

Evidence appendix

FICTIONAL EXAMPLE. These invented records were processed through the Raven Nexus draft engine. No real veteran, clinician, or medical opinion is represented. Do not submit this example as evidence.

This is an unreviewed working draft, not medical evidence. The clinician must independently review the records and literature, reach their own conclusion, and author or adopt any final opinion.

Records

R-A: Rating decision, dated 2017-08-16, page 1

Exact selected excerpt: "Service connection for PTSD is granted. This decision does not address sleep apnea or state that PTSD causes another condition."

R-B: Sleep clinic history, dated 2021-05-11, page 2

Exact selected excerpt: "The patient reports snoring beginning before the PTSD treatment documented in the supplied records. The history also describes weight gain during a period of reduced activity. No causal medical opinion is recorded."

R-C: Sleep study, dated 2021-06-03, page 3

Exact selected excerpt: "Assessment: obstructive sleep apnea. The sleep study documents an apnea-hypopnea index of 22 events per hour. The study establishes the recorded sleep diagnosis, not its cause."

R-D: Behavioral health follow-up, dated 2024-10-14, page 4

Exact selected excerpt: "The patient reports nightmares and disrupted sleep during PTSD symptoms. The note does not distinguish awakenings associated with nightmares from respiratory events during sleep."

Separately attributed history

Veteran-selected primary condition: PTSD. Service-connected status is not verified by this selection.

Veteran-reported symptoms: Unrefreshing sleep despite attempts to use prescribed equipment.

Veteran-reported contrary or complicating facts: Snoring was reported before the supplied PTSD treatment notes. Changes in weight and activity need separate consideration.

Research analysis and source context

L-A: Saskia van Liempt, Herman G M Westenberg, Johan Arends, Eric Vermetten. Obstructive sleep apnea in combat-related posttraumatic stress disorder: a controlled polysomnography study. European journal of psychotraumatology. 2011. PMID 22893807. DOI 10.3402/ejpt.v2i0.8451. <https://pubmed.ncbi.nlm.nih.gov/22893807/>

Research candidate, not proof of an individual medical connection. Applicability requires independent clinician review.

Verified: 2026-09-07T03:06:21.996Z

No study-specific analysis passed the current checks. Do not treat this citation alone as a medical rationale.

Source scope: abstract only, not full-paper review. Publication types: Journal Article.

Exact primary-source abstract follows. Any quantities below are quoted from the source, not generated or estimated by AI. Read results with the methods and source sample-size context; if the source omits a denominator, it is not supplied here.

BACKGROUND

Obstructive sleep apnea (OSA) may be highly prevalent in posttraumatic stress disorder (PTSD) and may exacerbate PTSD complaints.

OBJECTIVE

Our objective was to determine whether the prevalence of OSA was high in a sample of Dutch veterans with PTSD as compared to age- and trauma-matched controls, and whether OSA was associated with more severe PTSD complaints.

METHODS

We determined the apnea hypopnea indices (AHI) with polysomnographic registrations in 20 veterans with PTSD, 24 veterans without PTSD, and 17 healthy controls. PTSD severity and nightmare complaints were assessed with the Clinician-Administered PTSD Scale (CAPS).

RESULTS

The prevalence of an AHI>10 was 29% in PTSD, 21% in trauma controls, and 29% in healthy controls ($\chi^2=0.60$, $df=2$, $p=n.s.$). The mean CAPS score in patients with OSA ($n=6$) was significantly higher than in patients without OSA ($p<0.05$), while nightmare severity was similar in PTSD patients with OSA as compared to PTSD patients without OSA ($p=n.s.$). Furthermore, there was a significant correlation between AHI and CAPS score in PTSD patients ($r=0.46$, $p<0.05$, $df=14$).

CONCLUSIONS

Our results indicate that PTSD is not necessarily associated with a higher prevalence of OSA. However, PTSD severity was related to OSA, which may possibly mean that comorbid OSA leads to an increase in PTSD complaints. However, future research should indicate whether OSA exerts a negative influence on PTSD, and treatment of OSA alleviates PTSD symptoms.

L-B: Amit J Shah, Viola Vaccarino, Jack Goldberg, Minxuan Huang, Yi-An Ko, Xin Ma, Oleksiy M Levantsevych, Nicholas L Smith, Nikila Alagar, Iman Mousselli, Dayna A Johnson, Gari D Clifford, J Douglas Bremner, Donald L Bliwise. Posttraumatic Stress Disorder and Obstructive Sleep Apnea in Twins. JAMA network open. 2024. PMID 38913378. DOI 10.1001/jamanetworkopen.2024.16352. <https://pubmed.ncbi.nlm.nih.gov/38913378/>

Research candidate, not proof of an individual medical connection. Applicability requires independent clinician review.

Verified: 2026-09-07T03:06:21.996Z

No study-specific analysis passed the current checks. Do not treat this citation alone as a medical rationale.

Source scope: abstract only, not full-paper review. Publication types: Journal Article; Twin Study; Research Support, N.I.H., Extramural; Research Support, Non-U.S. Gov't.

Exact primary-source abstract follows. Any quantities below are quoted from the source, not generated or estimated by AI. Read results with the methods and source sample-size context; if the source omits a denominator, it is not supplied here.

IMPORTANCE

Obstructive sleep apnea (OSA) is a common condition in older adult (aged >65 years) populations, but more mechanistic research is needed to individualize treatments. Previous evidence has suggested an association between OSA and posttraumatic stress disorder (PTSD) but is limited by possible selection bias. High-quality research on this association with a careful evaluation of possible confounders may yield important mechanistic insight into both conditions and improve treatment efforts.

OBJECTIVE

To investigate the association of current PTSD symptoms and PTSD diagnosis with OSA.

DESIGN, SETTING, AND PARTICIPANTS

This cross-sectional study of twin pairs discordant for PTSD, which allows for adjustment for familial factors, was conducted using in-laboratory polysomnography from March 20, 2017, to June 3, 2019. The study sample comprised male veteran twins recruited from the Vietnam Era Twin Registry. The data analysis was performed between June 11, 2022, and January 30, 2023.

EXPOSURE

Symptoms of PTSD in twins who served in the Vietnam War. Diagnosis of PTSD was a secondary exposure.

MAIN OUTCOMES AND MEASURES

Obstructive sleep apnea was assessed using the apnea-hypopnea index (AHI) ($\geq 4\%$ oxygen saturation criterion as measured by events per hour) with overnight polysomnography. Symptoms of PTSD were assessed using the PTSD Checklist (PCL) and structured clinical interview for PTSD diagnosis.

RESULTS

A total of 181 male twins (mean [SD] age, 68.4 [2.0] years) including 66 pairs discordant for PTSD symptoms and 15 pairs discordant for a current PTSD diagnosis were evaluated. In models examining the PCL and OSA within pairs and adjusted for body mass index (BMI) and other sociodemographic, cardiovascular, and psychiatric risk factors (including depression), each 15-point increase in PCL was associated with a 4.6 (95% CI, 0.1-9.1) events-per-hour higher AHI. Current PTSD diagnosis was associated with an adjusted 10.5 (95% CI, 5.7-15.3) events-per-hour higher AHI per sleep-hour. Comparable standardized estimates of the association of PTSD symptoms and BMI with AHI per SD increase (1.9 events per hour; 95% CI, 0.5-3.3 events per hour) were found.

CONCLUSIONS AND RELEVANCE

This cross-sectional study found an association between PTSD and sleep-disordered breathing. The findings have important public health implications and may also enhance understanding of the many factors that potentially affect OSA pathophysiology.

L-C: Bengt B Arnetz, Thomas Templin, Waleed Saudi, Hikmet Jamil. Obstructive sleep apnea, posttraumatic stress disorder, and health in immigrants. *Psychosomatic medicine*. 2012. PMID 23023679. DOI 10.1097/PSY.0b013e31826bf1ec. <https://pubmed.ncbi.nlm.nih.gov/23023679/>

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OBJECTIVE

To determine whether obstructive sleep apnea mediates the relationship between posttraumatic stress disorder (PTSD) and psychosomatic and somatic disorders and its implications for self-rated health (SRH) among Iraqi immigrants in the United States.

METHODS

A random sample of immigrants who had left Iraq before the 1991 Gulf War ($n = 145$) or after ($n = 205$) and are residing in metropolitan Detroit responded to a structured interview covering questions on sociodemographics, premigration trauma, SRH, physician-diagnosed and -treated obstructive sleep apnea, somatic disorders, and psychosomatic disorders. Structural equation modeling was used to evaluate the relationship between premigration trauma scores and health, as well as to explore mediating pathways between PTSD, obstructive sleep apnea, and health.

RESULTS

The prevalence of obstructive sleep apnea among post-Gulf War immigrants (30.2%) was significantly higher than among pre-Gulf War immigrants (0.7%; $p < .001$). Premigration trauma scores were positively associated with depression and PTSD. Structural equation modeling supported a model in which obstructive sleep apnea mediated the relationship between PTSD and psychosomatic and somatic disorders. Premigration trauma also related directly to SRH.

CONCLUSIONS

Part of the PTSD-associated adverse health effects observed in Iraqi immigrants is mediated by obstructive sleep apnea. Because sleep apnea in the current study is based on medical history and current treatment, there is a need for future confirmatory polysomnographic studies.

L-D: Ante Mayer, Maja Mizdrak, Marija Babić, Tonći Mastelić, Trpimir Glavina, Joško Božić, Tina Tičinović Kurir. Knowledge, Attitudes, and Screening for Obstructive Sleep Apnea and Diabetes Mellitus among War Veterans Seeking Treatment of Posttraumatic Stress Disorder. Healthcare (Basel, Switzerland). 2021. PMID 34946424. DOI 10.3390/healthcare9121698.

<https://pubmed.ncbi.nlm.nih.gov/34946424/>

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Abstract

Posttraumatic stress disorder (PTSD) is one of the most common psychiatric disorders. However, we should not neglect the somatic aspects of PTSD. Associations with cardiovascular diseases (CVD) are particularly concerning because PTSD was associated with an even 53% higher risk for CVD. This study aimed to analyze the prevalence of several CVD risk factors, especially diabetes mellitus among PTSD patients divided into three groups according to obstructive sleep apnea (OSA) risk stratification (low, intermediate, and high). This cross-sectional study included one hundred male PTSD veterans. The mean age was 53 (40-67) years. The estimated OSA risk was 95% for the whole cohort, and 53% were in the high-risk group. Median HbA1c was 5.6 (4.6-10)%. The hemoglobin A1c (HbA1c) levels showed that 34 patients were in the prediabetes group, and 20 of them fulfilled the criteria for diabetes. However, only 13 of them were aware of their previous diagnosis of diabetes mellitus. In testing knowledge about diabetes, 62% and only 23% of patients knew the correct definition of HbA1c and level of fasting plasma glucose, respectively. Diabetic patients had insufficient knowledge about diabetic complications and treatment. A higher level of PTSD symptoms in veterans was associated with a higher prevalence of OSA. The results strongly support further research and education into early detection of CVD risk factors associated with PTSD.

L-E: Ching-En Lin, Chi-Hsiang Chung, Li-Fen Chen, Wu-Chien Chien, Po-Han Chou. The Impact of Antidepressants on the Risk of Developing Obstructive Sleep Apnea in Posttraumatic Stress Disorder: A Nationwide Cohort Study in Taiwan. *Journal of clinical sleep medicine* : JCSM : official publication of the American Academy of Sleep Medicine. 2019. PMID 31538594. DOI 10.5664/jcsm.7910. <https://pubmed.ncbi.nlm.nih.gov/31538594/>

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STUDY OBJECTIVES

The association between posttraumatic stress disorder (PTSD) and obstructive sleep apnea (OSA) has been reported inconsistently, and the association between antidepressant use and the risk of developing OSA in patients with PTSD has not been previously studied. Therefore, we used the Longitudinal National Health Insurance Database (LHID) to investigate the impact of PTSD and antidepressant use on the risk of OSA development.

METHODS

Identified from the LHID, 2,316 individuals aged ≥ 18 years with PTSD, but with no history of OSA, and 23,160 control individuals matched for age, sex, obesity and index date were enrolled between 2000 and 2015 and followed up until the end of 2015 to identify the development of OSA. A two-tailed Bonferroni-corrected $P < .00038$ ($.05/13$) was considered statistically significant as we examined 13 antidepressants.

RESULTS

Individuals with PTSD had increased risk of developing OSA (adjusted hazard ratio 4.672, 95% confidence interval 2.246-9.787, $P < .001$) after adjusting for demographic data, medical comorbidities, and medication. Treatment with antidepressants was not significantly associated with an increased risk of developing OSA compared to no antidepressant treatment.

CONCLUSIONS

Asian patients with PTSD had increased risk of developing OSA, and treatment with antidepressants did not play a key role in increasing the risk of OSA development. Further studies are required to investigate the underlying mechanisms of PTSD and the roles of antidepressants on the risk of developing OSA.

CITATION

Lin C-E, Chung C-H, Chen L-F, Chien W-C, Chou P-H. The impact of antidepressants on the risk of developing obstructive sleep apnea in posttraumatic stress disorder: a nationwide cohort study in taiwan. *J Clin Sleep Med*. 2019;15(9):1233-1241.

L-F: Catherine A McCall, Nathaniel F Watson. A Narrative Review of the Association between Post-Traumatic Stress Disorder and Obstructive Sleep Apnea. *Journal of clinical medicine*. 2022. PMID 35054110. DOI 10.3390/jcm11020415. <https://pubmed.ncbi.nlm.nih.gov/35054110/>

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Source scope: abstract only, not full-paper review. Publication types: Journal Article; Review.

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Abstract

Obstructive sleep apnea (OSA) and post-traumatic stress disorder (PTSD) are often co-morbid with implications for disease severity and treatment outcomes. OSA prevalence is higher in PTSD sufferers than in the general population, with a likely bidirectional effect of the two illnesses. There is substantial evidence to support the role that disturbed sleep may play in the pathophysiology of PTSD. Sleep disturbance associated with OSA may interfere with normal rapid eye movement (REM) functioning and thus worsen nightmares and sleep-related movements. Conversely, hyperarousal and hypervigilance symptoms of PTSD may lower the arousal threshold and thus increase the frequency of sleep fragmentation related to obstructive events. Treating OSA not only improves OSA symptoms, but also nightmares and daytime symptoms of PTSD. Evidence suggests that positive airway pressure (PAP) therapy reduces PTSD symptoms in a dose-dependent fashion, but also presents challenges to tolerance in the PTSD population. Alternative OSA treatments may be better tolerated and effective for improving both OSA and PTSD. Further research avenues will be introduced as we seek a better understanding of this complex relationship.

L-G: Johanna Inhyang Kim, Hyeon Park, Beomjun Min, Sohee Oh, Ji-Hye Lee, Jeong-Hyun Kim. The mediation effect of depression and alcohol use disorders on the association between post-traumatic stress disorder and obstructive sleep apnea risk in 51,149 Korean firefighters: PTSD and OSA in Korean firefighters. *Journal of affective disorders*. 2021. PMID 34126310. DOI 10.1016/j.jad.2021.05.077. <https://pubmed.ncbi.nlm.nih.gov/34126310/>

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BACKGROUND

Post-traumatic stress disorder (PTSD) is shown to be linked to a higher risk of obstructive sleep apnea (OSA). Firefighters are at high risk for PTSD given the increased exposure to trauma. However, the relationship between PTSD and OSA remains unclear in firefighters. Moreover, alcohol use disorders (AUDs) and depression - also common in firefighters - show a high comorbidity rate with both PTSD and OSA. The purpose of this study was to investigate the association of PTSD, depression, and AUDs with OSA in a national sample of Korean firefighters.

METHODS

A total of 51,149 Korean firefighters completed self-reported questionnaires, assessing the severity of PTSD, OSA, depression, and alcohol misuse. Multivariable logistic regression and mediation analyses were performed.

RESULTS

PTSD, depression, and AUDs were significantly associated with OSA. In the mediation analyses, PTSD had both direct and indirect effects mediated by depression and AUDs on OSA. Depression had both direct and indirect effects on OSA, with the latter mediated by AUDs.

LIMITATIONS

First, high-risk of OSA was measured using the Berlin Questionnaire. Second, other medical comorbidities or medication use were not considered. Third, self-report questionnaires were used for assessment, which are prone to subjectivity and recollection bias. Finally, the majority of the study population were male and all Korean, limiting generalizability.

CONCLUSIONS

PTSD had both direct and indirect effects on OSA, mediated by depression and AUDs. In patients with both PTSD and OSA, depression and AUD symptoms should be screened routinely.

Board passages used in the examiner-response section

No Board passages are included.

Provider guidance (descriptive, not medical reasoning)

Board figures (Claim Raven's reading of Board decisions, 2021 to 2026): the Board granted 37.7% of 4031 decided service connection rulings on Sleep Apnea claimed secondary to PTSD. Of every Sleep Apnea ruling it granted or denied with a private medical opinion in the record, it granted 86.3% (8509 rulings). These figures do not identify who should sign and do not predict an outcome. The clinician must independently confirm that the medical question is within their scope and practice.