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Who sleeps more and who works longer in the US Navy: Officers or enlisted personnel?

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ABSTRACT

Objectives: To determine whether United States Navy (USN) officers and enlisted personnel have different sleep and work patterns while underway on USN surface ships.
Methods: Variables of interest were assessed by actigraphy, activity logs, and validated questionnaires.
Results: The 2 groups had similar daily sleep (officers: 6.41 ± 0.95 hrs/day; enlisted: 6.57 ± 0.97 hrs/day) and work duration. Enlisted personnel, however, were more likely to report excessive daytime sleepiness—EDS (41% more likely), clinically relevant insomnia (105%), to have both EDS and elevated insomnia (121%), to be classified as poor sleepers (17%), to use nicotine products (174%), and to forego routine exercise (57%). Enlisted personnel were 487% more likely to report all 3 of these behaviors: drink caffeinated beverages, use nicotine/tobacco products, forego routine exercise.
Conclusions: Even though the work and sleep hours do not differ significantly, the state of well-being of enlisted personnel is in general lower than officers. Our findings can provide insight to Navy leadership towards improving sailor well-being and crew endurance.

Introduction

Approximately 16.8% of the 320,000 active-duty service members (ADSMs) in the United States Navy (USN) are officers and 83.2% are enlisted personnel.[1] The duties of commissioned officers include mission planning, organizing, and managing personnel. The duties of enlisted personnel are more "hands-on" to include operating, maintaining, and repairing equipment, performing technical activities, and supervising subordinates in enlisted ranks.

Earlier research has shown that when compared to officers, enlisted personnel are at higher risk to be diagnosed with insomnia, obstructive sleep apnea, post-traumatic stress disorder, and alcohol use disorder.[2-4] In terms of sleep, Snodgrass and Kohlman found that 28.6% of USN officers reported sleeping seven hours or more per night compared to only 14.5% of enlisted personnel.[5] A survey of Army personnel showed that 38% of warrant and commissioned officers reported sleeping 7 hours or more compared to 28% of junior enlisted.[6] In contrast, Russell and colleagues indicated that officers on surface ships reported sleeping on average 5.69 hours/day compared to 5.41 hrs/day for enlisted personnel.[7] Also, a survey of a mixed-service sample of ADSMs showed that 30.2% of commissioned officers and 31.3% of enlisted ADMSs reported sleeping 7 hours or more on a daily basis.[8] In general, our findings regarding the well-being of enlisted personnel agree with earlier epidemiological research focusing on service member health. Specifically, enlisted personnel compared to officers have significantly higher prevalence of insomnia, obstructive sleep apnea, post-traumatic stress disorder, and alcohol use disorder.[2-4] Our review of the literature showed that officers tended to sleep the same or more than enlisted personnel. However, many of the sleep assessments in these studies were based on self-reports gathered with nonvalidated questionnaires. More importantly, the studies we reviewed did not holistically assess the differences between these two occupational groups.

With these limitations in mind, the goal of our study was to assess differences in sleep patterns and work hours between officers and enlisted personnel in a sample of USN sailors while their ships were underway (ie, a ship that has pulled out of port and is out to sea) and the sailors were performing their normal duties at sea. This study is part of a multiyear effort designed to systematically and empirically assess sailor well-being, work/rest patterns, occupational factors affecting sailor performance in a variety of shipboard operational environments and provide insight and guidance for future naval operations.[9-12]

Participants and Methods

Participants

Volunteers (N = 1190 sailors) from 10 surface ships (1 dock landing ship, 6 destroyers, 1 aircraft carrier, 1 cruiser, 1 frigate) of the US

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Navy (179 [15%] officers and 1,011 [85%] enlisted; 941 [79.1%] males and 249 [20.9%] females) participated in the data collections. All participants were deemed "fit for duty" (ie, they were able to perform fully the naval duties to which they normally would be assigned) and provided informed consent. Data were collected in 10 time points (May 2009, December 2012, September 2013, June and November 2014, June 2017 and December 2017, December 2018, August 2019, and October 2020).

The experimental protocols were approved by the Institutional Review Board at the Naval Postgraduate School.

Measures

The prestudy questionnaire included items on age, sex, rank, and sleep-related behaviors. The poststudy questionnaire asked participants to report whether they had been standing watch during the underway, as well as administering four standardized tools. The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality with scores >5 characterizing poor sleepers.[13] The Epworth Sleepiness Scale (ESS) was used to assess average daytime sleepiness with scores >10 indicative of excessive daytime sleepiness (EDS).[14] The Insomnia Severity Index (ISI) was used to assess the severity of both nighttime and daytime components of insomnia with scores ≥15 associated with moderate to severe symptoms of insomnia.[15] The Profile of Mood States (POMS) was used to assess dimensions of the mood construct.[16]

Sleep was assessed by using one of two types of actigraph, the Motionlogger Watch (Ambulatory Monitoring, Inc. [AMI]; Ardsley, New York) or the Spectrum Plus (Philips-Respironics [PR]; Bend, Oregon). AMI data collected in the Zero-Crossing Mode were scored using Action W version 2.7.2155 software with the Cole-Kripke algorithm for rescoring. PR data were scored using Actiware software version 6.0.0. Data were collected in 1-minute epochs. All parameters for collecting and scoring the actigraphic data were the default values in the corresponding software packages. Sailors with a total of 5 or more 24-hour periods of actigraphic data were included in the sleep analysis.[17] On average, each sailor provided 10 days of actigraphic data. Participants also completed a sleep/activity log documenting their daily routine in 15-minute intervals, that is, training, maintenance/work, time on duty (includes all time spent working on ship-related duties), and service diversion (ie, activities required by regulations or the nature of shipboard or staff routine, to include quarters, inspections, sick call, and other administrative requirements).[18]

Procedures

The information presented herein is a subset of the measures taken from multiple field assessments on sailors aboard USN ships. Data were collected using a prospective naturalistic design with an average underway data collection period of 11 days ranging from 7 to 18 days. Sailors completed the study questionnaires at the beginning and end of the study, wore an actigraph, and completed an activity log. At the beginning of all data collections, sailors had been working on the same daily schedule for at least three days. Sailors completed the study questionnaires in groups in the mess deck of their ships.

Statistical analysis

Sleep metrics (daily sleep duration and number of sleep episodes per day) were aggregated to get an average score for each individual over the entire study period. First, data underwent descriptive statistical analysis. Next, the 2 occupational groups (officers and enlisted) were compared. Statistical analysis was conducted with JMP statistical software. (JMP Pro 16; SAS Institute; Cary, NC) Data normality was assessed with the Shapiro-Wilk W test. An alpha level of 0.05 was used to determine statistical significance. Summary data are reported as mean ± standard deviation (M ± SD) or median (interquartile range) (MD [IQR]) as appropriate. Post-hoc statistical significance was assessed using the Benjamini–Hochberg False Discovery Rate (BH-FDR) controlling procedure with q = 0.20.[19] Imputation was not applied and missing data did not show a systematic pattern.

Results

On average, officers were older (28 [8] years) compared to enlisted personnel (25 [8] years; Wilcoxon rank sum test, Z = 7.75, $P < .001$), but the 2 occupational groups did not differ in terms of sex (Fisher's exact test, $P = .136$) and watchstander/nonwatchstander ratios (Fisher's exact test, $P = .207$). The enlisted personnel group included 162 (16.0%) sailors with the rank of E1-E3, 769 (76.1%) with ranks of E4-E6, and 80 (7.91%) with ranks of E6-E9. The officers group included 152 (84.9%) with the rank of O1-O3 and 27 (15.1%) with the rank of O4-O6.

Next, we compared the 2 occupational groups (Table 1). Compared to officers, enlisted personnel reported higher daytime sleepiness (ESS score; $P < .001$), more severe insomnia symptoms (ISI score; $P = .002$), worse sleep quality (PSQI global score; $P < .001$), worse mood (total mood disturbance, tension-anxiety, depression, anger-hostility, vigor-activity; all $P < .025$). Enlisted personnel were more likely to have EDS (ESS score >10) by 41%, clinically relevant insomnia symptoms (ISI score ≥15; 105%), to have both EDS and elevated insomnia symptoms (121%), and to be classified as poor sleepers (PSQI Global score >5; 17%). Also, enlisted personnel were more likely to use nicotine or tobacco products (174%), and to forego an exercise routine (57%). More importantly, enlisted personnel were 487% more likely to drink caffeinated beverages and use nicotine/tobacco products while foregoing an exercise routine. The prevalence of drinking caffeinated beverages was high for both occupational groups, that is, 83.1% for enlisted personnel and 90.0% for officers.

The two occupational groups, however, were equivalent in terms of daily sleep duration, the prevalence of split sleep (number of sleep episodes per day), fatigue level, and hours of daily work (time on duty). Of note, officers spent twice as much time in service diversion activities compared to enlisted personnel. These results were further verified using generalized linear model analysis adjusting for ship, rank group (from lowest to highest ranks: apprentices E1-E3, petty officers E4-E6, chief petty officers E7-E9, junior commissioned officers O1-O3, senior commissioned officers O4-O6), age (square root transformed) nested within the rank group, sex, and watchstanding status.

Discussion

Compared to officers, enlisted personnel reported higher daytime sleepiness, more severe insomnia symptoms, worse sleep quality, and worse mood in terms of total mood disturbance, tension-anxiety, depression, anger-hostility, and vigor-activity. Consequently, enlisted sailors were more likely to have excessive daytime sleepiness, clinically relevant insomnia symptoms, and to be classified as poor sleepers. Use of nicotine/tobacco products, lacking an exercise routine, and drinking caffeinated beverages were more prevalent in enlisted sailors.

In contrast, the 2 occupational groups were equivalent in terms of daily sleep duration, the prevalence of split sleep (number of sleep episodes per day), fatigue, and hours of work per day (time on duty). Our actigraphic findings regarding sleep duration refute earlier studies that officers sleep more than enlisted personnel. We postulate that this difference can be attributed to the fact that earlier studies assessed sleep duration using self-report instead of the more accurate objective method (actigraphy) that we used in our study.[7] Also, the fact that the 2 occupational groups do not differ in sleep and work

Table 1
Occupational group (Officers, Enlisted personnel) as a predictor factor for sailor well-being, sleep attributes, sleep-related behaviours, and work hours.[1]

Variable	Officers	Enlisted personnel	Pairwise comparison	
			Unadjusted *P*-value	Effect size
Epworth Sleepiness Scale (ESS) score, M ± SD	8.94 ± 4.25	10.3 ± 4.77	≤**0.001**[a]	0.275[c]
Elevated daytime sleepiness (EDS) (ESS > 10), # (%)	55 (32.0%)	437 (45.1%)	**0.002**[e]	1.41 (1.12-1.77)[f]
Insomnia Severity Index (ISI) score, M ± SD	8.62 ± 5.02	11.2 ± 5.29	≤**0.001**[a]	0.489[c]
ISI score ≥ 15, # (%)	18 (13.3%)	231 (27.3%)	≤**0.001**[e]	2.05 (1.31-3.19)[f]
ESS > 10 and ISI ≥ 15, # (%)	11 (8.09%)	152 (17.9%)	**0.002**[e]	2.21 (1.24-3.97)[f]
Pittsburgh Sleep Quality Index (PSQI) Global score, M ± SD	7.33 ± 3.04	8.58 ± 3.43	≤**0.001**[a]	0.371[c]
Poor sleepers, # (%)	119 (69.2%)	769 (81.0%)	≤**0.001**[e]	1.17 (1.06-1.30)[f]
Profile of Mood States (POMS) scores, MD (IQR)				
Total mood disturbance (TMD)[2]	25.5 (36.3)	33.0 (51.0)	**0.002**[b]	0.103[d]
Tension-anxiety[2]	7.00 (7.00)	9.00 (9.00)	**0.025**[b]	0.075[d]
Depression[2]	5.00 (9.00)	7.00 (16.0)	**0.004**[b]	0.096[d]
Anger-hostility[2]	9.00 (10.0)	11.0 (15.0)	**0.003**[b]	0.101[d]
Vigor-activity[2]	13.0 (9.00)	11.0 (9.00)	≤**0.001**[b]	0.111[d]
Fatigue[2]	9.00 (8.00)	10.0 (10.0)	0.529[b]	0.021[d]
Confusion-bewilderment[2]	7.00 (6.00)	7.00 (7.00)	0.393[b]	0.028[d]
Sleep (actigraphy)				
Daily sleep duration in hours, M ± SD	6.41 ± 0.95	6.57 ± 0.97	0.080[a]	0.161[c]
Daily sleep duration <7 hours, # (%)	102 (71.8%)	531 (67.7%)	0.378[e]	1.06 (0.95-1.19)[f]
Sleep episodes/day, MD (IQR)[2]	1.43 (0.49)	1.33 (0.54)	0.135[b]	0.051[d]
Sailors with split sleep, # (%)	116 (89.2%)	617 (82.6%)	0.072[e]	1.08 (1.01-1.16)[f]
Sleep-related behaviours, # (%)				
Drinking caffeinated beverages	159 (90.9%)	818 (83.1%)	**0.009**[e]	1.09 (1.04-1.16)[f]
Using nicotine or tobacco products	22 (12.6%)	339 (34.5%)	<0.001[e]	2.74 (1.84-4.09)[f]
Do not have an exercise routine	33 (22.2%)	307 (34.8%)	0.003[e]	1.57 (1.15-2.15)[f]
Drinking caffeinated beverages and using nicotine/tobacco products and lacking an exercise routine	3 (2.16%)	109 (12.7%)	<0.001[e]	5.87 (1.89-18.2)[f]
Workload, hours/day				
Time on duty, M ± SD	11.9 ± 2.75	11.6 ± 2.40	0.300[a]	0.102[c]
Training, MD (IQR)[2]	0.321 (1.21)	0.286 (0.832)	0.299[b]	0.039[d]
Maintenance/work, MD (IQR)[2]	3.31 (5.08)	3.66 (4.84)	0.199[b]	0.048[d]
Service diversion, MD (IQR)[2]	1.50 (1.93)	0.631 (1.32)	<0.001[b]	0.223[d]

Note 1: Bold underlined *P*-values are statistically significant based on the post-hoc BH-FDR controlling procedure.
Note 2: ESS data from 1141 sailors; PSQI from 1,121 sailors, ISI from 981 sailors, POMS from 901 sailors, actigraphy from 916 sailors, activity logs from 722 sailors. (eg, MD, median; IQR, interquartile range)
[a] F test.
[b] Wilcoxon rank sum test.
[c] Hedge's g.
[d] Nonparametric effect size r.
[e] Fisher's exact test.
[f] Relative risk (95% confidence interval).

duration may be associated with increased work requirements, a known issue of work-saturated environments like the Navy.[20]

There are 2 concerning issues. First, approximately 68% of sailors were sleep-deprived, sleeping on average less than 7 hours/day; nearly one third (~31%) of the sailors slept less than 6 hrs/day. The second issue of concern is why differences in well-being exist even though the 2 groups did not differ in sleep and work duration. One explanation may be that officers tend to sleep in staterooms that they may share with a couple of other officers while berthing compartments have many sailors sleeping in the same berthing space. These large berthing spaces are adversely affected by noise, light, odors, and uncomfortable temperatures.[21,22] Such problems are not unique, however, to life at sea; sleep disruptions while deployed are evident in other military operational environments as well.[23,24]

In general, our findings regarding the well-being of enlisted personnel agree with earlier epidemiological research focusing on service member health. Specifically, compared to officers, enlisted personnel have a higher prevalence of insomnia, obstructive sleep apnea, post-traumatic stress disorder, and alcohol use disorder.[2-4]

Our findings can be used to tailor training programs to educate sailors, and in particular enlisted personnel, regarding the importance of sleep, light, and fatigue management on operational performance and health.[25,26] Also, ship leadership should consider improving habitability conditions in the enlisted personnel berthing compartments as a method to improve sailor sleep quality and well-being.[22]

This study has several limitations. First, we would have liked to have an even larger sample of sailors from various types of ships (to include littoral combat ships, mine countermeasures ships, patrol craft, and submarines). Second, our investigation of daily activities was based on just a few general categories. Future research, however, should further investigate why both groups work on average ~12 hrs/day and whether different duties or work schedules affect sailor well-being (for example, chronic night shiftwork, occupational specialties/rates). Another issue of concern is whether using 2 types of actigraphs could have affected our results. Earlier research, however, has shown that these 2 types of actigraph assess total sleep time for an ~8-hour night sleep episode with 3-minute precision.[27]

Our study also has 3 strengths. First, we used validated survey instruments to more reliably assess mood, average daytime sleepiness, insomnia symptoms, and sleep quality. Second, sleep was assessed objectively with actigraphy, the recommended method for assessing sleep in field settings.[17,28] Lastly, the distribution of ranks in our study reflected the actual ratios of these ranks on USN ships which increases the external validity/generalizability of our findings.

Conclusions

Even though sleeping and working the same number of hours, the state of well-being of enlisted personnel is, in general, lower than officers. Our findings can provide valuable insight to Navy leadership

towards improving sailor well-being, crew endurance, and ship operational performance.

Declaration of Conflict of Interest

Both the authors have nothing to disclose.

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