Apnea, Insomnia, and Cognition in Veterans with Gulf War Illness

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screen for Obstructive Sleep Apnea (OSA)

Snore loudly

Tired, fatigued, or sleepy during daytime

Observed apnea; gasping during sleep

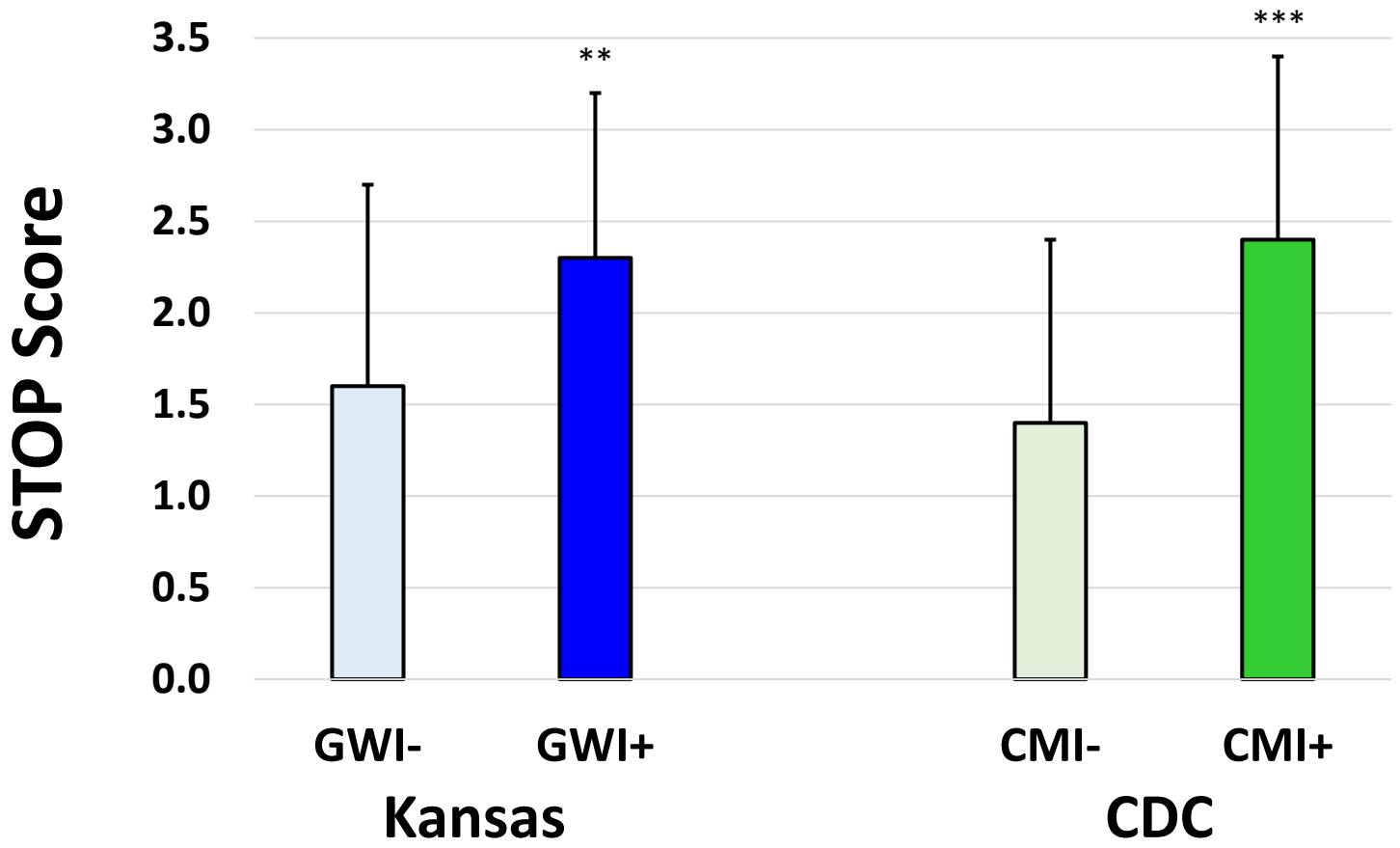
Pressure (high blood pressure)

Military Medicine AMSUS The Society of Federal Health Professionals

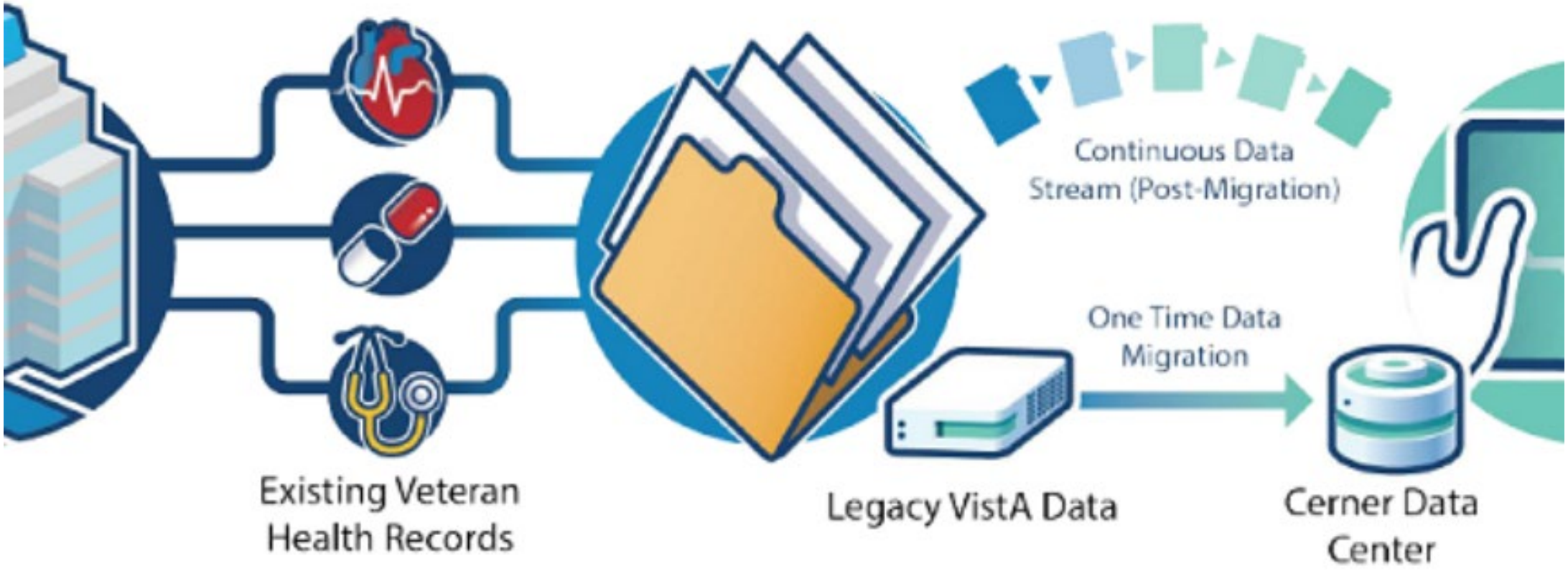
Insomnia Severity, Subjective Sleep Quality, and Risk for Obstructive Sleep Apnea in Veterans With Gulf War Illness

Linda L. Chao, PhD†‡; Linda R. Abadjian, PhD*; Iva L. Esparza, BA*; Rosemary Reeb, BS*†*

MILITARY MEDICINE, 181, 9:1127, 2016



VHA's electronic health records (EHR)



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ORIGINAL RESEARCH

ATS Journals

The Association of Ambient Air Pollution with Sleep Apnea: The Multi-Ethnic Study of Atherosclerosis

Martha E. Billings[1], Diane Gold[2,3], Adam Szpiro[4], Carrie P. Aaron[5], Neal Jorgensen[4], Amanda Gassett[6,7], Peter J. Leary[1], Joel D. Kaufman[6,7], and Susan R. Redline[2*]

Individuals with higher exposures to NO_2 and $PM_{2.5}$ had a greater odds of sleep apnea.

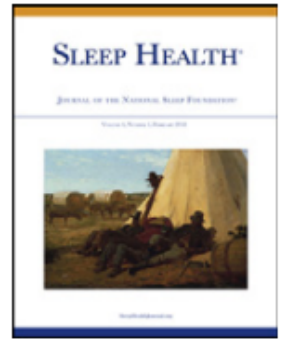
Sleep Health 4 (2018) 20–26

Contents lists available at ScienceDirect

Sleep Health

Journal of the National Sleep Foundation

journal homepage: sleephealthjournal.org



Sleep apnea and pesticide exposure in a study of US farmers☆

Brittney O. Baumert, MPH [a], Megan Ulmer Carnes, PhD [a], Jane A. Hoppin, ScD [b], Chandra L. Jackson, PhD [a], Dale P. Sandler, PhD [a], Laura Beane Freeman, PhD [c], Paul K. Henneberger, ScD [d], David M. Umbach, PhD [e], Srishti Shrestha, PhD [a], Stuart Long, BS [f], Stephanie J. London, MD, DrPH [a,*]

Factors that increase OSA risks:

- Male sex
- **Advancing age**

International Journal of
Environmental Research and Public Health

MDPI

Article

Rates of Chronic Medical Conditions in 1991 Gulf War Veterans Compared to the General Population

Clara G. Zundel [1,2], Maxine H. Krengel [1,3], Timothy Heeren [4], Megan K. Yee [1], Claudia M. Grasso [1], Patricia A. Janulewicz Lloyd [5], Steven S. Coughlin [6] and Kimberly Sullivan [5,*]

Factors that increase OSA risks:

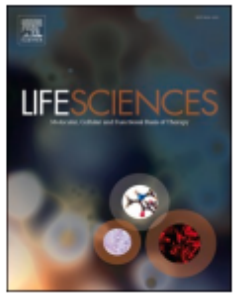
- Male sex
- Advancing age
- **Hormonal changes**

Life Sciences 328 (2023) 121908

Contents lists available at ScienceDirect

Life Sciences

journal homepage: www.elsevier.com/locate/lifescie



Hormonal changes in veterans with Gulf War Illness

Gursimrat Bhatti [a,b], Audri Villalon [a,b], Ruosha Li [c], Mohamed Elammari [a,b], Alexandra Price [b], Lea Steele [b], Jose M. Garcia [d], Marco Marcelli [a], Ricardo Jorge [a,b,*]

Factors that increase OSA risks:

- Male sex
- Advancing age
- Hormonal changes
- **Obesity**

The Open Epidemiology Journal, 2011, *4*, 140-146

Open Access

Selected Health Conditions Among Overweight, Obese, and Non-Obese Veterans of the 1991 Gulf War: Results from a Survey Conducted in 2003-2005

Steven S. Coughlin*, Han K. Kang and Clare M. Mahan

Slides removed because it is unpublished data.

International Journal of
Environmental Research and Public Health

MDPI

Review

Comorbid Insomnia and Obstructive Sleep Apnea (COMISA): Current Concepts of Patient Management

Beatrice Ragnoli [1], Patrizia Pochetti [1], Alberto Raie [1] and Mario Malerba [1,2,*]

- **6%-84%** patients with **sleep apnea** have **co-occurring insomnia**.
- **7%-69%** patients with **insomnia** have **co-occurring OSA**.

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Military Medicine AMSUS The Society of Federal Health Professionals

Insomnia Severity, Subjective Sleep Quality, and Risk for Obstructive Sleep Apnea in Veterans With Gulf War Illness

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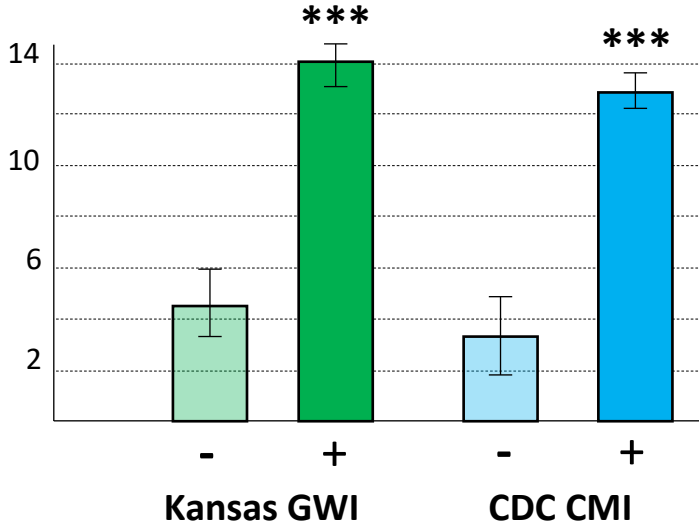
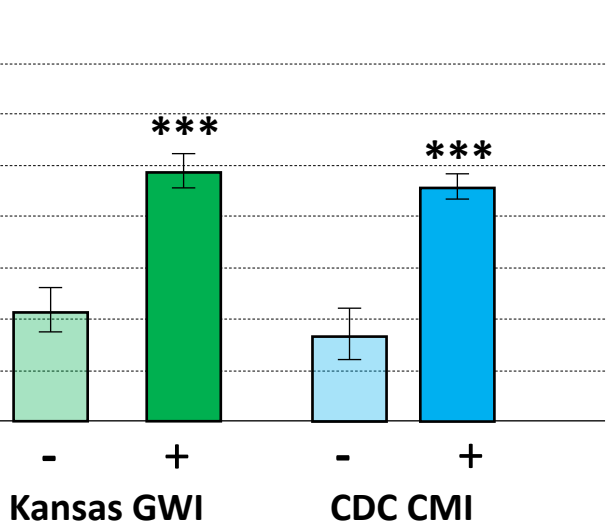
MILITARY MEDICINE, 181, 9:1127, 2016

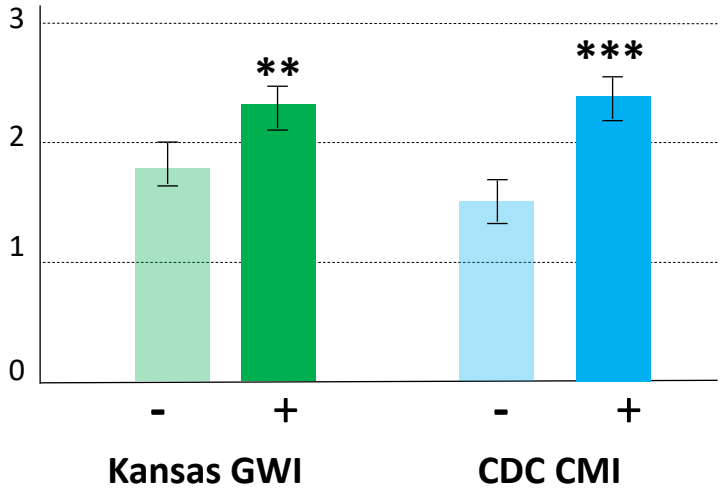
Insomnia Severity Index



Pittsburgh Sleep Quality Index



OSA Risk



SLEEP Sleep Research Society

ASSOCIATIONS BETWEEN SLEEP QUALITY AND BRAIN VOLUME IN GULF WAR VETERANS

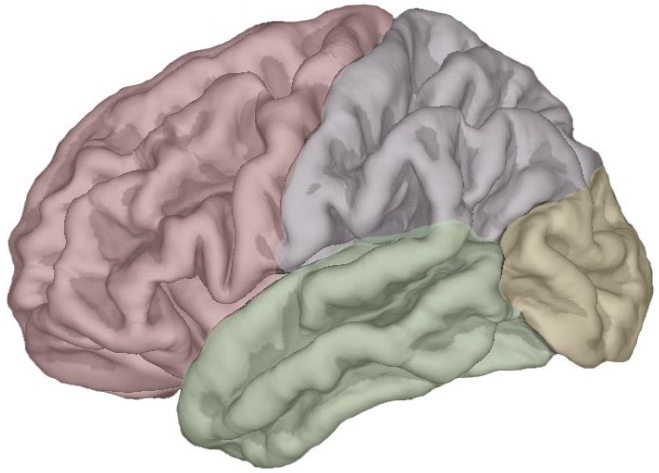
http://dx.doi.org/10.5665/sleep.3472

Associations between Subjective Sleep Quality and Brain Volume in Gulf War Veterans

Linda L. Chao, PhD[1,2,3]; Brian S. Mohlenhoff, MD[2,3]; Michael W. Weiner, MD[1,2,3]; Thomas C. Neylan, MD[2,4]

Departments of [1]Radiology and Biomedical Imaging and [2]Psychiatry, University of California, San Francisco, CA; [3]Center for Imaging of Neurodegenerative Diseases and [4]Mental Health Service, Department of Veterans Affairs Medical Center, San Francisco, CA

- Sleep quality was inversely related to total gray matter and frontal lobe gray matter volume



SLEEP

Sleep Research Society

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Departments of [1]Radiology and Biomedical Imaging and [2]Psychiatry, University of California, San Francisco, CA; [3]Center for Imaging of Neurodegenerative Diseases and [4]Mental Health Service, Department of Veterans Affairs Medical Center, San Francisco, CA

Region	Intercept	PSQI	Age	ICV	GWI	Adult trauma	Psych Med	Lifetime CAPS	Current CAPS	HAM-D
Total gray matter	**127722 (24220)**	**-1080 (494)**	**-1288 (192)**	**0. 255 (0.013)**	7938 (4430)	5735 (5665)	-6127 (5054)	-28 (142)	6 (164)	287 (438)
Frontal Lobe	**57132 (11317)**	**-567 (231)**	**-540 (90)**	**0.087 (0.006)**	1690 (2070)	-8 (2647)	-2828 (2376)	38 (67)	-23 (77)	239 (205)
Parietal Lobe	**32733 (8394)**	-237 (171)	**-343 (37)**	**0.073 (0.004)**	2881 (1535)	1307 (1964)	-304 (1762)	-5 (49)	-12 (57)	20 (152)
Temporal Lobe	**25180 (7110)**	-148 (145)	**-261 (56)**	**0.059 (0.004)**	**2908 (1300)**	3225 (1663)	-752 (1493)	-41 (42)	9 (48)	31 (129)
Occipital Lobe	8858 (5179)	-86 (106)	**-128 (41)**	**0.028 (0.003)**	581 (947)	999 (1211)	-2110 (1087)	-17 (30)	21 (35)	-3 (94)

Poor sleep quality/insomnia has been linked with:

- **brain atrophy** (Sexton et al., 2014; Koo et al., 2017; Altena et al., 2010; Li et al., 2018; Winkleman et al. 2013; Joo et al., 2014; Grau-Rivera et al., 2020).
- **higher risk of late-life dementia** (Potvin et al., 2012; Sindi et al., 2018; Lim et al., 2013).
- **β-amyloid and tau accumulation in the brain** (Ju et al., 2015; Holth et al., 2019).
- **Impaired cognition, particularly executive function** (Grau-Rivera et al., 2020).

OSA has been linked with:

- **brain atrophy and decreased white matter integrity** (Cross et al., 2018; Macey et al., 2008; Kumar et al., 2012; Joo et al., 2014).
- **cognitive deficits in multiple domains** (Bucks et al. 2013; Leng et al., 2017).
- **increased risk for and earlier progression to Mild Cognitive Impairment (MCI) and dementia** (Yaffe et al., 2011; Osoris et al., 2015).

Mild **C**ognitive **I**mpairment (**MCI**)

- Clinical syndrome defined as cognitive decline greater than that expected for the person's age but does not impact activities of daily life.
- Transition between normal aging and dementia.
- Increased risk for dementia.

International Journal of
Environmental Research and Public Health

MDPI

Article

The Prevalence of Mild Cognitive Impairment in a Convenience Sample of 202 Gulf War Veterans

Linda L. Chao [1,2,3]

- 12% of GW Veteran sample (median age 52 years) had MCI according to actuarial neuropsychological criteria.

SPECIAL ARTICLE LEVEL OF RECOMMENDATION

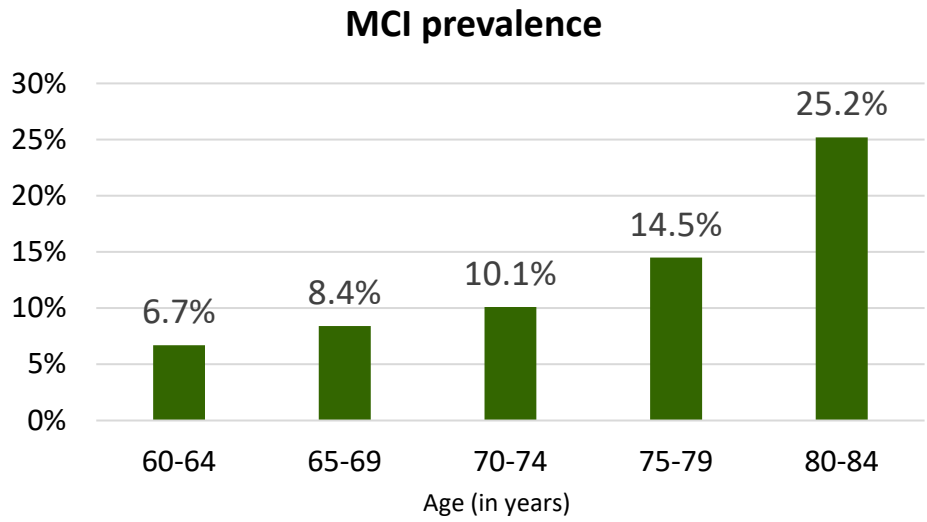
Practice guideline update summary: Mild cognitive impairment

Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology

Ronald C. Petersen, MD, PhD, Oscar Lopez, MD, Melissa J. Armstrong, MD, MSc, Thomas S.D. Getchius, Mary Ganguli, MD, MPH, David Gloss, MD, MPH&TM, Gary S. Gronseth, MD, Daniel Marson, JD, PhD, Tamara Pringsheim, MD, Gregory S. Day, MD, MSc, Mark Sager, MD, James Stevens, MD, and Alexander Rae-Grant, MD

Correspondence
American Academy of Neurology
guidelines@aan.com

Neurology® 2018;90:126-135. doi:10.1212/WNL.0000000000004826



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Life Sciences 279 (2021) 119147

Contents lists available at ScienceDirect

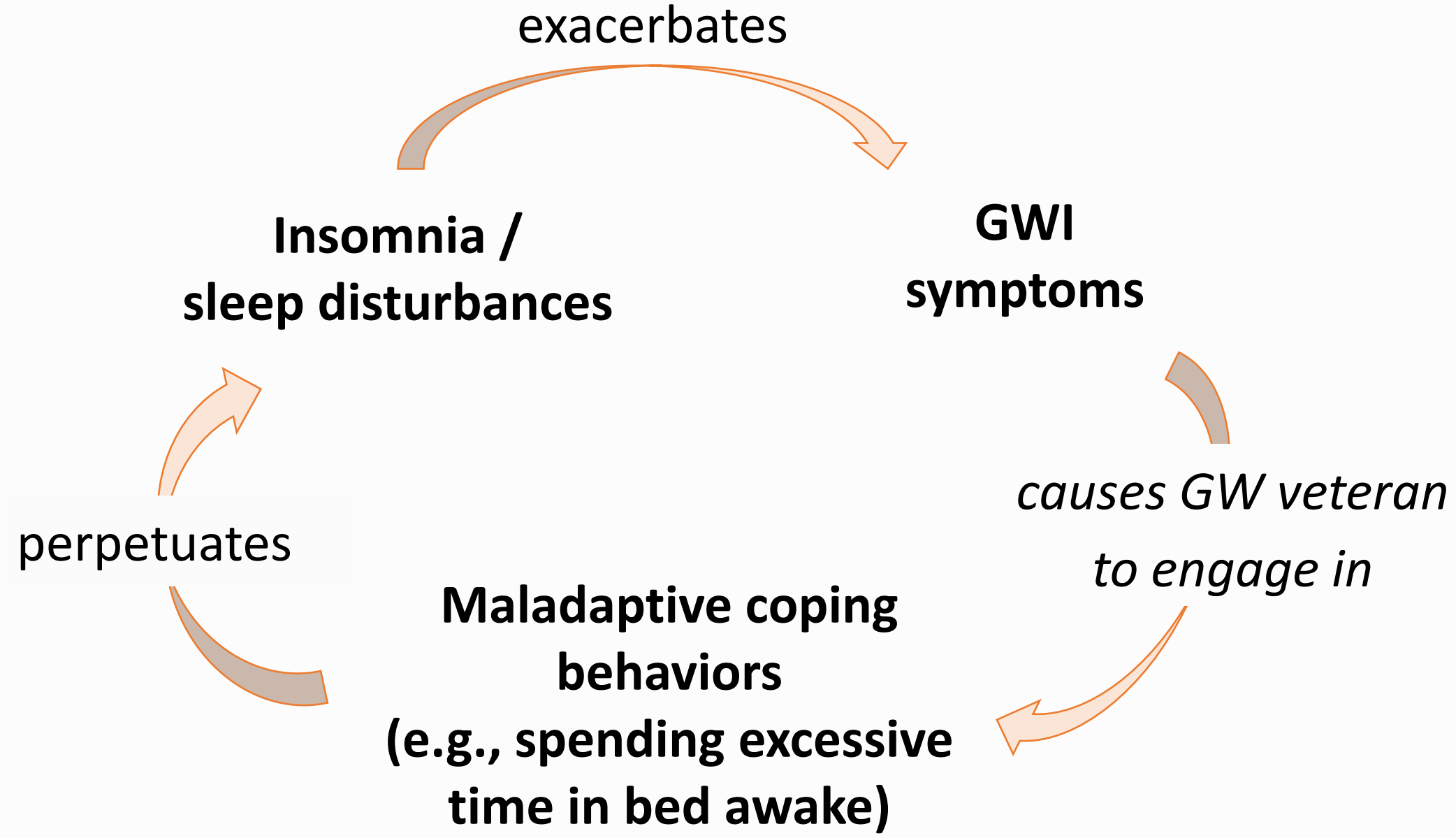
Life Sciences

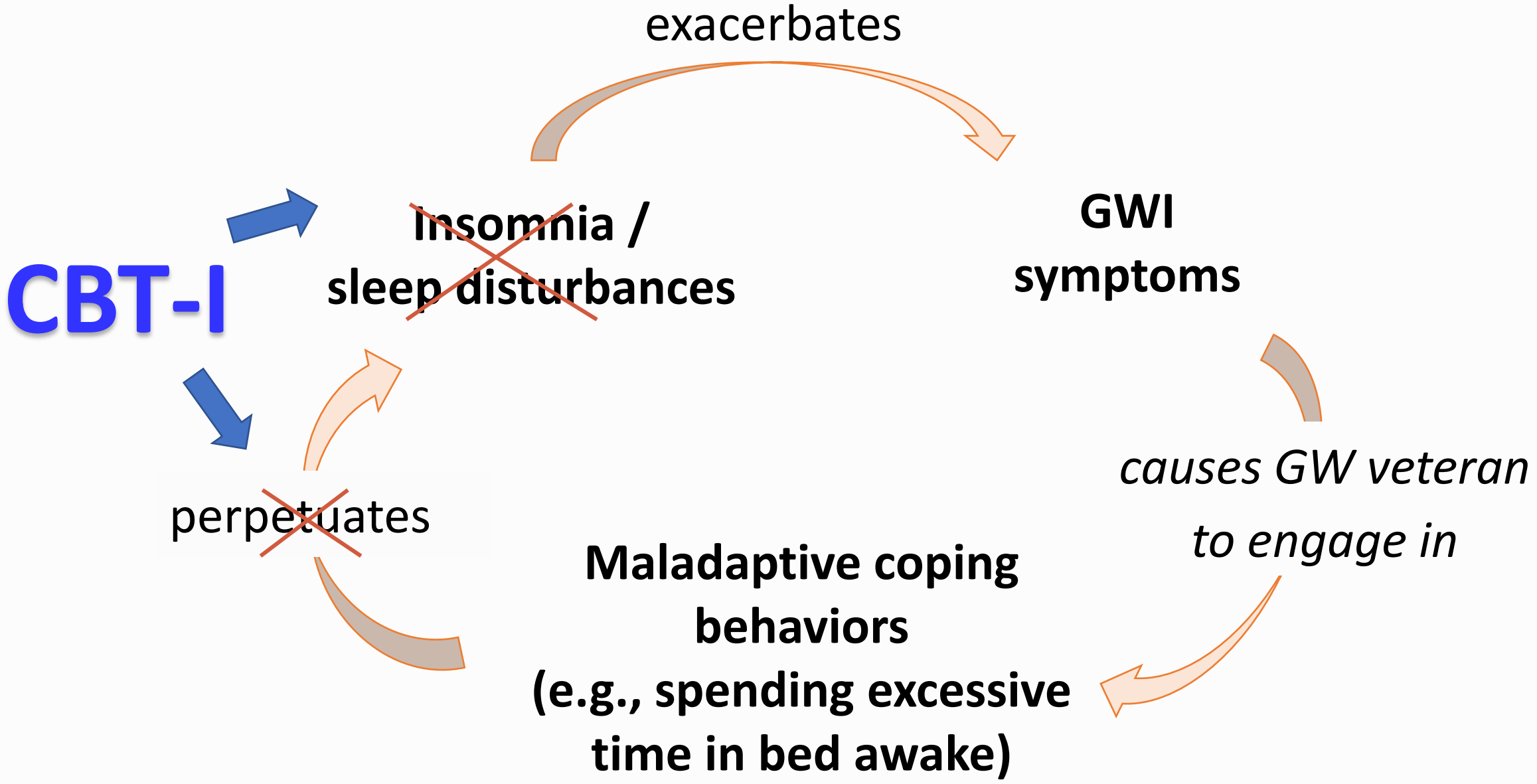
journal homepage: www.elsevier.com/locate/lifescie

Cognitive behavioral therapy for insomnia in veterans with gulf war illness: Results from a randomized controlled trial

Linda L. Chao [a,b,*], Jennifer C. Kanady [c], Nicole Crocker [a], Laura D. Straus [a,b,d], Jennifer Hlavin [a], Thomas J. Metzler [a,b,d], Shira Maguen [a,b,d], Thomas C. Neylan [a,b,d]

[a] San Francisco Veterans Affairs Health Care System, San Francisco, CA 94121, USA
[b] University of California, San Francisco, CA 94143, USA
[c] Big Health, Sleepio, San Francisco, CA 94108, USA
[d] Sierra Pacific Mental Illness Research, Education, and Clinical Center, San Francisco, CA 94121, USA


exacerbates
Insomnia / sleep disturbances
GWI symptoms
causes GW veteran to engage in
Maladaptive coping behaviors (e.g., spending excessive time in bed awake)
perpetuates


exacerbates
CBT-I
Insomnia /
sleep disturbances
GWI
symptoms
causes GW veteran
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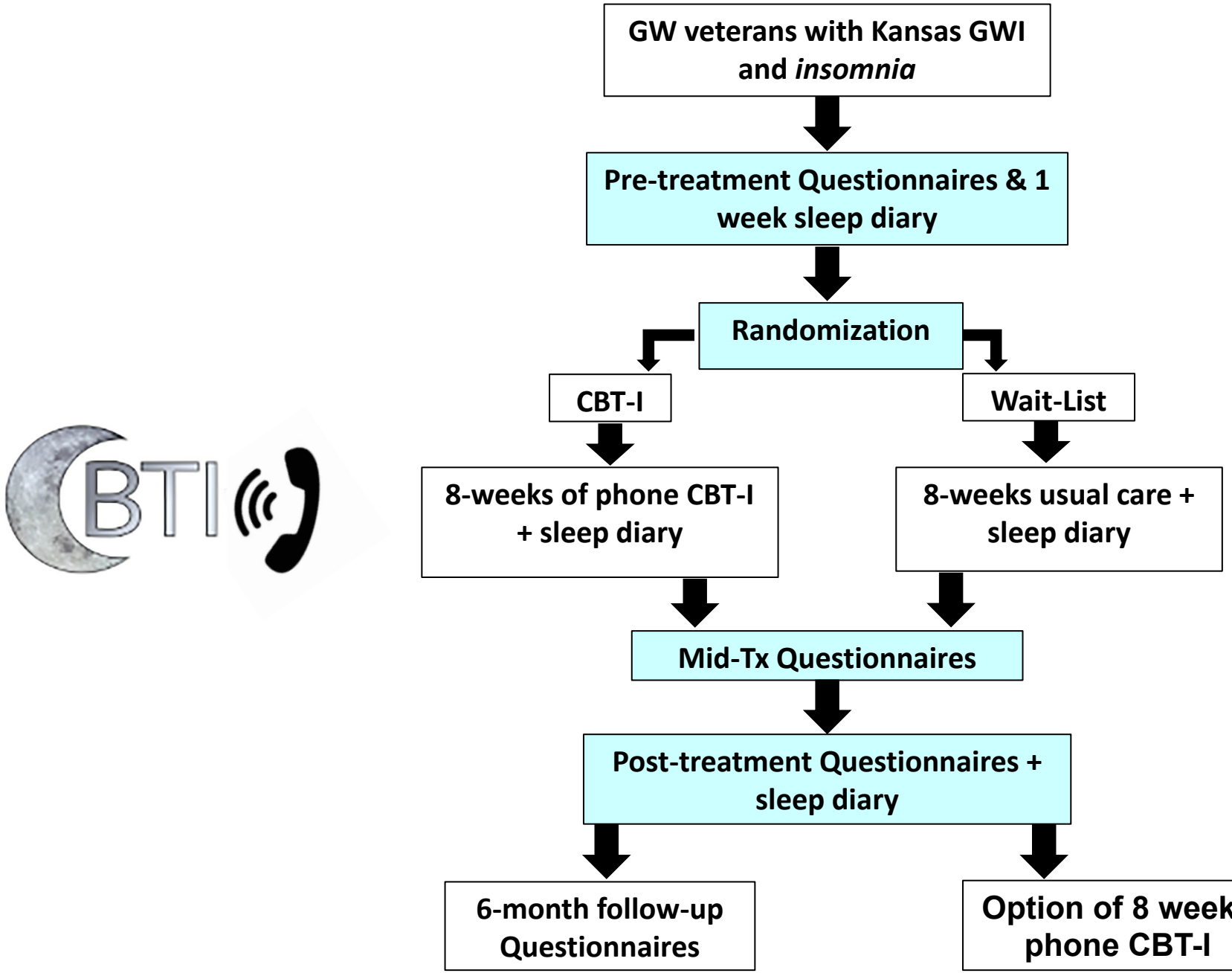
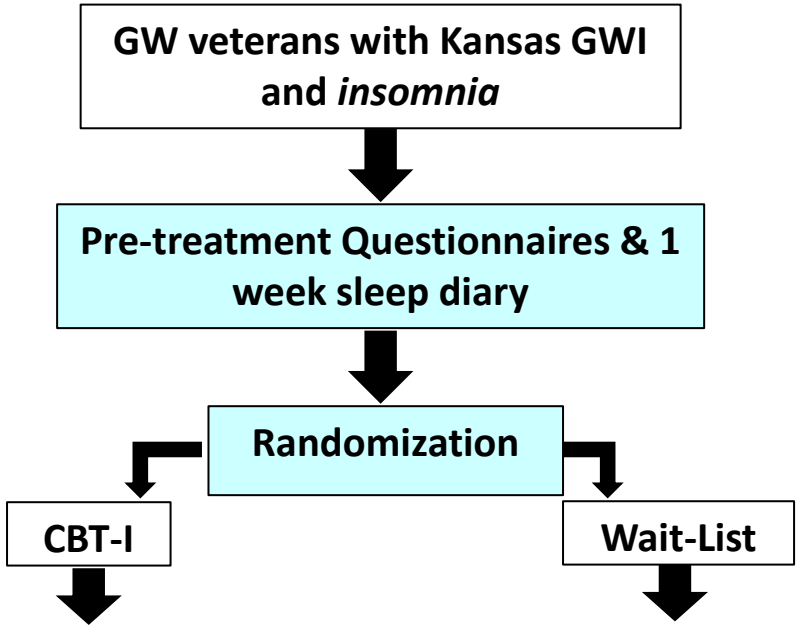
Maladaptive coping
behaviors
(e.g., spending excessive
time in bed awake)

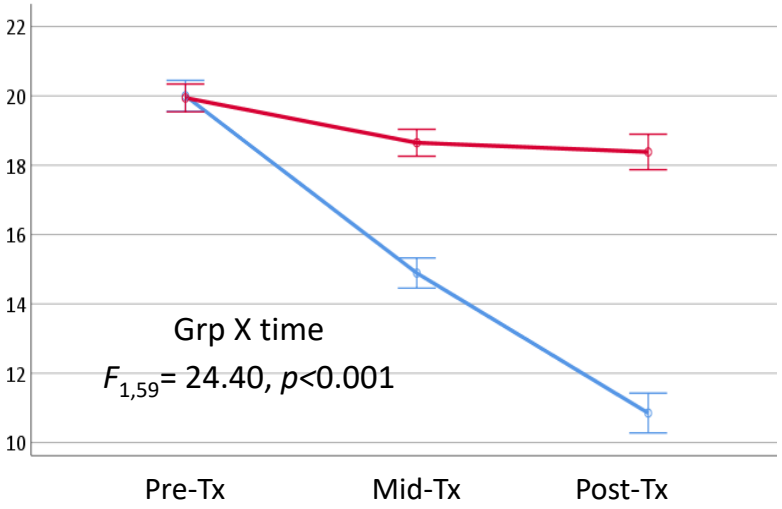

GW veterans with Kansas GWI and *insomnia*
Pre-treatment Questionnaires & 1 week sleep diary
Randomization
CBT-I
Wait-List
8-weeks of phone CBT-I + sleep diary
8-weeks usual care + sleep diary
Mid-Tx Questionnaires
Post-treatment Questionnaires + sleep diary
6-month follow-up Questionnaires
Option of 8 weeks phone CBT-I



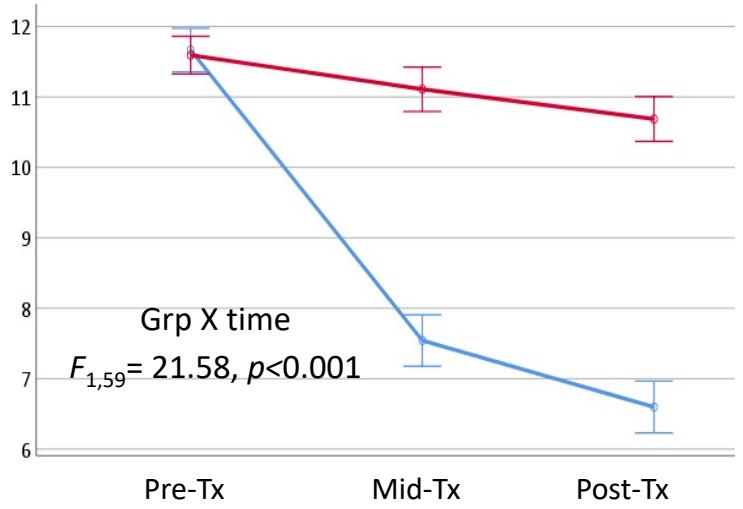
N	29	35
No. Female (%)	8 (28%)	7 (20%)
Age, years	51.8 ± 11.4	54.5 ± 6.1
Education, years	14.9 ± 3.5	15.7 ± 4.8
No. Caucasian (%)	18 (62%)	27 (77%)
No. current PTSD (%)	4 (11%)	8 (28%)
No. current MDD (%)	2 (6%)	4 (14%)
Baseline ISI	20 ± 5.5	20 ± 3.8
Baseline GWI severity	69.4 ± 16.7	66.0 ± 14.6

Insomnia severity, subjective sleep quality, and GWI symptoms improved after CBT-I

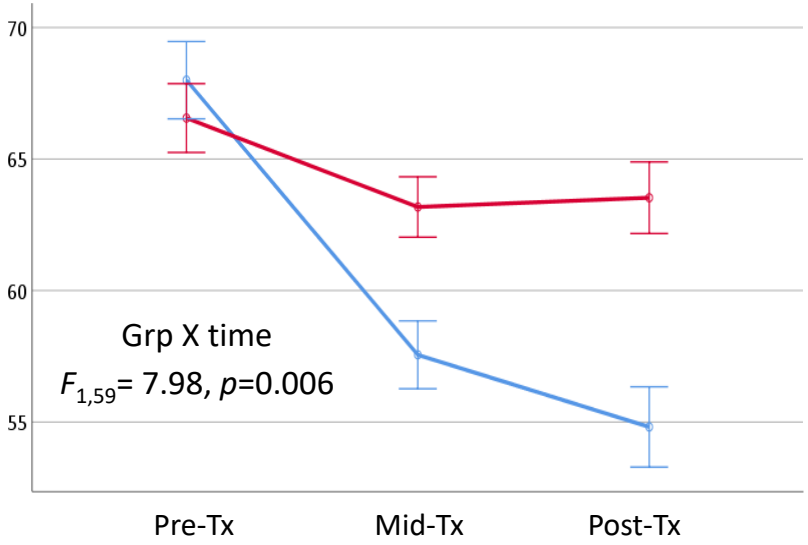
Insomnia Severity Index (ISI)



Subjective Sleep Quality (PSQI)



GWI Severity Index

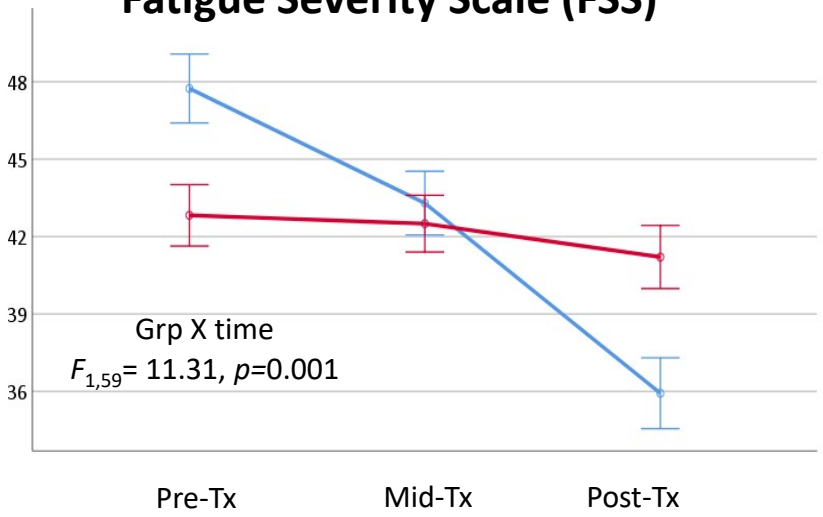


Wait List
CBT-I

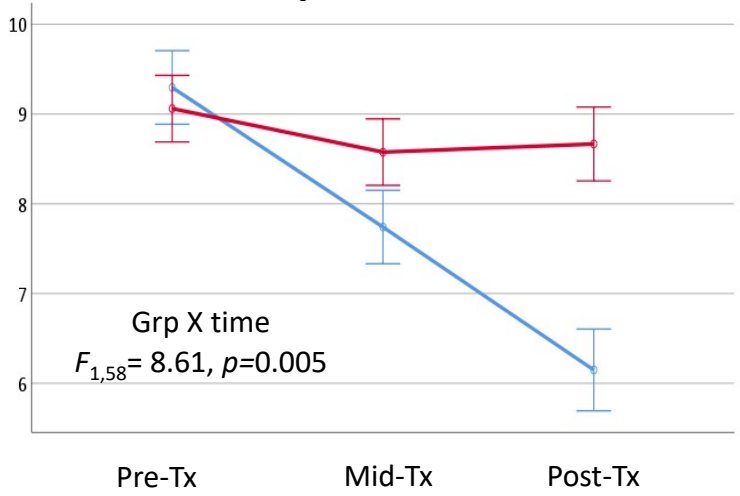
Fatigue, depression and anxiety decreased after CBT-I

Hospital Anxiety and Depression Scale (HADS)

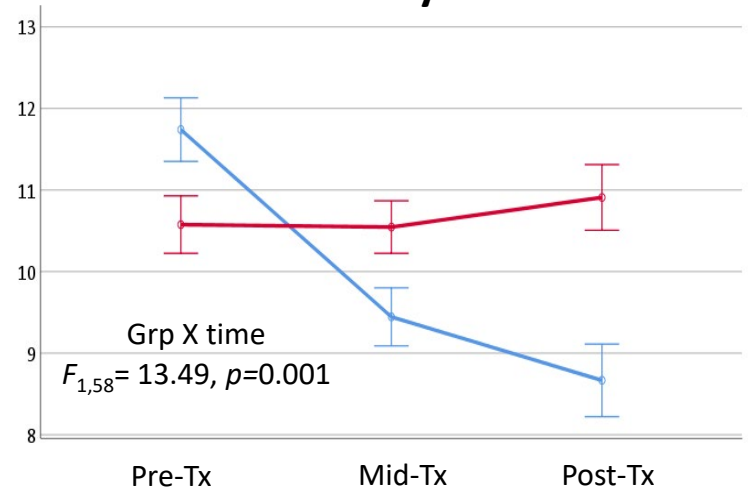
Fatigue Severity Scale (FSS)



Depression



Anxiety

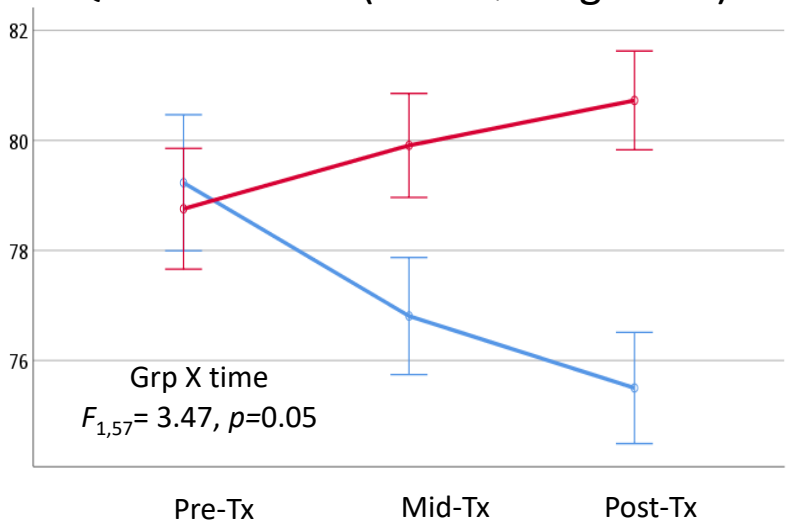


Wait List

CBT-I

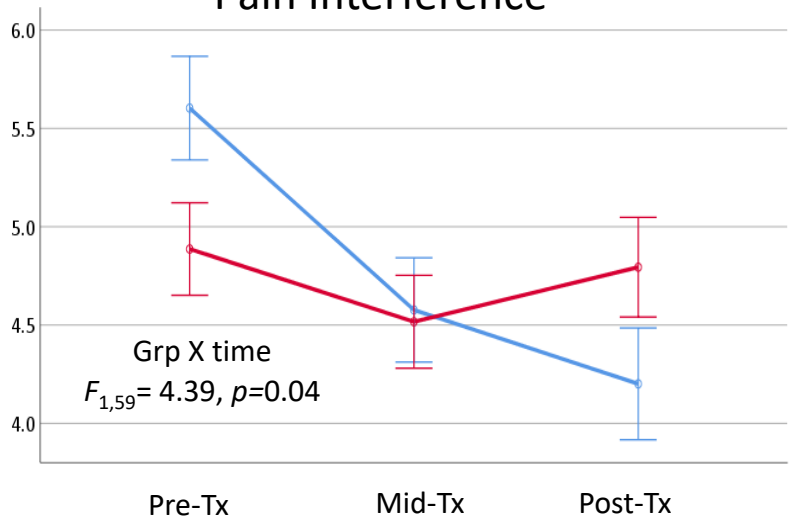
Cognition and Pain Interference Improved after CBT-I

Multiple Ability Self-Report Questionnaire (MASQ - cognition)

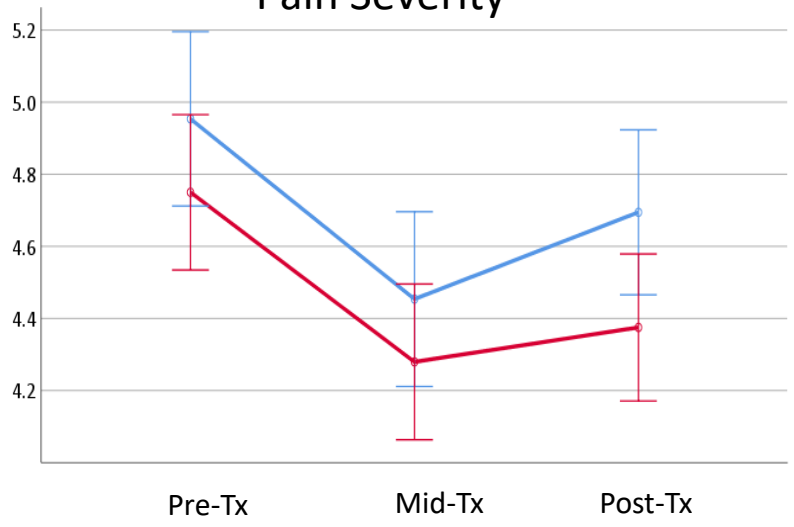


Brief Pain Inventory (BPI)

Pain Interference

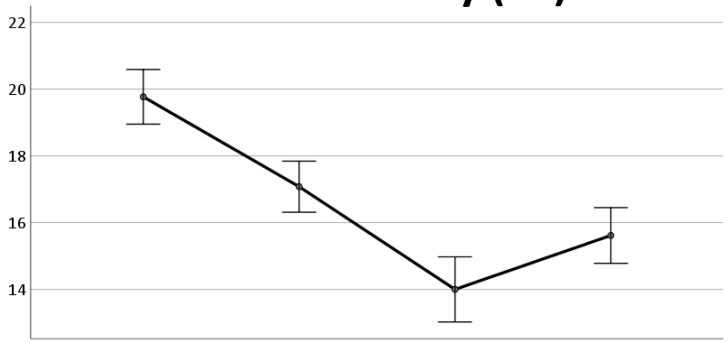


Pain Severity

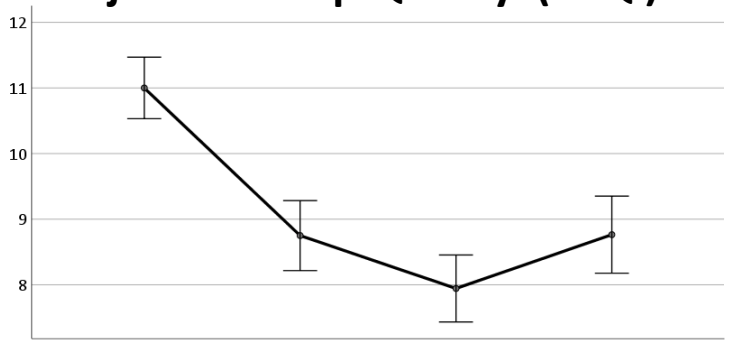


Wait List
CBT-I

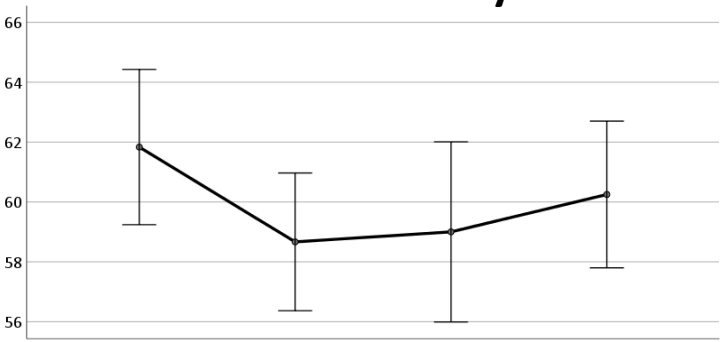
Insomnia Severity (ISI)



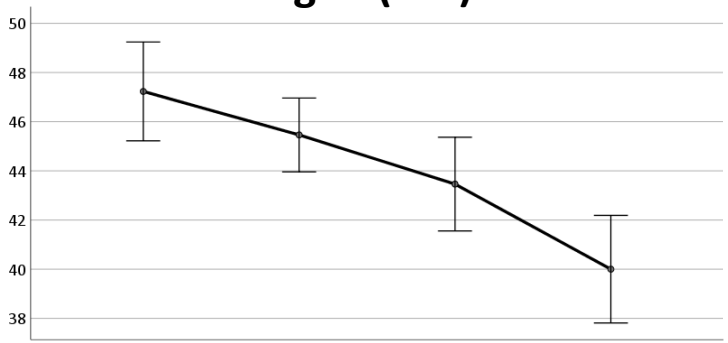
Subjective Sleep Quality (PSQI)



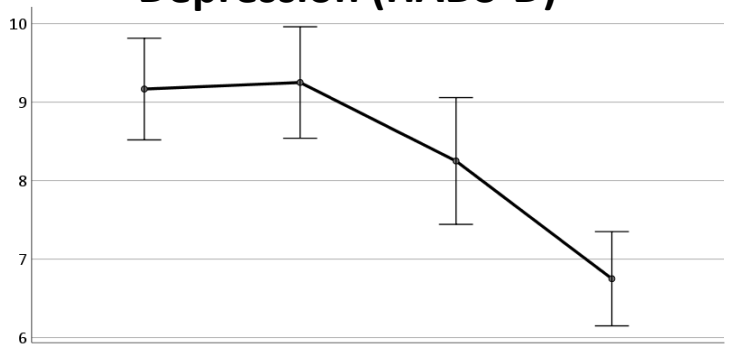
GWI Severity



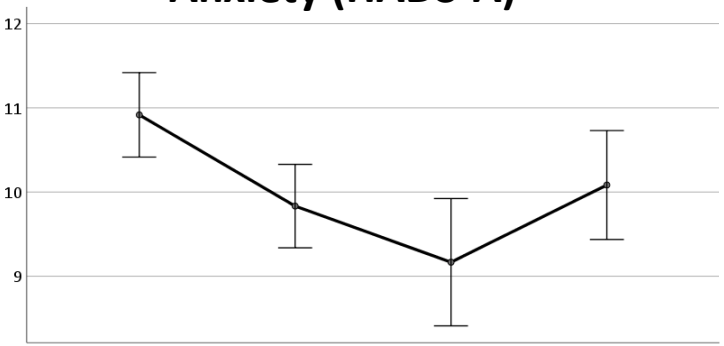
Fatigue (FSS)



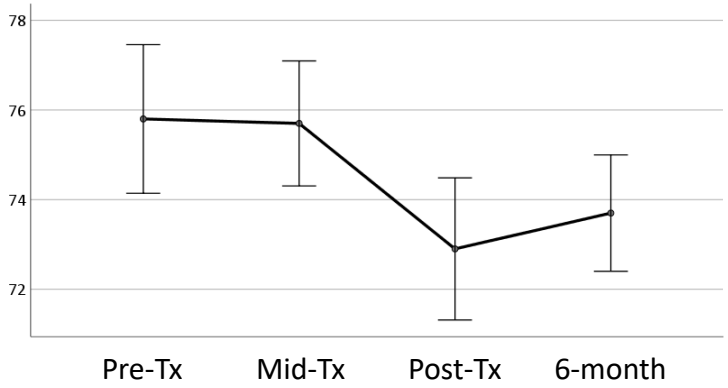
Depression (HADS-D)



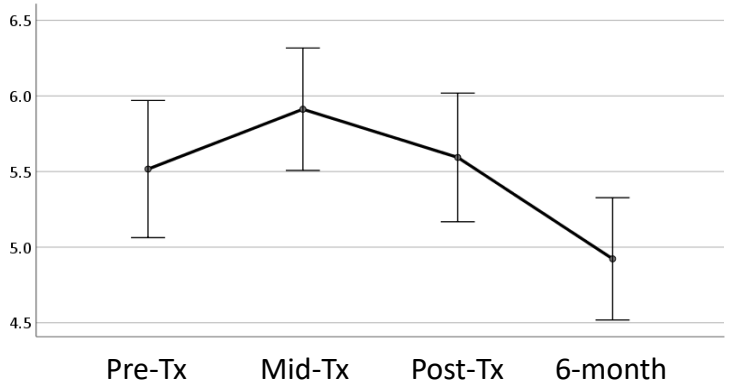
Anxiety (HADS-A)



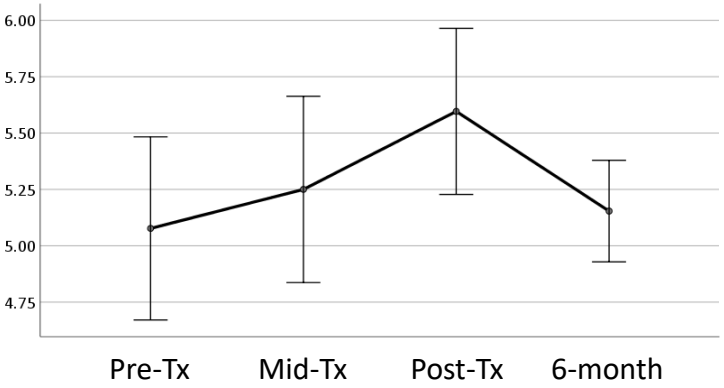
Cognitive Abilities (MASQ)



Pain Interference (BPI)



Pain Severity (BPI)



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