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SEASONAL CHANGES OF PERFORMANCE IN DIFFERENT NATURAL DAYLIGHT CONDITIONS AMONG SHIFT WORKERS LIVING IN NORTHERN REGION

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Introduction: Shift work is very common among medical staff. Misalignment of biological clocks due to shift work can lead to fatigue, sleep loss, and excessive sleepiness. The daylight length changes seasonally in 3.5 times on 61st latitude in Northern region so it may have effect on body clocks. The aim of the current study was to determine sleep and performance of shift workers in natural seasonal conditions.

Methods: 136 healthcare workers participated in the study during in 2 weeks periods around winter (daylight length 5 h 33 min) and summer solstice (daylight length 19 h 19 min). There were 53 men (mean age 32.4+6.2 years) and 83 women (mean age 36.8+7.7 years) who worked 24 h shifts (79 people) with 48 h rest; 12 h shifts with 36 h rest period (36 people) and control group 8 h daily work (21 people). Sleep quality was determined using the Russian sleep characteristics questionnaire. Sleepiness was measured by Epworth Sleepiness Scale. Melatonin levels were assessed by 6-sulfatoxymelatonin (a6MT) in the morning urine samples before and after night shift. Psychomotor performance was measured by the M.P. Moroz method "Express diagnostics of performance and functional status of human" in the beginning and in the end of shifts with assessment of Mean Response Time. Data were analyzed using repeated measures ANOVA.

Results: Daily sleepiness by the Epworth Questionnaire was in normal range in all groups. Changes in the sleep quality were only in daily workers from 17.4+2.0 in winter to 21.4+3.6 ($p = 0.04$) in summer (pathological is < 19). A6MT level was higher in all groups in winter than in summer and showed increase significantly after shift in summer in 12 h group. A6MT level correlated with Mean Response Time.

Conclusion: Our results showed seasonal changes in sleep quality for daily workers with worse scores in short day length period. Natural changes in daylight conditions may have effect to performance in shift workers by suppression of melatonin that improve psychomotor performance.

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SHIFTWORK PRACTICES IN THE UNITED STATES NAVY: A STUDY OF SLEEP AND PERFORMANCE IN WATCHSTANDERS ABOARD THE USS JASON DUNHAM

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Introduction: It is well established that members of the military get inadequate sleep. Shay (1998) traced sleep deprivation in the military back to the ancient Greeks. Kleitman (1963) reported the poor sleep practices of Navy submariners dating to the 1950s. Unfortunately, all branches of the military have a tradition of sacrificing sleep and the problem has only been exacerbated by the 24/7 nature of continuous operations in the current defense climate. Despite efforts to address sleep deprivation in the military, it still poses a serious threat to safety and operational effectiveness. Sailors in the United States Navy are habitual shiftworkers, often working shifts that result in circadian misalignment equating to an 18 or 20-hour day without weekends or time for recovery. Working other than a 24-hour day, especially shorter days that impose a type of chronic jet-lag, is a well-known contributor to fatigue in the civilian shiftwork population. We proposed the adoption of a 3-on/9-off circadian-aligned

watchstanding schedule based on a 4-section watchbill where sailors stand 3-hour watches that commence every 12 hours.

Methods: As part of a larger data collection on 122 crewmembers, 33 U.S. Navy sailors participated in a two-week study of two work/rest schedules in an operational environment. The alternative watchstanding schedule ("3/9") involved standing 3 hours of watch followed by 9 hours off watch. The standard schedule ("6/6") consisted of standing 6 hours of watch followed by 6 hours off watch. Each sailor wore an actigraph, completed a daily sleep and activity log, and performed a 3-minute psychomotor vigilance test before and after standing watch.

Results: This preliminary analysis focused on sailors' sleep patterns. A mixed-effects ANOVA was used to examine the effects of watchstanding schedule and day on total sleep time per 24-hour period. Sailors working the alternative watchstanding schedule received an average of 86 minutes more sleep compared to their counterparts working the standard 6/6 schedule ($F_{1,302} = 22.06$; $p < 0.001$). The interaction between watchstanding schedule and day of the study was also statistically significant ($F_{11,302} = 2.17$; $p = 0.02$).

Conclusion: Preliminary results indicate sailors working an alternative watchstanding schedule get more sleep than those on a standard schedule. Additional sleep gained using this alternative schedule may have direct impact on sailors' performance within the surface Navy community.

Support (If Any): This study was supported by the United States Navy Bureau of Medicine, United States Navy N171, and the Office of Naval Research.

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FIGHTING FIRES AND FATIGUE: EFFECT OF 4-HOURS SLEEP DEPRIVATION ON FIREFIGHTER PHYSICAL PERFORMANCE DURING SIMULATED BUSHFIRE SUPPRESSION

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Introduction: To curtail the spread of bushfire, Australia's firefighters regularly work for 2-5 consecutive days obtaining on average 3-4 hours' sleep per night. The inherent dangers faced by firefighters require optimal levels of physical and cognitive functioning to ensure the safety of themselves and those they protect. While the effects of sleep restriction on cognitive function are well established, less is known about the effect on physical work performance. Therefore, the aim of this study was to determine the effect of sleep restriction on firefighter physical work performance during simulated multi-day bushfire suppression.

Methods: Thirty-five firefighters were randomly allocated to either the control group (8-hour sleep opportunity, $n = 18$) or the sleep restricted group (4-hour sleep opportunity, $n = 17$) and asked to perform simulated firefighting activities across two days. Self-paced physical performance was evaluated during a 55-min circuit comprising of six key firefighting tasks. After each task, participants reported their rate of perceived exertion and motivation. Heart rate and energy expenditure was measured continuously. Sleep was monitored by polysomnography. A general linear mixed modelling approach was used for analyses.

Results: Preliminary results indicate that there were no significant deleterious effects of sleep restriction on firefighters' physical performance, heart rate, or perceptual responses during self-paced simulated firefighting work tasks, compared to the control group. However, the sleep restricted group expended less energy during periods of rest compared to the control group as evidenced by lower activity counts and heart rate.

Conclusion: Under self-paced work conditions, sleep restricted individuals preferentially selected to conserve effort during periods when movement was inessential to task completion. This may have aided