .00001$, $\phi = .88$). The highest SIR was at midnight; U.S. Veterans were eight times more likely to die by suicide than expected given the population awake (SIR = 8.17; 95% CI = 7.45–8.94).

Conclusions: Nocturnal wakefulness is associated with increased risk for suicide in U.S. Veterans. Overall patterns of observed suicides by clock hour were similar between U.S. Veterans and civilians. However, Veteran-specific SIRs suggest differences in magnitude of risk by clock hour across age groups. Future research examining female and Post-9/11 U.S. Veterans is warranted.

Statement of Significance

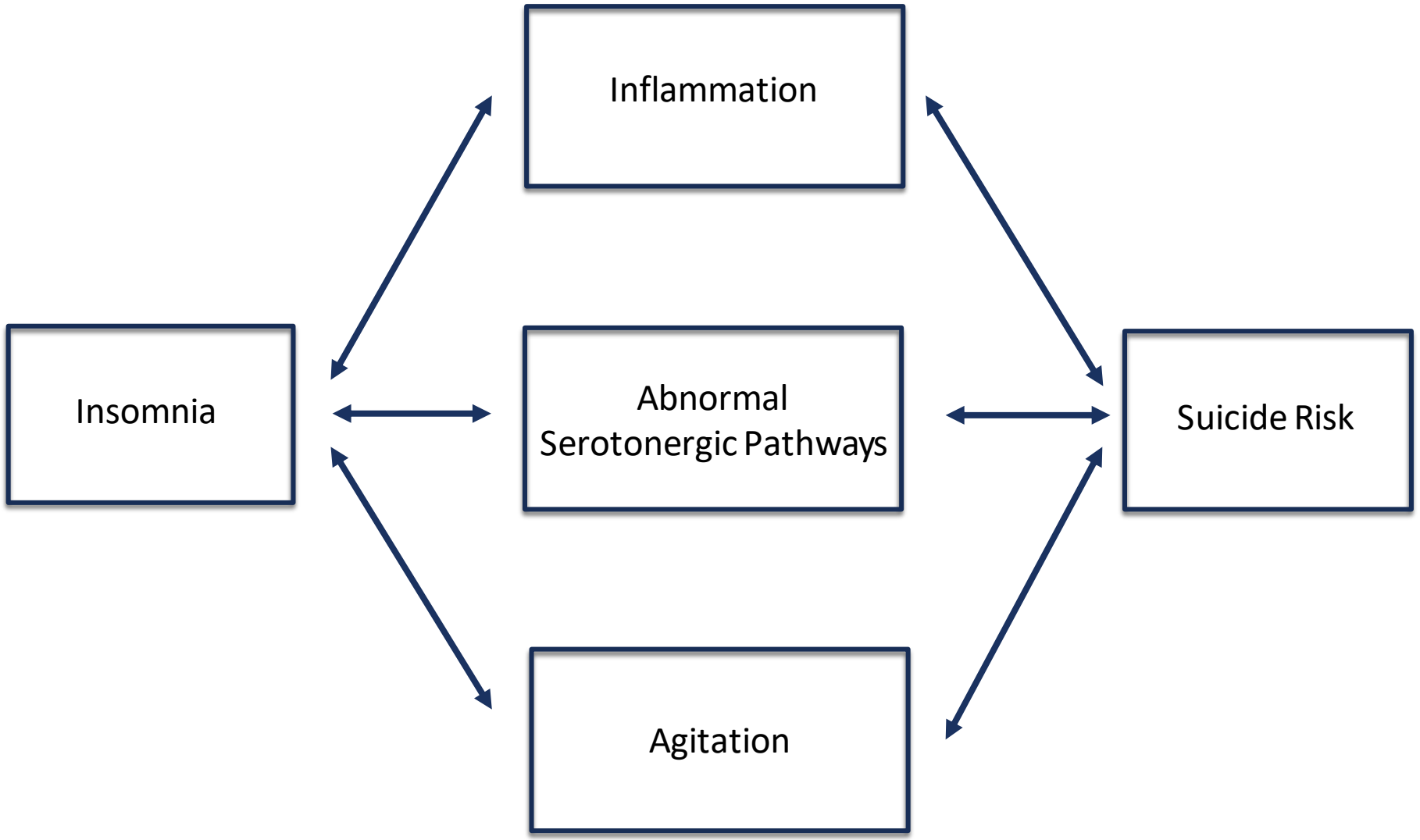
Suicide is a major public health concern and U.S. Veterans are a high-risk population with an increasing suicide rate. Sleep disturbances, prevalent in U.S. Veterans, can contribute to and exacerbate suicide risk. Understanding the temporal pattern of suicide in U.S. Veterans is critical to improving the impact of suicide prevention and intervention approaches. Future research is necessary to further evaluate age-related differences in timing of death by suicide between U.S. Veterans and civilians. Additionally, research investigating whether mechanisms associated with increased suicide risk due to nocturnal wakefulness differ between U.S. Veterans and civilians is both conceptually and clinically indicated.

Key words: sleep disturbance; nocturnal wakefulness; suicide; Veteran

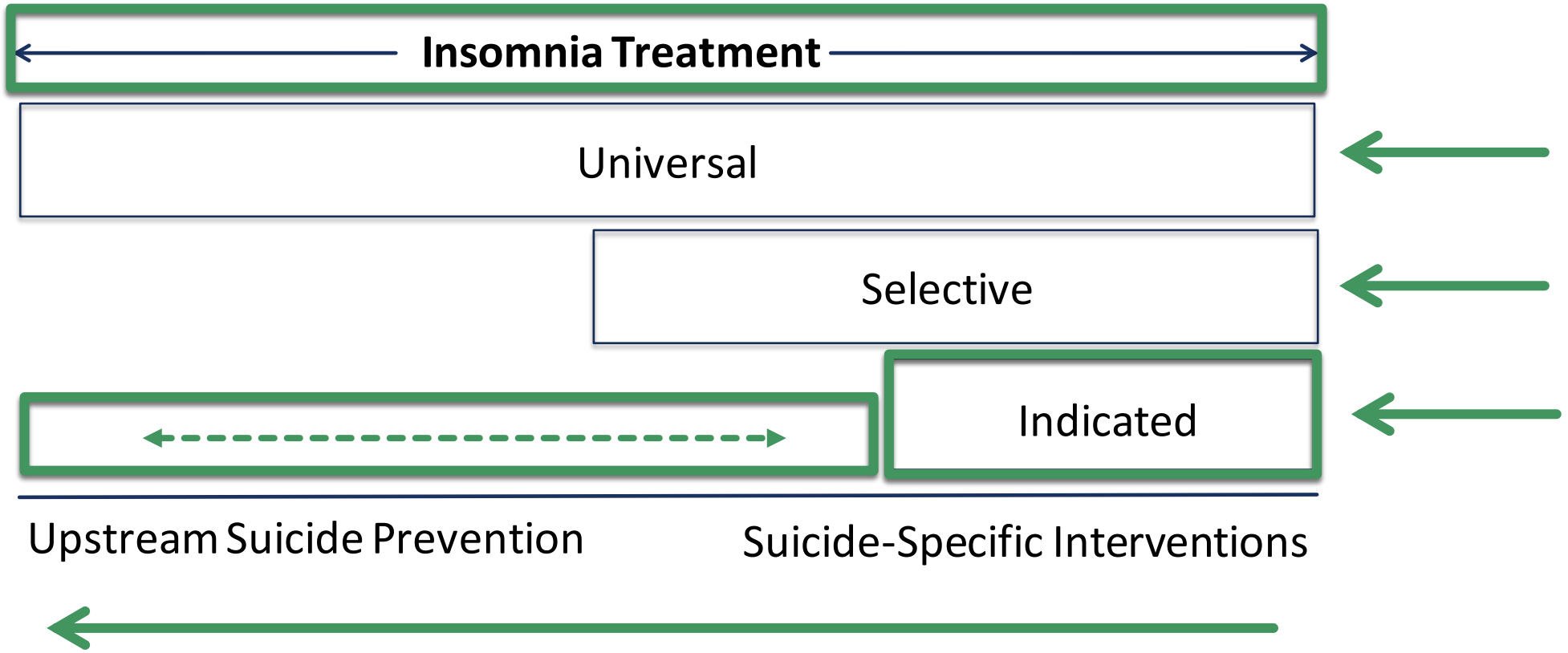
Submitted: 29 September, 2018; Revised: 28 January, 2019

Decreased Frontal Lobe Functioning → Emotion Regulation/Processing Abilities → Problem Solving Abilities; Impulsivity

Goldstein & Parker, 2014; McCarthy et al., 2019; Perlis et al., 2016; Image: portal.abczdrowie.pl


Inflammation
Insomnia
Abnormal
Serotonergic Pathways
Suicide Risk
Agitation

INSOMNIA AND SUICIDE PREVENTION



COGNITIVE BEHAVIORAL THERAPY FOR INSOMNIA (CBT-I)

Cognitive Behavioral Treatment
for Insomnia (CBT-I)

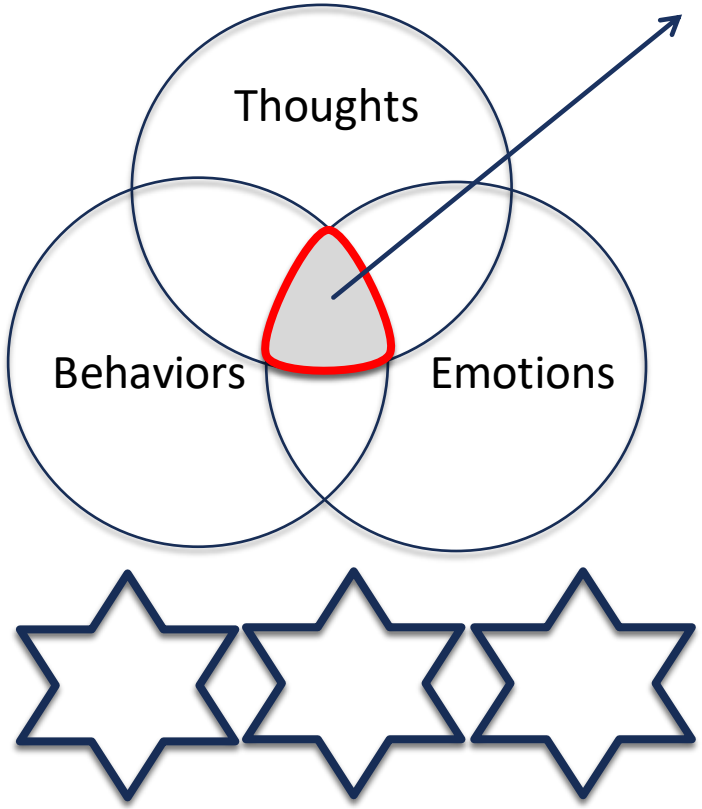


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Image: https://pixabay.com

CBT-I EVIDENCE BASE

SLEEP AND BIOLOGICAL RHYTHMS

Sleep and Biological Rhythms 2011; 9: 24–34 doi:10.1111/j.1479-8425.2010.00481.x

ORIGINAL ARTICLE

A meta-analysis on the treatment effectiveness of cc behavioral therapy for primary insomnia

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[1]*Japan Somnology Center, Neuropsychiatric Research Institute,* [2]*Department of Somnology, Tokyo M University, Tokyo, Japan*

Abstract

Previous meta-analyses have shown the effectiveness of cognitive behavioral therapy for (CBT-I). However, conclusive information about therapeutic effects (especially during f effect sizes of objective sleep parameters and self-rating scales, and the problem of public has not been obtained. We conducted a meta-analysis focusing on these issues. We ide randomized controlled studies published between 1990 and 2009 that fulfilled our selectio Intra-group comparison of CBT-I and comparison between CBT-I and control groups were on these studies. The intra-group comparison revealed that the effect sizes of CBT-I for sleep variables from sleep diaries were medium to large at the end point of treatment, effect sizes were favorably maintained on follow-up. A between-group comparison rev CBT-I was more effective than the control for subjective sleep variables at the end of trea that its effectiveness was also recognized on follow-up. With regard to self-rating compared to the control group, the effect sizes in the CBT-I group were medium to large b end of treatment and on follow-up. However, there were problems of publication bias in s subjective or objective sleep variables. The abovementioned results support the effecti CBT-I for the treatment and prevention of relapse of primary insomnia despite the exis certain publication bias.

Key words: cognitive behavioral therapy, insomnia, meta-analysis, publication bias, ra controlled trial.

INTRODUCTION

Insomnia has been estimated to be prevalent in about one-fifth of the general adult population.[1] Several population-based studies have revealed that 25–35% of subjects experienced occasional or mild insomnia,[2,3] and that 10–15% of the ir lation showed a chronic course.[2,3] Fo of primary insomnia, two effective met widely accepted: pharmacotherapy, behavioral therapy for insomnia (CE pharmacotherapy is commonly used fo of insomnia, recurrence of symptom drug discontinuation is frequently obse it has been reported that CBT-I is effect ing insomnia symptoms in 70–80% and also has long-term effects on the recurrence.

To the best of our knowledge, th four meta-analyses on the effectivene

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0022-006X/95/$3.00

Identifying Effective Psychological Treatments for Insomnia: A Meta-Analysis

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La Trobe University

Insomnia is a debilitating and widespread complaint. Concern over the iatrogenic effects of pharmacological therapies has led to the development of several psychological treatments for insomnia. To clarify the effects of these treatments, 66 outcome studies representing 139 treatment groups were included in a meta-analysis. The results indicated that psychological treatments produce considerable enhancement of both sleep patterns and the subjective experience of sleep. In terms of enhancing sleep onset, active treatments were all superior to placebo therapies but did not differ greatly in efficacy. Greater therapeutic gains were available for participants who were clinically referred and who were not regular users of sedative hypnotics. Future research directions are suggested.

Insomnia, defined as the subjective inability to obtain adequate sleep (Gillin & Byerley, 1990), is a distressing and often debilitating condition that can affect health, daytime performance, relationships, mood, and psychological well being (Lacks, 1987; Sloan & Shapiro, 1993). Estimates of the prevalence of insomnia typically range between 15% to 20% for chronic insomnia and 30% to 40% for occasional or transient insomnia (Mellinger, Balter, & Uhlenhuth, 1985). Insomnia can therefore be regarded as a significant problem in the community.

The treatment of choice for insomnia, for practitioner and patient alike, has been the prescription of sedative hypnotics or other sleep-inducing agents (Bliwise, 1991). Pharmacological treatments may, however, involve a variety of iatrogenic effects, including poor-quality sleep (Kales & Kales, 1987), deterioration of daytime functioning (Johnson & Chernik, 1982), and, if used regularly, the development of psychological dependence, tolerance, and addiction (Espie, 1991). Withdrawal from the addiction cycle is made particularly difficult by the effects of "rebound insomnia" (Killen & Coates, 1979). A further consideration is that the habitual use of sleeping medication may involve substantial financial expense (Hauri, 1979).

Concern over the iatrogenic effects of pharmacological approaches has led researchers to explore alternative treatments for insomnia. These have included stimulus control (Bootzin, 1972); paradoxical intention (Frankl, 1955); sleep restriction therapy (Spielman, Saskin, & Thorpy, 1987); and relaxation-based therapies such as progressive muscle relaxation (Jacobson, 1938), meditation, systematic desensitization, imagery, autogenic training, and hypnosis. (For a detailed description of each treatment, see Espie [1991].)

Despite extensive research, the absolute and relative effects of these treatments are not clear. In general, qualitative reviews of the literature (Bootzin & Nicassio, 1978; Borkovec, 1982; Espie, 1991; Gillin & Byerley, 1990; Killen & Coates, 1979; Knapp, Downs, & Alperson, 1976; Montgomery, Perkin, & Wise, 1975; Ribordy & Denney, 1977; Turner & Di Tomasso, 1980) have been inconclusive. Although some reviewers have suggested that nonrelaxation treatments—in particular, stimulus control—are the most potent (e.g., Borkovec, 1982), others have concluded that the treatments do not differ in efficacy (e.g., Bootzin & Nicassio, 1978; Turner & Di Tomasso, 1980). Furthermore, it has been proposed that differences in efficacy may merely reflect the variable being measured and the time of measurement (Espie, 1991). For example, although stimulus control may cause greater improvements in sleep pattern measures such as sleep onset latency, particularly in the short term, relaxation-based approaches may be superior over the long term on subjective evaluations of sleep quality (Espie, Lindsay, Brooks, Hood, & Turvey, 1989).

It has been hypothesized that several treatment and patient characteristics may be important to therapeutic outcome, but they have been largely neglected as a subject for empirical investigation, and clarification of their effects has proved problematic for qualitative reviews. Identification of the conditions under which optimal effects are obtained may allow treatment success and efficiency to be maximized (Chambers, 1992; Sanavio, 1988).

Existing reviews of the literature may, however, have been compromised by their narrative approach (Cook & Leviton, 1980; Greenberg & Folger, 1988; Strube & Hartmann, 1983). Meta-analysis, a comprehensive form of review based on quantitative rigor and the statistical standards that are applied in primary data analysis, may be better able to exploit the information available within the research body on behavioral treatments of insomnia (Hunter, Schmidt, & Jackson, 1982; Wolf, 1986).

Although the majority of reviews have been narrative, four previous studies have applied quantitative approaches to the lit-

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We thank those people whose research contributed to this study, in particular, those who responded to our requests for unpublished information.

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Nonpharmacological Interventions for Insomnia: A Meta-Analysis of Treatment Efficacy

Charles M. Morin, Ph.D., James P. Culbert, Ph.D., and Steven M. Schwartz, M.S.

Objective: Because of the role of psychological factors in insomnia, the shortcomings of hypnotic medications, and patients' greater acceptance of nonpharmacological treatments for insomnia, the authors conducted a meta-analysis to examine the efficacy and durability of psychological treatments for the clinical management of chronic insomnia. Method: A total of 59 treatment outcome studies, involving 2,102 patients, were selected for review on the basis of the following criteria: 1) the primary target problem was sleep-onset, maintenance, or mixed insomnia, 2) the treatment was nonpharmacological, 3) the study used a group design, and 4) the outcome measures included sleep-onset latency, time awake after sleep onset, number of nighttime awakenings, or total sleep time. Results: Psychological interventions, averaging 5.0 hours of therapy time, produced reliable changes in two of the four sleep measures examined. The average effect sizes (i.e., z scores) were 0.88 for sleep latency and 0.65 for time awake after sleep onset. These results indicate that patients with insomnia were better off after treatment than 81% and 74% of untreated control subjects in terms of sleep induction and sleep maintenance, respectively. Stimulus control and sleep restriction were the most effective single therapy procedures, whereas sleep hygiene education was not effective when used alone. Clinical improvements seen at treatment completion were well maintained at follow-ups averaging 6 months in duration. Conclusions: The findings indicate that nonpharmacological interventions produce reliable and durable changes in the sleep patterns of patients with chronic insomnia.

(Am J Psychiatry 1994; 151:1172–1180)

Insomnia is among the most frequent health complaints brought to the attention of health care practitioners. Epidemiological surveys suggest that 10%–15% of adults complain of chronic insomnia (1, 2), and the prevalence estimates are higher among women, older adults, and patients with medical (3) or psychiatric disorders. Chronic insomnia is not a benign problem as it can adversely affect a person's life by causing substantial psychosocial, occupational, health, and economic repercussions (4). For example, individuals with chronic sleep disturbances experience more psychological distress, report greater impairments of daytime functioning, take more sick leave, are more preoccupied with somatic problems, and utilize health care resources more often than good sleepers (1, 2, 5, 6).

Received July 23, 1993; revisions received Dec. 20, 1993, and Jan. 27, 1994; accepted Feb. 25, 1994. From the Medical College of Virginia, Virginia Commonwealth University. Address reprint requests to Dr. Morin, Department of Psychiatry, Box 980268, Medical College of Virginia, Virginia Commonwealth University, Richmond, VA 23298-0268.

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Pharmacotherapy is the most frequently used method for treating insomnia. The National Institute of Mental Health survey of psychotherapeutic drug use indicated that 7.1% of adults have used either prescribed or over-the-counter sleeping aids in the course of a year and 11% of the users of hypnotics have used their medication regularly for more than a year (1). Benzodiazepine hypnotics, the most commonly prescribed sleeping aids, are efficacious on a short-term basis in reducing sleep latency, decreasing the number and duration of nocturnal awakenings, and increasing total sleep time and sleep efficiency (7, 8). The short-term use of hypnotic medications may be clinically indicated for selected subtypes of situational insomnia caused by acute stress, jet lag, or the like. There are few data, however, on their long-term efficacy, and their usefulness in the management of chronic insomnia is unclear (9). Furthermore, several problems are likely to arise either during the course of treatment or after its discontinuation: alteration of sleep stages, daytime residual effects, tolerance, dependence, and rebound insomnia (7, 8, 10). Because of reduced metabolic functioning with aging, their clinical use in geriatric patients warrants special cautions (11).

Recognition of the mediating role of psychological fac-

Reviews and Overviews

Comparative Meta-Analysis of Pharmacotherapy and Behavior Therapy for Persistent Insomnia

Michael T. Smith, Ph.D.
Michael L. Perlis, Ph.D.
Amy Park, B.S.
Michelle S. Smith, Ph.D.
JaeMi Pennington, B.S.
Donna E. Giles, Ph.D.
Daniel J. Buysse, M.D.

Objective: Although four meta-analytic reviews support the efficacy of pharmacotherapy and behavior therapy for the treatment of insomnia, no meta-analysis has evaluated whether these treatment modalities yield comparable outcomes during acute treatment. The authors conducted a quantitative review of the literature on the outcome of the two treatments to compare the short-term efficacy of pharmacotherapy and behavioral therapy in primary insomnia.

Method: They identified studies from 1966 through 2000 using MEDLINE, psycINFO, and bibliographies. Investigations were limited to studies using prospective measures and within-subject designs to assess the efficacy of benzodiazepines or benzodiazepine receptor agonists or behavioral treatments for primary insomnia. Benzodiazepine receptor agonists included zolpidem, zopiclone, and zaleplon. Behavioral treatments included stimulus control and sleep restriction therapies. Twenty-one studies summarizing outcomes for 470 subjects met inclusion criteria.

Results: Weighted effect sizes for subjective measures of sleep latency, number of awakenings, wake time after sleep onset, total sleep time, and sleep quality before and after treatment were moderate to large. There were no differences in magnitude between pharmacological and behavioral treatments in any measures except latency to sleep onset. Behavior therapy resulted in a greater reduction in sleep latency than pharmacotherapy.

Conclusions: Overall, behavior therapy and pharmacotherapy produce similar short-term treatment outcomes in primary insomnia.

(Am J Psychiatry 2002; 159:5–11)

Persistent insomnia, defined as problems initiating and/or maintaining sleep at least three nights/week accompanied by daytime distress or impairment (ICD-10), is associated with an array of individual and societal consequences, including greater medical and psychiatric morbidity (1–7), life-threatening accidents, reduced quality of life, impaired job performance, and absenteeism (3, 8–12). Ten percent to 15% of adults report persistent sleep problems (13–17); the rates of sleep problems among women and older adults are even higher (18–21).

The cost of insomnia in terms of lost productivity and accidents has been estimated to be $77–$92 billion annually (22). Despite these costs, the overwhelming majority of individuals with insomnia remain untreated (17). More than 50% of primary care patients experience insomnia (13), but only about one-third mention this problem to their physicians (23), and only 5% seek treatment (13). Most patients with insomnia (67%) report a poor understanding of treatment options, and many turn to alcohol (28%) or untested over-the-counter remedies (23%) (13). This is particularly unfortunate given that insomnia can be readily diagnosed and treated. Four meta-analyses (24–27), two pharmacological and two behavioral, summarized more than 150 controlled investigations supporting the efficacy of treatments for primary insomnia.

The meta-analyses of pharmacotherapy support short-term (2–4-week) effectiveness of medication compared with placebo. Benzodiazepine receptor agonists like temazepam, zolpidem, and zaleplon were the most widely used medications. Clinical gains were reported to be very reasonable (24), with preferential effects on total sleep time (25). Perhaps the primary limitation of pharmacotherapy is the absence of data regarding long-term efficacy. Long-term use has been thought to result in tolerance, dependence, and rebound insomnia on discontinuation (28–30). Limited evidence from two uncontrolled open-label studies with zolpidem and zaleplon, however, indicates that these medications may be effective for 3 to 6 months without dose escalation (31, 32). No data suggest sustained improvement when medication is withdrawn.

Two meta-analyses support behavioral interventions for improving sleep (26, 27). Behavioral treatments focus on modifying contingencies thought to maintain chronic insomnia (33). Effective treatment typically involves four to eight weekly sessions and requires substantial patient motivation. The most efficacious components are considered to be stimulus control and sleep restriction (26). Sleep hygiene instructions and cognitive therapy may be included as well. Advantages of behavior therapy are minimal side effects and sustained improvement. Treatment gains have

Okajima et al., 2011; Morin et al., 1994; Murtagh & Greenwood, 1995; Smith et al., 2002

CBT-I

Risk for SI and SDV

Nocturnal Wakefulness

Cognitive Deficits

Impulsivity

Mood Dysregulation

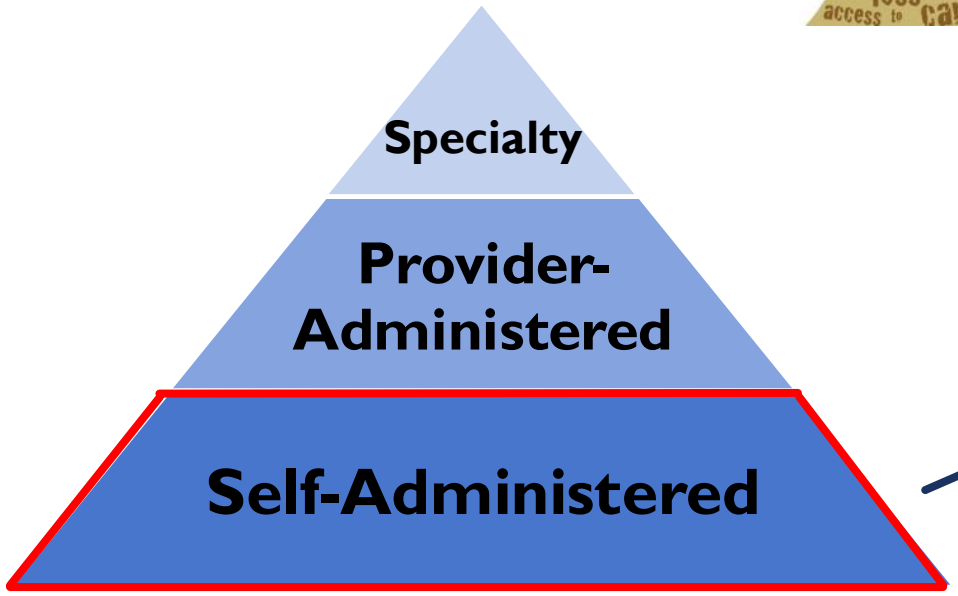
Hopelessness

Distorted Cognitions

Inflammation

Livingston et al., 2015; Winsper & Tang, 2014; Woosley et al., 2014; Woznica et al., 2015; Image: portal.abczdrowie.pl

COMPUTERIZED COGNITIVE BEHAVIORAL THERAPIES



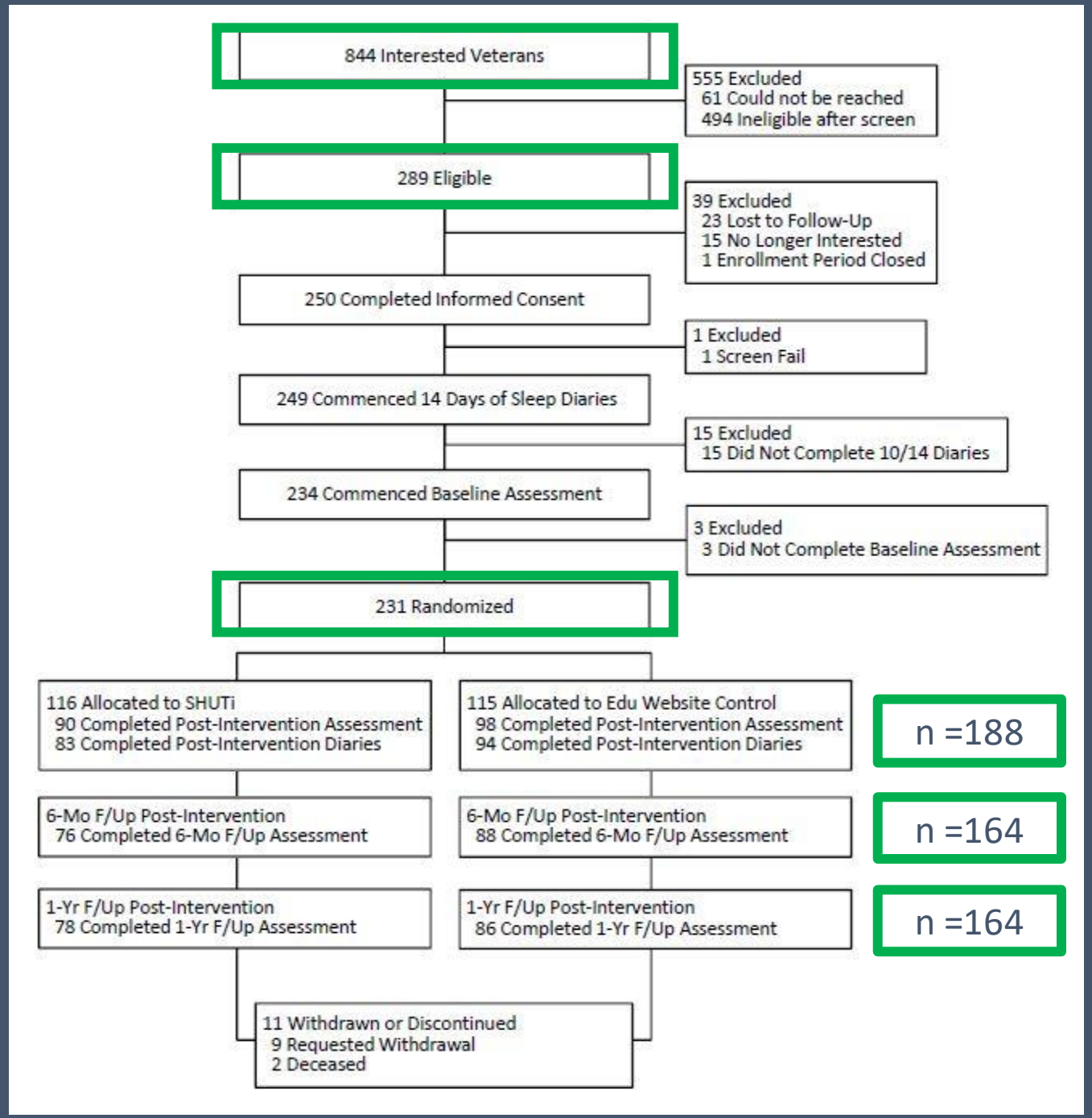
Bennett & Glasgow, 2009; Cartreine et al., 2010; Espie, 2009; Images: www.clipartview.com; www.tripspark.com; www.clipartix.com; www.sites.psu.edu; www.kommunikate.files.wordpress.com

SHUTI RCT

SLEEP HEALTHY USING THE INTERNET (SHUT-I)

SPECIFIC AIM: DETERMINE THE EFFICACY OF SHUTI FOR TREATMENT OF INSOMNIA IN OEF/OIF/OND VETERANS

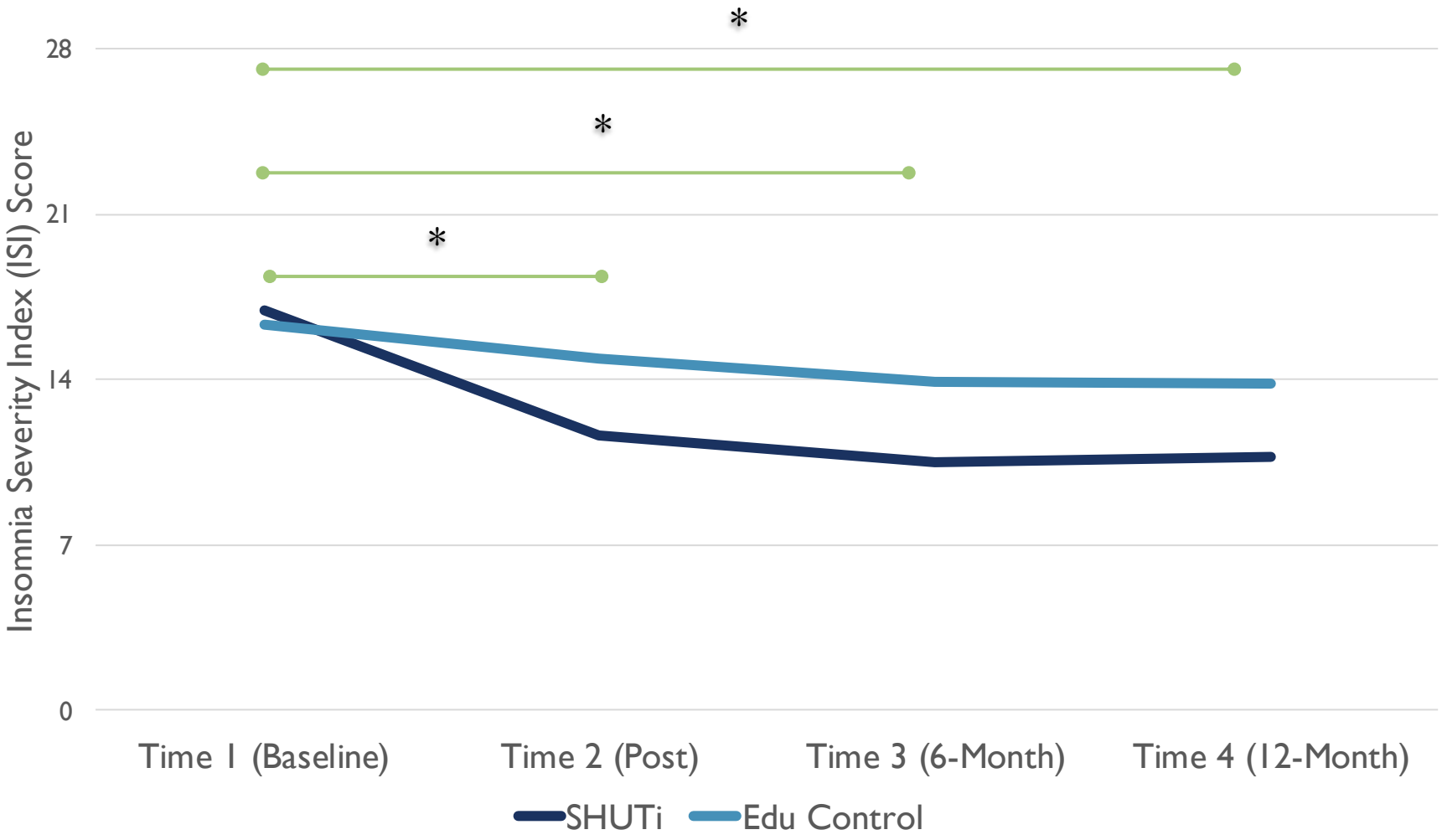
- Objective 1.1
  - Determine if there are significant differences in insomnia symptom reduction and physical and mental health functioning between groups.
    - H1.1: Participants randomized to SHUTi will report a significant pre-intervention to post-intervention decrease in insomnia symptoms, and improvement in functioning compared to participants who are randomized to the educational website control.
- Objectives 1.2 & 1.3
  - Determine whether changes in insomnia symptoms and physical and mental health functioning are maintained six-months and one-year post-intervention.
    - H1.2 & H1.3: Participants randomized to SHUTi will report a significant pre-intervention to six-months and one-year post-intervention decrease in insomnia symptoms, and improvement in functioning compared to participants who are randomized to the educational website control.
- Exploratory Objective 1.4
  - Determine whether SHUTi is associated with significant reductions in additional key variables.


844 Interested Veterans
555 Excluded
61 Could not be reached
494 Ineligible after screen
289 Eligible
39 Excluded
23 Lost to Follow-Up
15 No Longer Interested
1 Enrollment Period Closed
250 Completed Informed Consent
1 Excluded
1 Screen Fail
249 Commenced 14 Days of Sleep Diaries
15 Excluded
15 Did Not Complete 10/14 Diaries
234 Commenced Baseline Assessment
3 Excluded
3 Did Not Complete Baseline Assessment
231 Randomized
116 Allocated to SHUTi
90 Completed Post-Intervention Assessment
83 Completed Post-Intervention Diaries
115 Allocated to Edu Website Control
98 Completed Post-Intervention Assessment
94 Completed Post-Intervention Diaries
n =188
6-Mo F/Up Post-Intervention
76 Completed 6-Mo F/Up Assessment
6-Mo F/Up Post-Intervention
88 Completed 6-Mo F/Up Assessment
n =164
1-Yr F/Up Post-Intervention
78 Completed 1-Yr F/Up Assessment
1-Yr F/Up Post-Intervention
86 Completed 1-Yr F/Up Assessment
n =164
11 Withdrawn or Discontinued
9 Requested Withdrawal
2 Deceased

	SHUTi (N=116)	Edu Control (N=115)	p-value
Age	39.1 (8.0)	39.5 (7.6)	0.72
Gender[a]			0.88*
Male	84 (73%)	86 (75%)	
Female	30 (26%)	29 (25%)	
Transfemale	1 (1%)	0 (0%)	
Race[b]			0.92
White/Caucasian	85 (76%)	87 (77%)	
Black/African American	13 (12%)	13 (12%)	
Multiracial	6 (5%)	4 (4%)	
Other	8 (7%)	9 (8%)	
Hispanic[c]	16 (14%)	20 (18%)	0.45
Deployed	99 (85%)	106 (92%)	0.10
History of a Suicide Attempt	23 (20%)	23 (20%)	0.97

[a]N=115 SHUTi; [b]N=112 SHUTi, N=113 Control; [c]N=115 SHUTi, N=114 Control; *Fisher's Exact Test

CHANGE IN INSOMNIA SYMPTOM SEVERITY: SHUTI VS EDU CONTROL



*p<0.0001

INTENT TO TREAT ANALYSIS: INSOMNIA SEVERITY INDEX

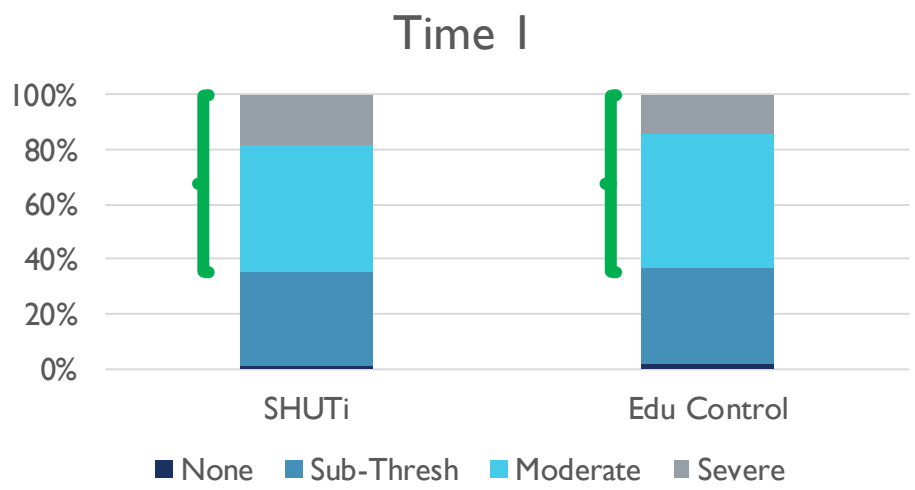
			Generalized eta²	Generalized omega²	p value	
			0.13	0.12	**<0.0001***	
Baseline ISI		-2.15	0.02	0.02	0.03	0.20
			0.0008		0.69	

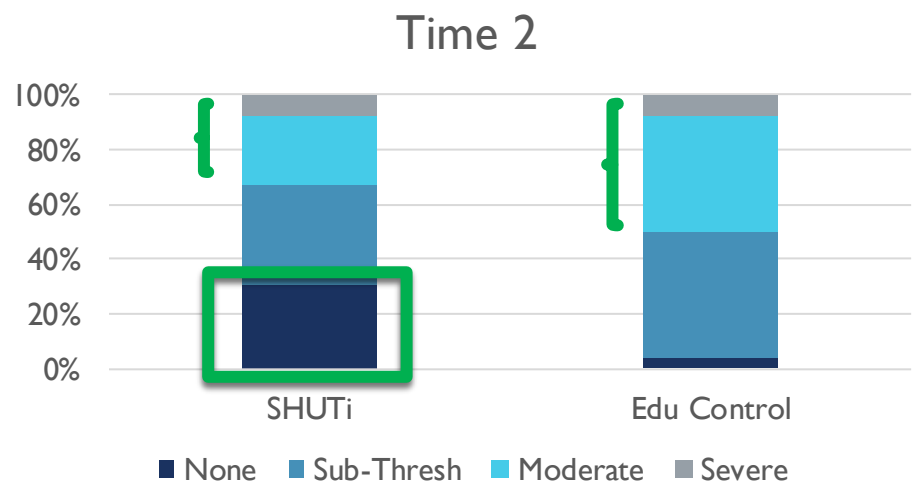
			Generalized eta²	Generalized omega²	p value	
			0.12	0.12	**<0.0001***	
Baseline ISI	-0.25 (0.09)	-2.80	0.05	0.04	0.006	0.14
History of Attempt		0.50			0.62	

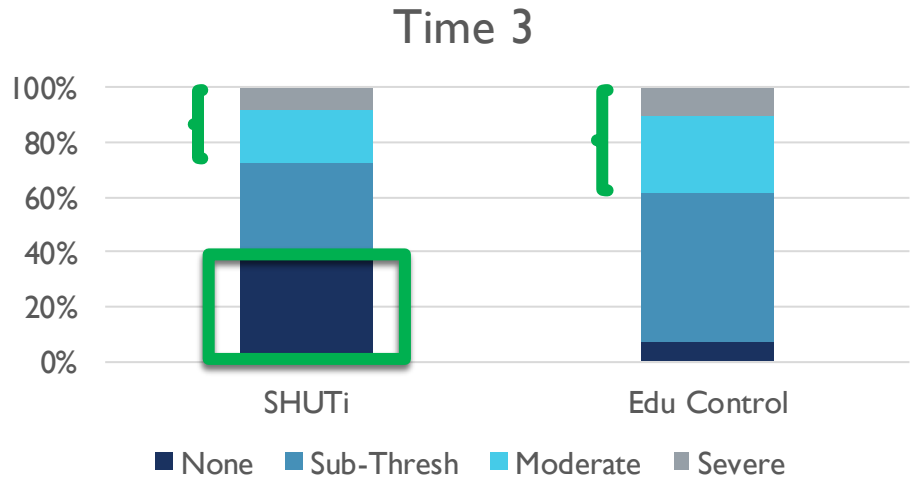
			Generalized eta²	Generalized omega²	p value	
			0.10	0.09	**<0.0001***	
Baseline ISI	-0.35 (0.09)	-3.93	0.09	0.08	0.0001	0.13
History of Attempt	0.38 (0.97)	0.39	0.0009	-0.005	0.69	

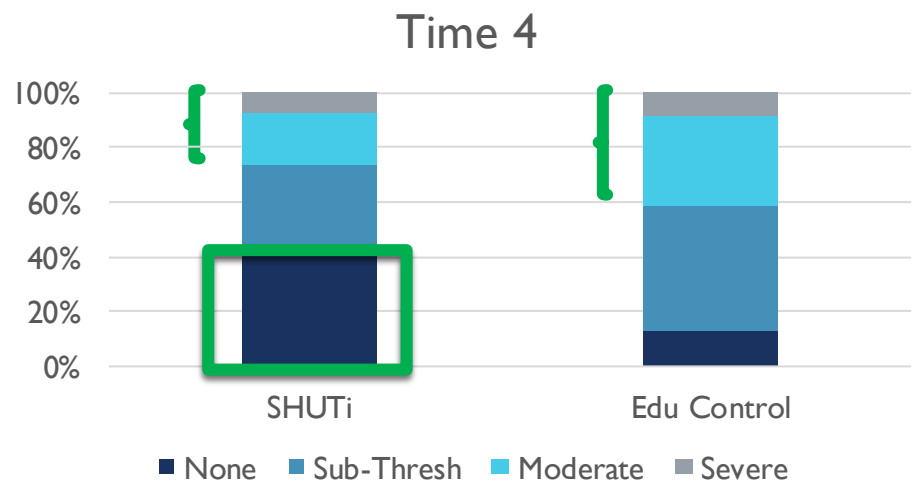
***Significant based on the Holm Sequential Procedure, considering all 9 outcomes**

INSOMNIA SYMPTOM SEVERITY:TIME X GROUP

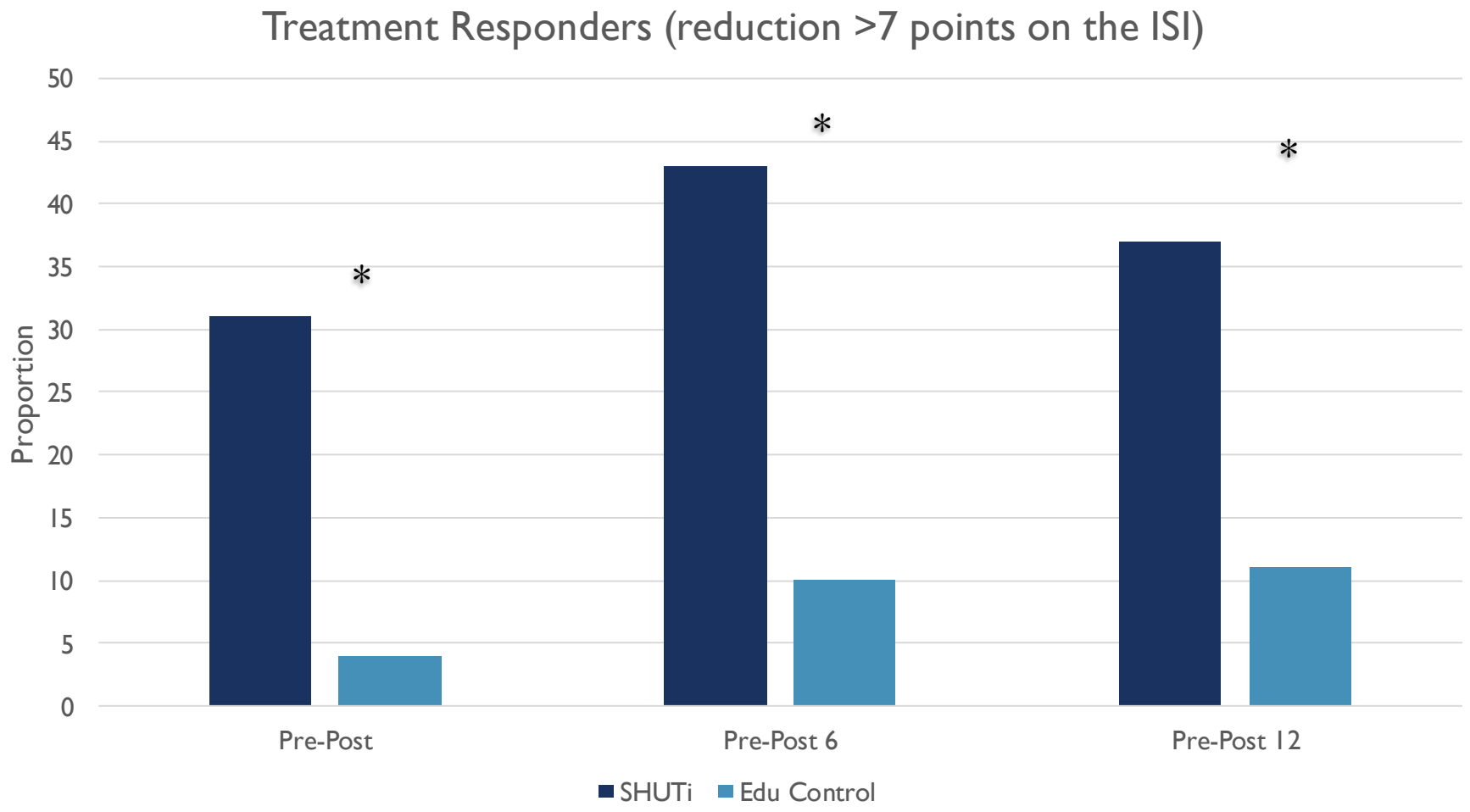






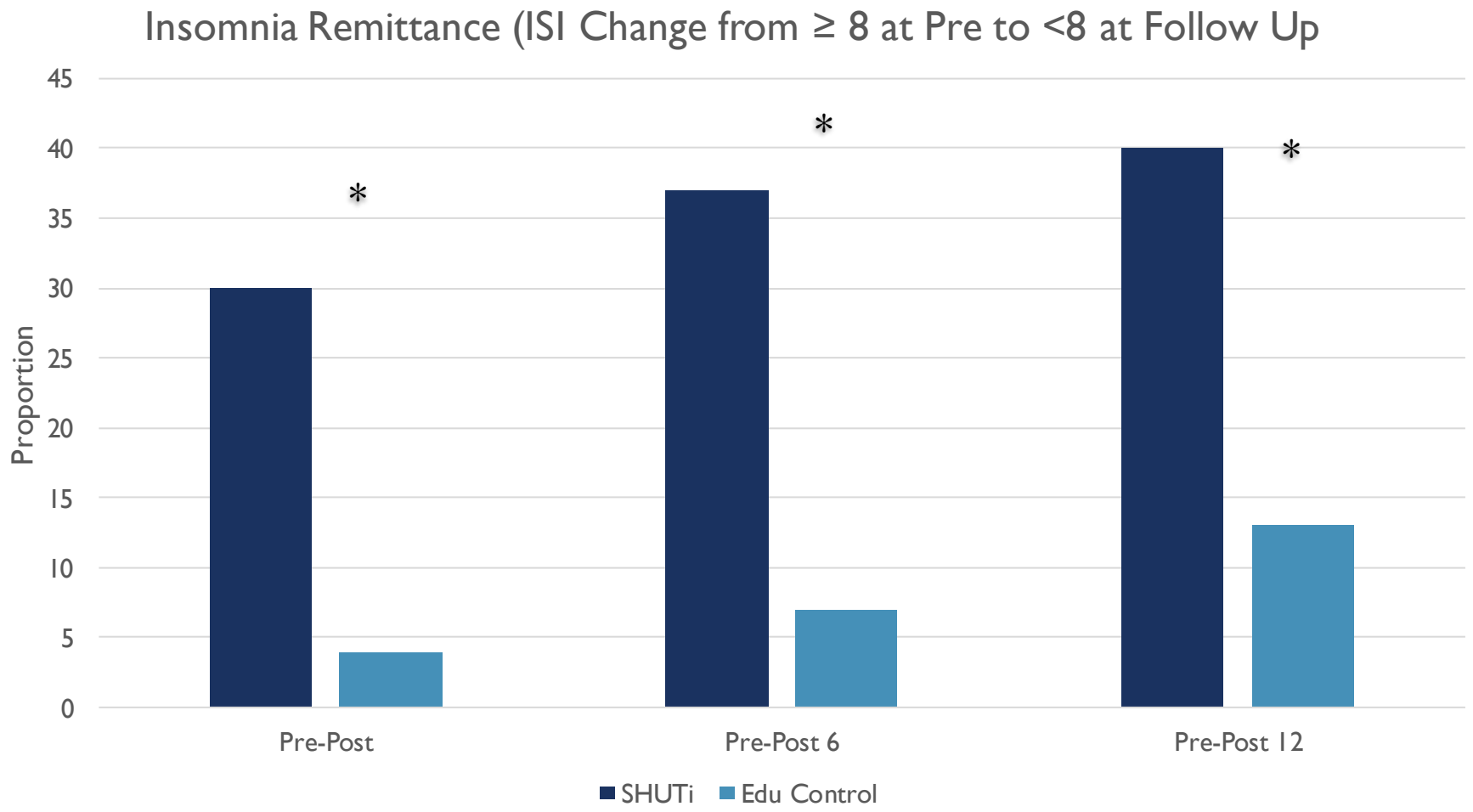


CLINICAL SIGNIFICANCE: SHUTI VS EDU CONTROL



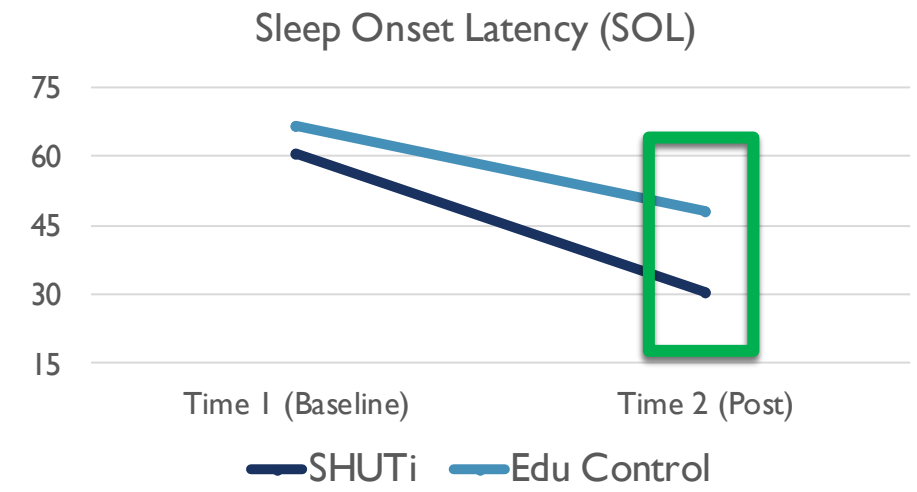
*p<0.0001

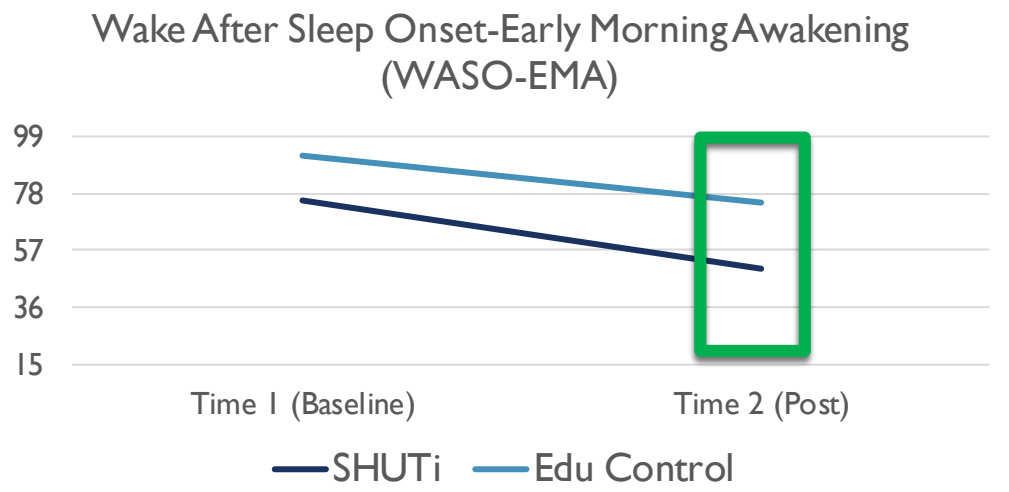
CLINICAL SIGNIFICANCE: SHUTI VS EDU CONTROL

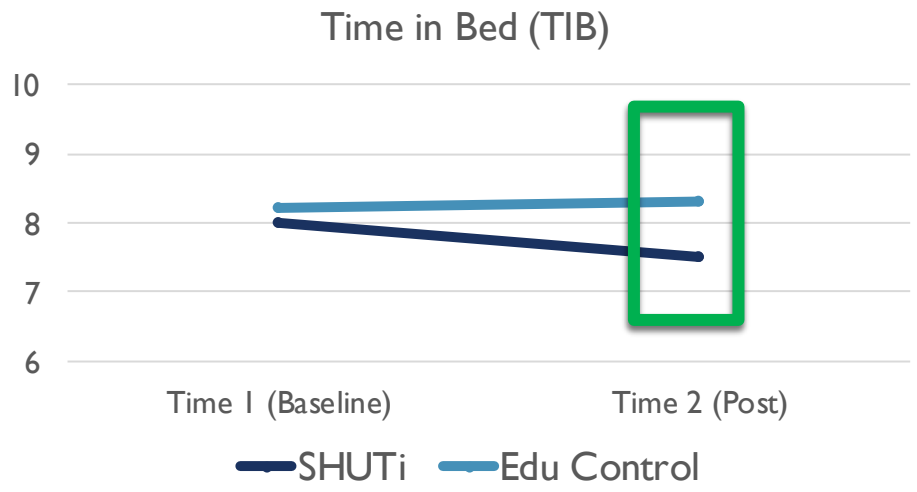


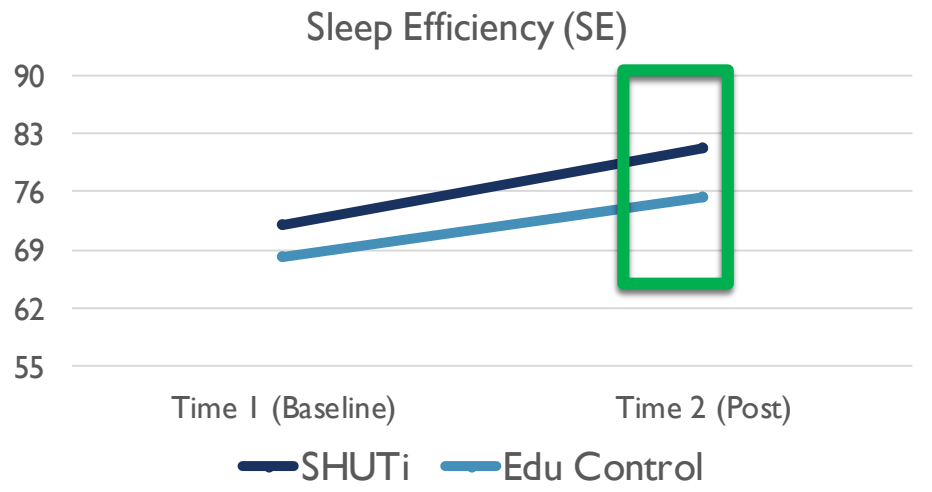
*p<0.0001

Sleep Diary Variables (Intent to Treat)

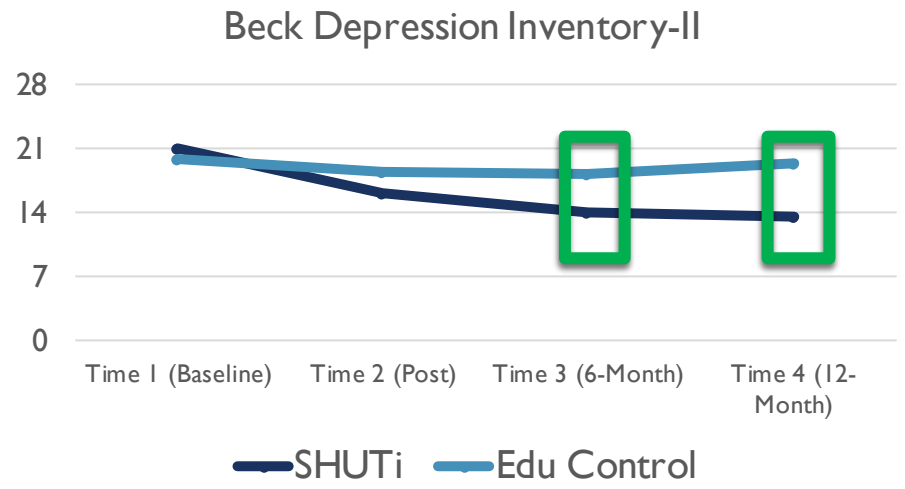


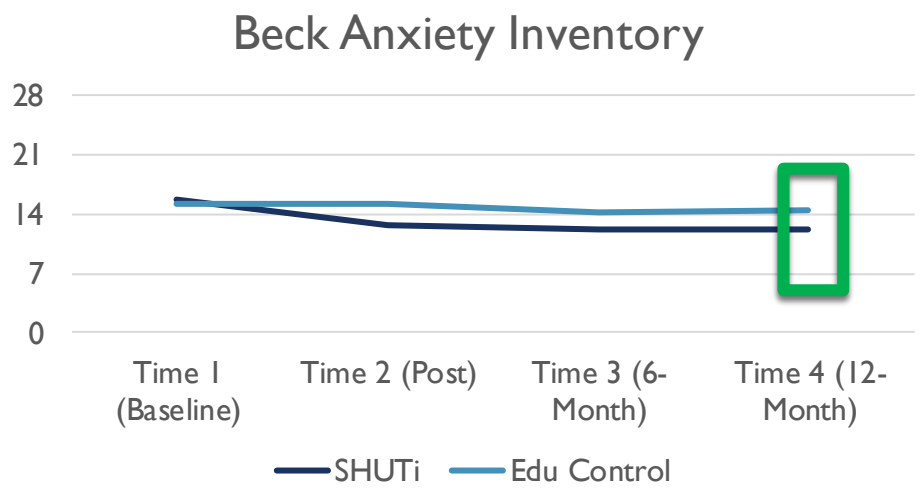


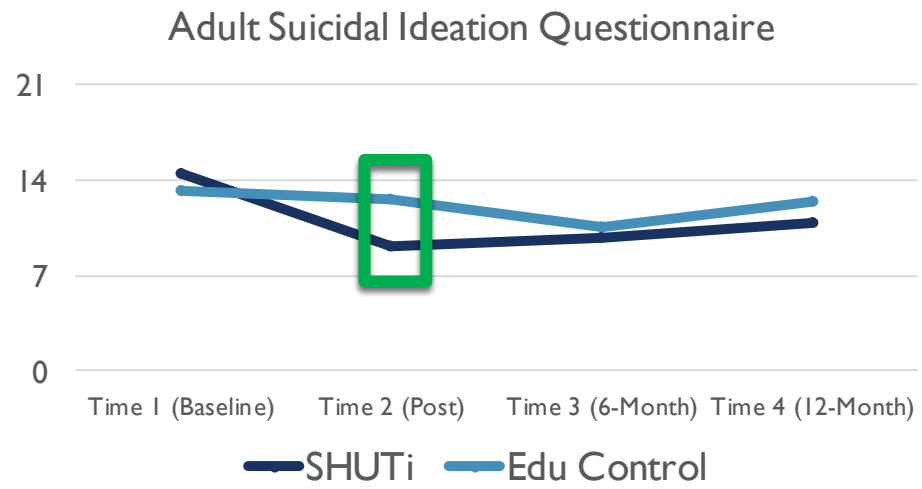


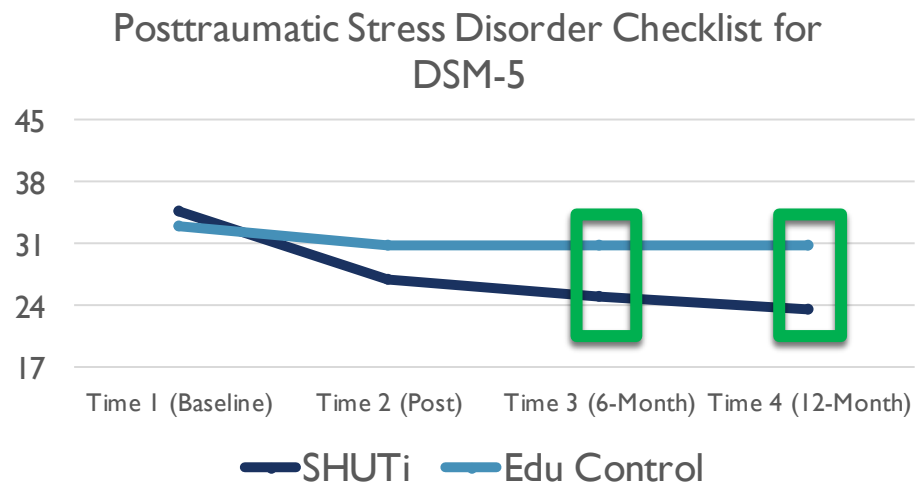


Exploratory Findings: Depression, Anxiety, PTSD, Suicidal Ideation (Intent to Treat)







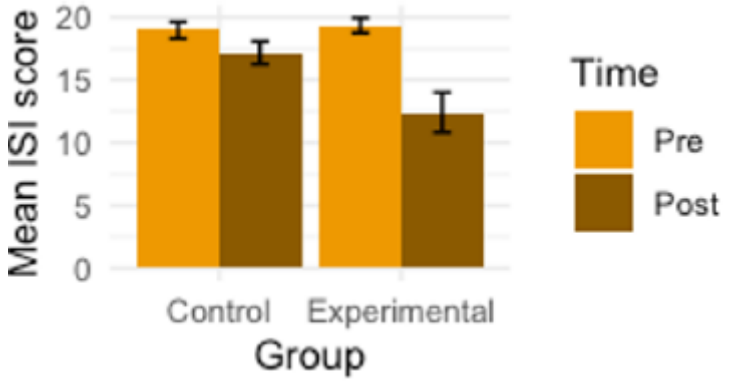


SUMMARY

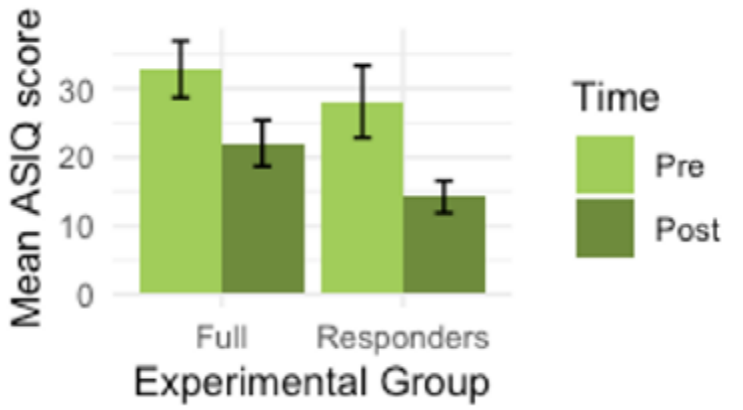
- RCT supports the use of computerized or mobile-based CBT-I in Veterans
  - Outcomes gained with "hands off" intervention
  - Engagement intervention
  - Depressive symptoms
  - Physical/Mental Health Functioning

FUTURE WORK

- Technology-based delivery of CBT-I is effective in a population characterized by complicated comorbidity
  - Timing of CBT-I delivery in military populations (i.e., sleep restriction)
  - What is the most effective implementation model?
  - Determine if there are specific profiles that are most associated with gains
- Use of mobile CBT-I in indicated populations
  - NIMH Submission (PI: Haghighi): Examine the efficacy of mCBT-I in a sample of Veterans at elevated risk for suicide



d = -0.83



d = -0.52

d = -0.98

Thank you!

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