



German Air Force Centre of Aerospace Medicine
RTG 320: Fatigue Management in Aircrew

Sleep Disorders are a Readiness Issue

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March 2023



BUNDESWEHR



OVERVIEW

Introduction

Increased prevalence of sleep disorders in our military

Sleep Disorders and Cardiovascular Risk

Sleep headlines

- Post COVID and sleep
- Military operations and sleep
- CPAP shortage impacts

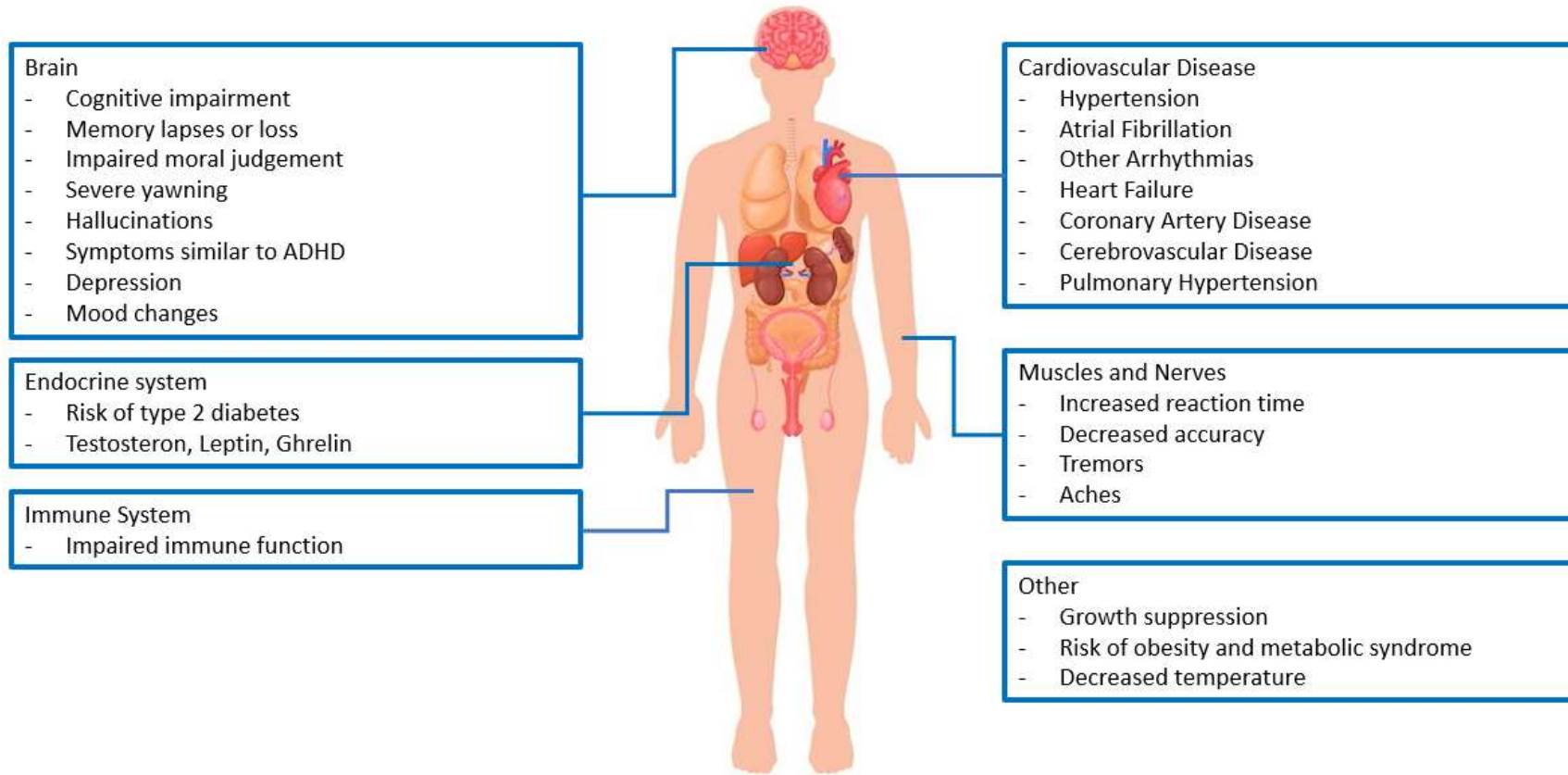


Common Sleep Disorders in Military Population

- Poor sleep hygiene
- Insomnia
- Hypersomnolence
- Parasomnias
- Obstructive Sleep Apnea
- Incident rates of insomnia (11 to 333 per 10,000) and obstructive sleep apnea (6 to 272 per 10,000) have increased by 30 and 45-fold respectively for U.S. Service Members (study conducted from 2004 – 2019, published in 2021) (
<https://academic.oup.com/sleep/advance-article-abstract/doi/10.1093/sleep/zsab024/6127013?redirectedFrom=fulltext>
)



Health Impacts of Sleep Disorders





Qualitative Sleep Disorders and Cardiovascular Risk

| Definition | Description | Association with cardiovascular risk factor | Association with cardiovascular events |
|----------------------------------|---|---|--|
| Insomnia | Quantitative and qualitative sleep disorder characterized by difficulty falling asleep, frequent nocturnal interruption, early awakening, accompanied by daytime symptoms related to this condition | ↑↑ | ↑↑ |
| Fragmented sleep | Qualitative alteration of sleep characterized by frequent and brief awakenings | ↑= | ↑↑ |
| Sleep disordered breathing | A group of clinical conditions characterized by abnormal breathing during sleep. They include: obstructive apnoeas, central apnoeas, hypoventilation and sleep-related hypoxemia | ↑↑ | ↑↑ |
| Obstructive sleep apnoea | Episodes of partial or complete closure of the upper airways during sleep leading to respiratory interruption, desaturation and awakening. If accompanied by daytime symptoms, it is called "obstructive sleep apnoea syndrome" | ↑↑↑↑ | ↑↑↑ |
| Periodic limb movements in sleep | Repetitive contraction of the upper or lower limbs during sleep, which often lead to frequent awakenings and fragmented sleep | = | = |
| Restless leg syndrome | Motor restlessness, uncontrolled movements and contractions of the lower limbs that occurs in the phases of falling asleep, sleep and awakening. When conscious, the patient feels a sensation of discomfort in the legs, accompanied by the need to move them continuously | ↑↑ | ↑ |
| Circadian rhythm sleep disorders | Alterations caused by the desynchronization between the endogenous sleep-wake rhythms and the normal external light-dark cycle, from endogenous causes (delayed or advanced sleep phases) or exogenous (intermittent night shifts) | ↑↑↑ | ↑↑ |

Del Pinto R et al., High Blood Press Cardiovasc Prev 2021; 28(2):85-102



Classification of Sleep Disordered Breathing

Classification of Sleep Disordered Breathing in Adults (simplified)

Obstructive

- Repetitive narrowing or closure of upper airway during sleep

AHI $\geq 5/h$ + characteristic symptoms
OR AHI > 15 with or without symptoms

Central: repetitive loss of respiratory drive

- Central Sleep Apnea (CSA)
- CSA with Cheyne-Stokes breathing (CSA-CSB)

Central AHI ≥ 5 events/hr & central apnea/hypopnea $\geq 50\%$ of total
(CSB has a crescendo/decrecendo breathing amplitude pattern with a cycle length > 40 s)

- Treatment-emergent CSA (CSA persisting or emerging when predominantly OSA is treated with positive airway pressure, and in the absence of co-morbidity or substance use that might trigger CSA)
- High altitude periodic breathing
- Opioid (or other substance) related CSA

Apnea: near absence of airflow for ≥ 10 s

Hypopnea: $\geq 30\%$ reduction in airflow for ≥ 10 s PLUS either PaO_2 drop $\geq 3\%$ OR cortical arousal

AHI: Apnea Hypopnea Index = apnea or hypopnea events per hour of sleep

NB Phenotype and clinical presentation may overlap

Cowie MR et al., J Am Coll Cardiol 2021; 78(6):608-624



Sleep Disordered Breathing

Sleep disordered breathing causes repetitive episodes of nocturnal hypoxemia, sympathetic nervous activation, and cortical arousal, often associated with excessive daytime sleepiness.

It is common in people with, or at risk of, cardiovascular (CV) disease (obesity, hypertension, coronary artery disease, heart failure, or atrial fibrillation).

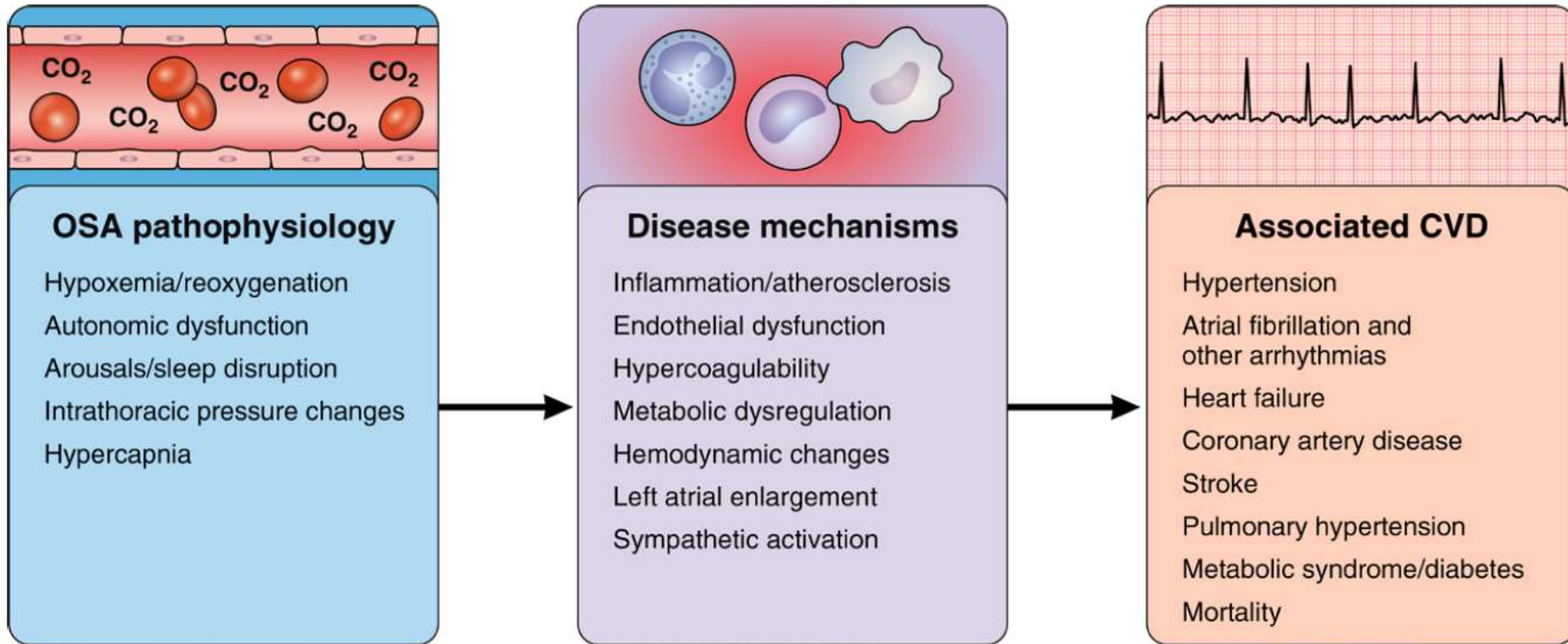
Current therapy of obstructive sleep apnea including weight loss, exercise, and positive airway pressure (PAP) improves daytime sleepiness, but PAP has not been shown to improve CV outcome in randomized trials.

For central sleep apnea (CSA) treatment is tailored based on etiology of CSA.

Cowie MR et al., J Am Coll Cardiol 2021; 78(6):608-624



Obstructive Sleep Apnea



Yeghiazarians et al., Circulation 2021; 144:e56-e67



Obstructive Sleep Apnea

Cardiovascular Complications of Obstructive Sleep Apnea (OSA):

(OSA is a condition with potential for negative feedback in which it worsens conditions that may in turn worsen the OSA.)

Hypertension: 30 – 50% of hypertensive patients have comorbid OSA, up to 80% of those with resistant hypertension. Disappointing results of CPAP on blood pressure.

Atrial fibrillation (AF): OSA is an independent risk factor of AF. CPAP can reduce AF burden after ablation or cardioversion.

Other arrhythmias: OSA is associated with a spectrum of arrhythmia and sudden cardiac death. Long pauses and bradycardia are common in patients with OSA. CPAP can reduce cardiac arrhythmias. Severe OSA can increase the risk of sudden cardiac death.

Heart failure (HF): OSA is highly prevalent in HF and associated with adverse outcome. Patients with HF are at increased risk for central sleep apnea (CSA). Prevalence of sleep-disordered breathing is 40% to 60% among those with symptomatic HF (equal proportions of OSA and CSA).

Yeghiazarians et al., Circulation 2021; 144:e56-e67



Obstructive Sleep Apnea

Cardiovascular Complications of Obstructive Sleep Apnea (OSA):

(OSA is a condition with potential for negative feedback in which it worsens conditions that may in turn worsen the OSA.)

Coronary artery disease (CAD): OSA independently increases the risk of coronary events. It has been associated with a 2-fold increase in risk of cardiovascular events and death. The onset of myocardial infarction is more likely to occur during the nighttime.

Cerebrovascular disease: Prevalence of post-stroke OSA is 71% in a recent meta-analysis. OSA is an independent risk factor for incident stroke, stroke recurrence, mortality, and functional and cognitive outcomes.

Pulmonary hypertension (PH): OSA is strongly associated with PH, with a reported prevalence of 70% to 80% among patients diagnosed with PH. The literature suggests potential benefit associated with treatment of PH with CPAP.

Yeghiazarians et al., Circulation 2021; 144:e56-e67



Obstructive Sleep Apnea

Cardiovascular Complications of Obstructive Sleep Apnea (OSA):

(OSA is a condition with potential for negative feedback in which it worsens conditions that may in turn worsen the OSA.)

Metabolic syndrome and type 2 diabetes: OSA has been associated with a greater likelihood of the metabolic syndrome and type 2 diabetes, independently of adiposity level. CPAP has not been demonstrated to affect lipid levels, glycemic control, or rates of metabolic syndrome or diabetes.

Mortality: OSA has consistently been associated with reduced survival in epidemiological studies. A meta-analysis of 16 studies showed that severe OSA (AHI ≥ 30) was associated with increased all-cause and cardiovascular mortality. An association between mild or moderate OSA and increased mortality has not been found. Studies on the effect of PAP on survival have been contradictory.

Yeghiazarians et al., Circulation 2021; 144:e56-e67



Recommendations for OSA Screening

| Screen for OSA | Consider sleep study if concerning signs/symptoms of sleep apnea are present |
|--|--|
| Resistant/poorly controlled hypertension | NYHA class II–IV HF symptoms |
| Pulmonary hypertension | Tachy-brady syndrome |
| Recurrent atrial fibrillation (after either cardioversion or ablation) | Sick sinus syndrome |
| | Ventricular tachycardia |
| | Survivors of sudden cardiac death |
| | Stroke |

Yeghiazarians et al., Circulation 2021; 144:e56-e67



Sleep Headlines



POST COVID AND SLEEP

News > Medscape Medical News > Conference News > SLEEP 2022

'Alarming' New Data on Disordered Sleep After COVID

Megan Brooks
June 07, 2022

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Long COVID: Disrupted sleep, fatigue common months after infection



Katarina Patushaj/EyeEm/Getty Images

HEALTH

Struggling to sleep following a COVID-19 infection? You're not alone, experts say

ABC Health & Wellbeing / By health reporter Olivia Willis

Posted Wed 23 Mar 2022 at 3:00pm



MILITARY OPERATIONS AND IMPACT ON SLEEP

Military challenges to obtaining good sleep

Circadian Shift

24 Hour Operational tempos

Poor Sleep environments

Night Shift work (reverse sleep cycles)

Military culture

The screenshot shows the top portion of a Stars and Stripes website article. At the top left is a 'SUBSCRIBE' button. The site logo 'STARS AND STRIPES' is centered, with a search bar and 'LOGIN' button to the right. Below the logo is a navigation menu with categories: THEATERS, BRANCHES, VETERANS, HISTORY, LIVING, SPORTS, MULTIMEDIA, and COMMUNITIES. A dark banner below the menu contains several promotional tiles: 'DISCOVER MORE', 'BROWSE', 'SALES FLYER', 'CUSTOM LISTS', 'FACE ID ENABLED!', and 'DOWNLOAD THE APP' with icons for the App Store and Google Play. The article title is 'Sleep deprivation hurts military readiness despite anti-sleep culture, Pentagon study says'. The author is listed as 'By CAITLIN DOORNBOS' and the date as 'STARS AND STRIPES • March 3, 2021'. The article content is partially obscured by a vertical line on the right side of the screenshot.



CPAP SHORTAGE

DIVE BRIEF

ResMed warns supply constraints may last 18 months after Philips completes recall of sleep-apnea devices

Published June 10, 2022

By [Nick Paul Taylor](#)
Contributor



Advertisement

CPAP machine shortage causing people to lose sleep

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ResMed responds to 'humanitarian emergency' over demand for CPAP devices with new factory

Published Jan. 10, 2023

 [Elise Reuter](#)
Reporter



 [Marlei Martinez](#)   
Reporter



CPAP SHORTAGE: INTERIM USAF WAIVER GUIDANCE

MILD to MODERATE OBSTRUCTIVE or CENTRAL SLEEP APNEA

SEVERE OBSTRUCTIVE or CENTRAL SLEEP APNEA

Symptoms of excessive daytime somnolence (ESS >10) or drowsy driving prior to diagnosis

NO

YES

Presence of any of below comorbidities:
Morbid obesity
Atrial fibrillation
Mental Health diagnosis (Anxiety, Depression, PTSD)
CHF
History of cardiac arrest
COPD

NO

YES

CONTINUE DNIF/DNIC

Interim 6-month waiver with interventions below:

- Sleep time of 7-8 hours/day
- Positional therapy (sleeping on side)
- Diet and exercise to maintain BMI <24
- Dental appliance/orthotic if available

DISCLAIMER: Member may NOT deploy without definitive treatment. Once adequately treated with CPAP, due to discordance with civilian sleep labs, FCII waivers still require ACS review and in person evaluation.



CONCLUSION

Sleep is an essential life function that when poorly impacted has a myriad of adverse physical and mental outcomes.

Clinical sleep disorders commonly encountered in the military population include obstructive sleep apnea, insomnia and insufficient sleep and have adverse cardiovascular impacts.

Military operations, COVID 19 and CPAP shortages have further complicated the effective management of sleep in our population

With the growing prevalence of sleep disorders in our military population, early identification of sleep disturbances and effective coping strategies and treatment are increasingly critical to risk mitigation in aeromedical setting.



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