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# Mindfulness Meditation for Sleep and Anxiety Post Acquired Brain Injury: Pilot Study

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**Abstract**

Quality sleep is essential for recovery from acquired brain injury (ABI); however, there is limited research in the field that examines sleep within this population. This study aims to investigate the effect of an eight-session telehealth mindfulness meditation program on sleep quality and anxiety in adults with ABI. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), while anxiety was measured with the Patient-Reported Outcomes Measurement Information System (PROMIS) Anxiety Short Form. A one-group pretest-posttest design was employed, involving 11 participants in this pilot study. Most participants were female (81.1%), with a mean age of 30.91 years (± 16.60 years). The results demonstrated significant improvements ($p < 0.05$) in PSQI sleep efficiency, overall sleep quality, and PROMIS anxiety scores. The telehealth mindfulness meditation program showed promising results and has the potential to be implemented as an intervention to address sleep and anxiety. These preliminary findings support the need for further investigation into sleep and anxiety using mindfulness meditation in this population.

**Keywords:** acquired brain injury, sleep, anxiety, mindfulness meditation, mental health

## 1. Introduction

Sleep is crucial for physical, emotional, and mental well-being. According to the National Sleep Foundation (2025), six out of ten adults do not obtain sufficient sleep. Sleep deprivation has been linked to numerous chronic health issues, including diabetes, hypertension, obesity, and cardiovascular disease (National Heart, Lung, and Blood Institute, n.d.). Individuals with acquired brain injury (ABI) are particularly vulnerable to sleep problems. Studies show that 30-70% of the ABI population experience impaired sleep and meet the criteria for at least one sleep disorder (Viola-Saltzman & Watson, 2012; Fleming et al., 2020). Those with brain injuries may struggle to maintain or initiate a regular sleep/wake cycle, resulting in excessive daytime sleepiness, fatigue, irritability, and frequent headaches (Krainin et al., 2019). The underlying causes of sleep disturbances in the ABI population often include structural damage to the suprachiasmatic nuclei in the hypothalamus, which regulate circadian rhythms. This damage can result in disruptions to both rapid eye movement (REM) and non-rapid eye movement (NREM) sleep cycles. Consequently, individuals with brain injuries typically spend less time in REM sleep and more time in NREM sleep (Aoun et al., 2019). Common sleep disorders identified in the ABI population include obstructive sleep apnea (OSA), insomnia, parasomnias, and periodic limb movement disorder (Silva et al., 2022; Viola-Saltzman et al., 2012).

Moreover, mental health disorders such as anxiety and depression significantly impact sleep quality. Anxiety disorders rank as the second most common neuropsychiatric condition following depression in the brain injury population. One reason for the high incidence of anxiety diagnoses in this demographic is injury to brain structures like the amygdala, which plays a key role in emotion regulation and physiological feedback (Braga et al., 2022). Numerous studies have established a correlation between anxiety and sleep quality in individuals with brain injuries. Research indicates that anxiety and depression exert a profound influence on sleep quality following mild traumatic brain injury (mTBI) compared to healthy control groups. Additionally, correlations between sleep quality and anxiety have been explored in individuals who have experienced a cerebrovascular accident (CVA),

revealing worsened sleep and heightened anxiety among this population (Ma et al., 2019; Xiao et al., 2020; Niu et al., 2023).

Quality sleep is essential for recovery from an ABI. A study by Fleming et al. (2020) found that poor sleep quality resulted in longer recovery times and decreased motor functioning among individuals with brain injuries. Approximately 58.2% of people with ABI in rehabilitation settings experience sleep disturbances such as prolonged sleep onset latency, insomnia, and OSA. These disturbances are associated with reduced functional independence and longer hospital stays, negatively affecting overall occupational performance and well-being (Dey et al., 2021). Adequate sleep is vital for supporting the immune system and maintaining cardiovascular health. These findings highlight the importance of investigating sleep disturbances in the ABI population, underscoring the need for future research and the development of targeted, effective interventions.

Recently, non-pharmacological interventions have gained attention in healthcare for managing sleep, particularly as pharmacological treatments can lead to adverse side effects. While evidence supports the effectiveness of such interventions in promoting sleep health, there remains a gap in research focused on non-pharmacological interventions for the ABI population. One promising approach is mindfulness meditation, a mind-body intervention that emphasizes the systematic regulation of thoughts and emotions (Black et al., 2015). This approach may provide valuable insights and alternatives for addressing sleep disturbances in individuals with ABI. According to Black et al. (2015), mindfulness-based interventions can help reduce sleep disturbances, thereby improving quality of life. The use of mindfulness meditation has also been linked to decreased stress and anxiety. A systematic review by Ford et al. (2020) examined various non-pharmacological treatments for insomnia within the ABI population, revealing that cognitive behavioral therapy (CBT) and acupuncture were the most frequently studied interventions. Another systematic review found that mindfulness-based interventions have improved mental health, physical health, and overall quality of life (Acabchuk et al., 2021). Despite the prevalence of sleep disturbances following brain injury, there are limited studies investigating the impact of mindfulness meditation on sleep quality and anxiety within this population. Therefore, the current study aims to: 1) examine the effect of an eight-session telehealth mindfulness meditation program on sleep quality, as assessed by the Pittsburgh Sleep Quality Index (PSQI), in individuals with ABI, and 2) examine the effect of an eight -session telehealth mindfulness meditation program on anxiety, as assessed by the Patient-Reported Outcomes Measurement Information System (PROMIS) Anxiety Short Form, in individual with ABI.

## 2. Method

### *2.1 Design*

A quasi-experimental, one-group pretest-posttest design was used to examine the effects of mindfulness meditation on sleep quality and anxiety levels in individuals with ABI. The study took place from January 2025 to May 2025. This research was approved by the Saint Joseph's University review board (2233742-1) and is registered in clinical trial.gov NCT06717399.

### *2.2 Participants*

Participants were community-dwelling adults with a self-identified history of ABI. A non-probability convenience sampling method was used to recruit participants. G*Power 3.1 software was used to calculate the sample size. Black et al. (2015) conducted a mindfulness meditation program that showed improvement in sleep quality among older adults with sleep disturbances. Based on this research, the current study sample size calculation utilized a power of 0.8, a significance level of 0.05, and an effect size of 0.89; a minimum of 12 participants was required to demonstrate significance. To account for an attrition rate of 20%, the researchers intended to recruit 15 individuals. Participants were recruited by sending emails and posting flyers at various local brain injury associations and local communities. The inclusion criteria were: 1) known diagnosis of ABI, 2) scored 19 or below on the Short Orientation Memory Concentration Test (SOMCT), 3) 18 years or older, 4) speak and comprehend English, 5) access to internet connection and electronic devices. The exclusion criteria was a known diagnosis of aphasia.

### *2.3 Assessments*

Demographic information included age, gender, ethnicity, time of ABI diagnosis, and history of sleep treatment to understand participants' characteristics. To ensure that participants met inclusion criteria, verbal consent was taken before completing the SOMCT. The SOMCT is comprised of six questions that assess attention, cognition, and executive functioning (Wade & Vergis, 1999). A study by Wade and Vergis (1999) demonstrated that the SOMCT is a reliable measure and a reasonable tool for screening cognitive deficits. A score of 19 or below indicates mild to moderate cognitive deficits. Individuals with severe impairments were excluded due to potential limitations that could interfere with the mindfulness meditation sessions, such as difficulty attending and following directions.

PSQI was used to evaluate sleep quality. The PSQI assesses sleep disturbances and sleep quality through a self-rated questionnaire (Buysse et al., 1989). This outcome measure is considered one of the "gold standards" for assessing sleep quality, as its consistency and validity have been verified in numerous studies. This 19-question self-reported assessment comprises seven subcategories: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction (Buysse et al., 1989). Each component is scored from 0 (no difficulty) to 3 (severe difficulty). The component scores are summed to produce a global PSQI score, which ranges from 0 (indicating good sleep quality) to 21 (indicating poor sleep quality). Higher scores on the PSQI indicate worse sleep quality. The cut-off score is five or greater and indicates a significant sleep disturbance (Buysse et al., 1989). Overall, the PSQI has been found to have high reliability and validity across various populations. A study by Spira et al. (2012) found that the PSQI is a reliable and valid measure of sleep for older adults. The study assessed the internal consistency of the PSQI and the Epworth Sleepiness Scale (ESS) in a sample of older men. The results indicated that internal consistency was adequate for the PSQI (Cronbach's $\alpha = .69$) and the ESS ($\alpha = .70$) total scores.

The PROMIS Anxiety Short Form was utilized to assess the anxiety level of the participants. The PROMIS Anxiety Short Form is an eight-question self-report measure to assess anxiety. Participants were asked to rate their responses to questions relating to feelings of anxiety in the past seven days. Participants rated their feelings using a 5-point Likert scale, with responses ranging from 1 to 5. Responses were scored as follows: 1 corresponds to "never," and 5 to "always." The raw score was calculated by summing the scores for all questions. A higher score on the PROMIS Anxiety Short Form indicated a greater severity of anxiety. Cella et al. (2019) examined the validity of three fixed-length PROMIS® Adult Health Profile instruments designed to efficiently assess seven core health-related quality of life domains: anxiety, depression, fatigue, pain interference/intensity, sleep disturbance, physical function, and social roles. These short forms demonstrated high reliability, strong correlations with full-item banks, and valid measurement of the construct across mild to severe clinical presentations.

To obtain participants' overall satisfaction with the program, the Patient Global Impression of Change Form was used. The PGIC is a single question on a Likert scale that allows participants to provide feedback on how the program ran (Federal Interagency Traumatic Brain Injury Research Informatics System [FITBIR], 2021). The lower the number, the greater the participant's satisfaction. In a study assessing pain management, PGIC was used to determine satisfaction with the program and the effectiveness of pain relief (Farooq et al., 2016).

*2.4 Procedure*

Rolling recruitment started after Institutional Review Board (IRB) approval and continued for five weeks. After individuals provided consent and met the inclusion criteria, they completed the pre-test and started the intervention sessions. The telehealth mindfulness meditation program consisted of 10 virtual sessions, including two sessions for pre-test and post-test measures, and eight mindfulness meditation sessions conducted over four to five weeks. Once participants expressed interest in the study by contacting the research team member, the consent form was sent to them electronically via email, and a pre-test session was scheduled. A pre-test session was held to answer any questions related to the study and to complete the screening test (SOMCT) to assess whether participants met the inclusion criteria. Participants completed all pre-test measures (PROMIS Anxiety Short Form, PSQI) and demographic questionnaires after signing the consent form and meeting the inclusion criteria. Once the pre-test measures were completed, the researcher provided an overview of the sessions and discussed how to register for the mindfulness meditation sessions, the number of sessions offered per week, and the times at which they would be conducted. The Zoom© link for each session was sent via the email provided on the consent form. Each thirty-minute session consisted of a five-minute introduction, 15 minutes of mindfulness meditation, and 10 minutes of education and discussion. The sessions were offered four times a day, five days a week (Monday through Friday), to accommodate busy schedules. Participants had an additional fifth week to make up for missed sessions. Each participant was required to attend a minimum of two sessions per week. Within one week of completing the eighth mindfulness meditation session, post-tests were completed (PSQI, PROMIS Anxiety Short Form, and PGIC). Attendance was recorded to ensure each participant attended the required number of sessions. A study by Benham et al. (2022) employed an eight-session, 30-minute telehealth mindfulness meditation program to investigate changes in sleep quality and perceived stress among higher education students. Sleep quality changes were measured using the Pittsburgh Sleep Quality Index, and perceived stress was assessed with the Perceived Stress Scale, both of which showed significant results. The results suggest that a synchronous mindfulness meditation program delivered via telehealth has the potential to improve sleep quality and decrease perceived stress in students. The current study included eight sessions of mindfulness meditation, each lasting 30 minutes, due to its effectiveness in the general population.

*2.5 Data Analysis*

Data was analyzed using IBM SPSS Statistics for Macintosh, Version 29.02.0. Descriptive statistics (frequency, percentages, means, standard deviations) were used to summarize data, demographic information and PGIC ratings. Paired t-tests were used to evaluate whether there was a meaningful change in global PSQI scores, sleep efficiency percentages, and PROMIS Anxiety Short Form raw scores and t-scores pre- to post-intervention. Global PSQI scores were calculated by summing the item responses. The sleep efficiency percentages were derived using the scoring instructions provided in the PSQI manual (Buysse et al., 1989). PROMIS Anxiety Short Form raw scores were calculated by summing the item responses, and t-scores were derived from the scoring manual (Health Measures, 2022). All analyses are based on two-tailed t-tests with an alpha level of 0.05.

## 3. Results

A total of twelve participants signed the consent form, and eleven individuals completed the study and were included in the analyses. Participants were primarily white (90.9%) and female (81.8%), with a mean age of 30.91 years (*SD* = 16.60). Refer to Table 1 for additional information.

Table 1. Demographic information

| **Characteristic** | ***f* (%) or *M* ± *SD*** |
|---|---|
| Sex | |
| Male | 2 (18.2) |
| Female | 9 (81.8) |
| Age | 30.91 ± 16.60 |
| Ethnicity | |
| Asian | 1 (9.1) |
| White | 10 (90.9) |
| Time of Injury | |
| Within the past year | 1 (9.1) |
| 1 to 2 years ago | 1 (9.1) |
| 3 to 5 years ago | 3 (27.3) |
| More than 5 years ago | 6 (54.5) |
| Current Sleep Treatment | |
| Medication | 2 (18.2) |
| PAP Machine | 1 (9.1) |
| Not Sure | 1 (9.1) |
| None | 7 (63.6) |

Based on the PGIC ratings, seven participants (63.6%) reported feeling much improved, and four (36.4%) reported feeling minimally improved after the intervention. There was a significant difference between pre ($M$ = 7.73, $SD$ = 3.17) and post ($M$ = 4.55, $SD$ = 2.66) intervention global PSQI scores. There was a mean decrease of 3.18 ($SD$ = 2.14) in scores from pre- to post-intervention, $t$ (10) = 4.94, $p < .001$, $d$ = 1.49. There was a significant difference between pre ($M$ = 78.84, $SD$ = 10.34) and post ($M$ = 88.57, $SD$ = 6.68) intervention PSQI sleep efficiency percentages. There was a mean increase of 9.73 ($SD$ = 13.30) in scores from pre- to post-intervention, $t$ (10) = 2.43, $p$ = 0.036, $d$ = .73. There was a significant difference between pre ($M$ = 19.82, $SD$ = 4.17) and post ($M$ =15.09, $SD$ = 3.30) intervention PROMIS raw scores. There was a mean decrease of 4.73 ($SD$ = 4.29) in scores from pre- to post-intervention, $t$ (10) = 3.65, $p$ = 0.004, $d$ =1.10. There was a significant difference between pre ($M$ = 58.18, $SD$ = 4.30) and post ($M$ =52.99, $SD$ = 3.82) intervention PROMIS T-scores. There was a mean decrease of 5.19 ($SD$ = 4.55) in scores from pre- to post-intervention, $t$ (10) = 3.78, $p$ = 0.004. $d$ =1.14. Refer to Table 2 for summary results of the PSQI and PROMIS Anxiety outcome measures. The analyses were repeated using the non-parametric equivalent of a paired t-test, a Related-Samples Wilcoxon Signed Rank Test, and significance was retained for all outcomes, the global PSQI scores ($p$ = 0.003), PSQI sleep efficiency ($p$ = 0.037), PROMIS raw

scores ($p$ = 0.012), and PROMIS T-scores ($p$ = 0.010).

Table 2. Summary of Results: T-tests ($N$ = 11)

| Assessment | Pre-Test | Post-Test | |
|---|---|---|---|
| | *M (SD)* | *M (SD)* | *p* |
| PSQI - Global Score | 7.73 (3.17) | 4. 55 (2.66) | <0.001* |
| PSQI - Sleep Efficiency | 78.84 (10.34) | 88.57 (6.86) | 0.036* |
| PROMIS Anxiety Short Form T-Score | 58.18 (4.30) | 52.99 (3.82) | 0.004* |
| PROMIS Anxiety Raw Score | 19.82 (4.17) | 15.09 (3.30) | 0.004* |

*Note:* PSQI = Pittsburgh Sleep Quality Index, decreases in PSQI global scores ≤5 good sleep quality; Normal sleep efficiency is considered to be >85% (Buysse et al. 1989); PROMIS = Patient-Reported Outcomes Measurement Information System. Decreases in PROMIS Anxiety Short Form scores indicate decrease in anxiety; *$p \leq 0.05$

## 4. Discussion

The purpose of this study was to evaluate the effectiveness of telehealth-based mindfulness meditation sessions in improving sleep quality and reducing anxiety in individuals with acquired brain injury (ABI). The results of the eight-session mindfulness meditation study revealed significant improvements in sleep quality and a decrease in anxiety levels among the ABI population. A study by Jermann et al. (2024) found that a mindfulness-based stress reduction (MBSR) program enhanced subjective sleep quality and reduced cognitive pre-sleep arousal in individuals with insomnia. Although the researchers did not analyze anxiety as an outcome, their findings indicate a correlation between the duration of formal mindfulness practice and a decrease in cognitive pre-sleep arousal, suggesting that consistent practice contributes to these positive outcomes. Similarly, a randomized clinical trial of app-based mindfulness training was conducted with individuals experiencing sleep disturbances due to heightened anxiety. Although no improvements were noted in sleep efficiency after two months of using the mindfulness meditation apps, a significant decrease in worry and emotional non-reactivity was observed (Gao et al., 2022).

The findings from the current telehealth-based mindfulness meditation program align with existing research on sleep quality, mental health, and mindfulness meditation. The results suggest that a telehealth mindfulness meditation program can positively impact sleep quality and anxiety within the ABI population. Delivering mindfulness meditation via Zoom© was found to be both feasible and appealing to participants, as they could complete the sessions in the comfort of their own environments. Furthermore, allowing participants to choose their preferred times and dates for meditation sessions provided them with autonomy, structure, and flexibility, which facilitated their participation. Participants reported that this intervention helped them accept both physical deficits and mental health challenges resulting from their ABI. As indicated by the Patient Global Impression of Change (PGIC) score, the majority of participants (63.6%) reported feeling significantly improved after completing the study.

Healthcare providers play a crucial role in sleep management, as insufficient sleep can hinder recovery. For individuals with ABI, sleep is often disrupted due to neurological, psychological, or environmental factors, which can significantly affect recovery and participation in daily life. Healthcare providers can incorporate non-pharmacological interventions that include mindfulness meditation, sleep routines, cognitive-behavioral strategies, and environmental adaptations. The telehealth mindfulness meditation study provides evidence that healthcare providers can consider meditation as an intervention for their ABI clients, addressing sleep and anxiety and ultimately improving overall well-being of their clients.

This study has limitations. Participants were recruited using non-probability convenience sampling from the tri-state area (New Jersey, New York, and Pennsylvania). The sample size was small, and the majority of participants were female and white. Therefore, the findings may not be generalizable to all ABI population living in the community. Furthermore, there may have been attentional bias, as participants might have been more aware of their sleep quality and anxiety while completing self-reported outcome measures. Although telehealth increased accessibility for some individuals, this format may have limited access for those without internet or electronic devices. Lastly, the absence of a control group makes it difficult to attribute observed improvement directly to the intervention.

## 5. Concluding Remarks

The study aimed to evaluate the effectiveness of telehealth-based mindfulness meditation on sleep quality and anxiety in individuals with acquired brain injury (ABI). The results indicated significant improvements in sleep quality and a reduction in anxiety levels following eight telehealth mindfulness sessions. While the study had a relatively small sample size, its findings are valuable for healthcare providers and future scholarly research. These results underscore the importance of interventions that prioritize sleep management and emotional well-being. The study establishes a foundation for accessible, non-pharmacological interventions for the ABI population. However, research on sleep and anxiety within this population is limited. This study paves the groundwork for future research and suggests potential interventions to address sleep issues and mental health in the ABI population. Future research should focus on a larger, diversified sample size with a control group. Additionally, future studies should consider incorporating objective sleep outcome measures.

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Generative AI tools, such as Grammarly Premium and ChatGPT-5, were used intermittently for language and grammar structure.

## References

Acabchuk, R. L., Brisson, J. M., Park, C. L., Babbott-Bryan, N., Parmelee, O. A., & Johnson, B. T. (2021). Therapeutic effects of meditation, yoga, and mindfulness-based interventions for chronic symptoms of mild traumatic brain injury: A systematic review and meta-analysis. *Applied Psychology: Health and Well-Being, 13*(1), 34-62.

American Occupational Therapy Association. (2020). Occupational therapy practice framework: Domain and process (4th ed.). *American Journal of Occupational Therapy, 74*(Suppl. 2), 7412410010. https://doi.org/10.5014/ajot.2020.74S2001

Aoun, R., Rawal, H., Attarian, H., & Sahni, A. (2019). Impact of traumatic brain injury on sleep: An overview. *Nature and Science of Sleep, 11,* 131-140. https://doi.org/10.2147/NSS.S182158

Benham, S., Enam, N., & Ivaturi, S. (2022). A mindfulness program addressing sleep quality and stress: Transition to a telehealth format for higher education students during COVID-19. *International Journal of Telerehabilitation, 14*(1). https://doi.org/10.5195/ijt.2022.6439

Black, D. S., O'Reilly, G. A., Olmstead, R., Breen, E. C., & Irwin, M. R. (2015). Mindfulness meditation and improvement in sleep quality and daytime impairment among older adults with sleep disturbances: A randomized clinical trial. *JAMA Internal Medicine, 175*(4), 494-501. https://doi.org/10.1001/jamainternmed.2014.8081

Braga, M. F. M., Juranek, J., Eiden, L. E., Li, Z., Figueiredo, T. H., De Araujo Furtado, M., & Marini, A. M. (2022). GABAergic circuits of the basolateral amygdala and generation of anxiety after traumatic brain injury. *Amino Acids, 54*(9), 1229-1249. https://doi.org/10.1007/s00726-022-03184-y

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*(2), 193-213. https://doi.org/10.1016/0165-1781(89)90047-4

Cella, D., Choi, S. W., Condon, D. M., Schalet, B., Hays, R. D., Rothrock, N. E., … Reeve, B. B. (2019). PROMIS® adult health profiles: Efficient short form measures of seven health domains. *Value in Health, 22*(5), 537-544. https://doi.org/10.1016/j.jval.2019.02.004

Dey, A., Kam, A., Tam, A., Bayley, M., & Guo, M. (2021). Sleep disturbance and length of stay in the setting of acquired brain injury rehabilitation. *Brain Injury, 35*(9), 1022-1027. https://doi.org/10.1080/02699052.2021.1945144

Farooq, F., Khan, R., & Ahmed, A. (2016). Assessment of patient satisfaction with acute pain management service: Monitoring quality of care in clinical setting. *Indian Journal of Anaesthesia, 60*(4), 248-252. https://doi.org/10.4103/0019-5049.179450

Federal Interagency Traumatic Brain Injury Research Informatics System (FITBIR). (2021, September 21). *Patient's global impression of change (PGIC) scale.* National Institutes of Health. Retrieved from https://fitbir.nih.gov/dictionary/publicData/dataElementAction!view.action?dataElementName=PGICChangeScl&publicArea=true&style.key=fitbir-style

Fleming, M. K., Smejka, T., Henderson Slater, D., van Gils, V., Garratt, E., Yilmaz Kara, E., & Johansen-Berg, H. (2020). Sleep disruption after brain injury is associated with worse motor outcomes and slower functional recovery. *Neurorehabilitation and Neural Repair, 34*(7), 661-671. https://doi.org/10.1177/1545968320929669

Ford, M. E., Groet, E., Daams, J. G., Geurtsen, G. J., Van Bennekom, C. A. M., & Van Someren, E. J. W. (2020). Non-pharmacological treatment for insomnia following acquired brain injury: A systematic review. *Sleep Medicine Reviews, 50,* 101255-101255. https://doi.org/10.1016/j.smrv.2019.101255

Gao, M., Roy, A., Deluty, A., Sharkey, K. M., Hoge, E. A., Liu, T., & Brewer, J. A. (2022). Targeting anxiety to improve sleep disturbance: A randomized clinical trial of app-based mindfulness training. *Psychosomatic Medicine, 84*(5), 632-642. https://doi.org/10.1097/PSY.0000000000001083

Health Measures. (2022). *Anxiety Scoring Manual.* PROMIS. Retrieved from https://www.healthmeasures.net/images/PROMIS/manuals/Scoring_Manual_Only/PROMIS_Anxiety_Scoring_Manual_03June2022.pdf

Jermann, F., Cordera, P., Carlei, C., Weber, B., Baggio, S., Bondolfi, G., & Cervena, K. (2024). Impact of Mindfulness-Based Stress Reduction on sleep-related parameters in a community sample. *Advances in Integrative Medicine, 11*(4), 273-279. https://doi.org/10.1016/j.aimed.2024.08.005

Krainin, J., Morrison, A. A., & Russo, M. B. (2019). Sleep/wake disturbances in mild traumatic brain injury patients. *Springer Nature Switzerland AG,* 129-150. https://doi.org/10.1007/978-3-030-22436-3_7

Ma, H. P., Chen, P. S., Wong, C. S., Chang, C. F., Ou, J. C., Tsai, Y. R., … Wu, J. (2019). Psychometric evaluation of anxiety, depression, and sleep quality after a mild traumatic brain injury: A longitudinal study. *Behavioural Neurology*, 1-9. https://doi.org/10.1155/2019/4364592

National Heart, Lung, and Blood Institute (n.d.). *What are sleep deprivation and deficiency?*. Retrieved from https://www.nhlbi.nih.gov/health/sleep-deprivation

National Sleep Foundation. (2025, March 6). *2025 Sleep in America® Poll: People with better sleep health are most likely to flourish*. Retrieved from https://www.thensf.org/sleep-in-america-polls/

Niu, S., Liu, X., Wu, Q., Ma, J., Zeng, L., & Shi, L. (2023). Sleep quality and cognitive function after stroke: The mediating roles of depression and anxiety symptoms. *International Journal of Environmental Research and Public Health, 20*(3), 2410. https://doi.org/10.3390/ijerph20032410

Silva, M. A., Arriola, N. B., Radwan, C. K., Womble, B. M., Healey, E. A., Lee, J. M., … Nakase-Richardson, R. (2022). Improving sleep apnea treatment adherence after traumatic brain injury: A nonrandomized feasibility study. *Rehabilitation Psychology, 67*(4), 461-473. https://doi.org/10.1037/rep0000473

Spira, A. P., Beaudreau, S. A., Stone, K. L., Kezirian, E. J., Lui, L.-Y., Redline, S., … Stewart, A. (2012). Reliability and validity of the Pittsburgh Sleep Quality Index and the Epworth Sleepiness Scale in older men. *The Journals of Gerontology: Series A, Biological Sciences and Medical Sciences, 67*(4), 433-439. https://doi.org/10.1093/gerona/glr172

Viola-Saltzman, M., & Watson, N. F. (2012). Traumatic brain injury and sleep disorders. *Neurologic Clinics, 30*(4), 1299-1312. https://doi.org/10.1016/j.ncl.2012.08.008

Wade, D. T., & Vergis, E. (1999). The short orientation–memory–concentration test: A study of its reliability and validity. *Clinical Rehabilitation, 13*(2), 164-170. https://doi.org/10.1191/026921599673848768

Xiao, M., Huang, G., Feng, L., Luan, X., Wang, Q., Ren, W., Chen, S., & He, J. (2020). Impact of sleep quality on post-stroke anxiety in stroke patients. *Brain and Behavior, 10*(12), 1716. Retrieved from https://doi-org.ezproxy.sju.edu/10.1002/brb3.1716

**Notes**

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Note 2. No funding was received for this study.

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