



# Night shift preparation, performance, and perception: are there differences between emergency medicine nurses, residents, and faculty?

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**Objective** Determine differences between faculty, residents, and nurses regarding night shift preparation, performance, recovery, and perception of emotional and physical health effects.

**Methods** Survey study performed at an urban university medical center emergency department with an accredited residency program in emergency medicine.

**Results** Forty-seven faculty, 37 residents, and 90 nurses completed the survey. There was no difference in use of physical sleep aids between groups, except nurses utilized blackout curtains more (69%) than residents (60%) and faculty (45%). Bedroom temperature preference was similar. The routine use of pharmacologic sleep aids differed: nurses and residents (both 38%) compared to faculty (13%). Residents routinely used melatonin more (79%) than did faculty (33%) and nurses (38%). Faculty preferred not to eat (45%), whereas residents (24%) preferred a full meal. The majority (>72%) in all groups drank coffee before their night shift and reported feeling tired despite their routine, with 4:00 a.m. as median nadir. Faculty reported a higher rate (41%) of falling asleep while driving compared to residents (14%) and nurses (32%), but the accident rate (3% to 6%) did not differ significantly. All had similar opinions regarding night shift-associated health effects. However, faculty reported lower level of satisfaction working night shifts, whereas nurses agreed less than the other groups regarding increased risk of drug and alcohol dependence.

**Conclusion** Faculty, residents, and nurses shared many characteristics. Faculty tended to not use pharmacologic sleep aids, not eat before their shift, fall asleep at a higher rate while driving home, and enjoy night shift work less.

**Keywords** Shift work schedule; Emergency medicine; Emergency nursing; Sleep wake disorders; Sleep aids, pharmaceutical

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## Capsule Summary

### What is already known

Night shift work has deleterious effects on physical and emotional health. Past surveys of emergency department nurses and physicians have reported night shift work is associated with career burnout, mood disorders, and family conflict.

### What is new in the current study

The comparison of night shift habits and perception between emergency department nurses and resident and faculty physicians has not been previously studied. We highlight similarities and differences between the three groups in this survey study.

## INTRODUCTION

Emergency medicine nurses and physicians routinely provide continuous 24-hour coverage in the emergency department (ED) and are familiar with the challenges of working at night and maintaining optimal sleep. Past studies of nurses and physicians have shown night shift work is a major factor in career dissatisfaction, burnout, work-family conflict, and dysphoria.<sup>1</sup> The negative aspects of night shift work have been known for centuries: the Italian physician Bernardino Ramazzini, in his occupational medicine treatise *De morbis artificum diatriba* [Diseases of workers] published in 1713, described bakers who "work at night, so when the others sleep they stay awake, while trying to sleep during the day like animals who escape the light: hence, in the same town, there are men living an antithetic life in comparison with the others."<sup>2,3</sup> Night shift work has been associated with deleterious health effects such as cardiovascular and gastrointestinal disease, certain cancers, suppression of immunity, diabetes, ageing, hormonal imbalance, increased risk of accidents, and premature death.<sup>4</sup> Neuropsychiatric ramifications include chronic fatigue, anxiety, depression, increased risk of medical errors, family discord, drug and alcohol abuse, and social isolation.<sup>1,5,6</sup>

The evolution of a 24-hour society has created challenges requiring adaptation to an inverse light and darkness cycle. As humans are diurnal by nature and require sleep at night in order for survival, night shift work represents an abnormal physiologic state with short-term effects on circadian rhythm for those working isolated night shifts, and long-term effects for career night shift workers (i.e., nocturnists).<sup>7</sup> Preparation for night shift work by nurses and physicians often involves a routine: pre- and post-shift sleep during daylight hours, use of sleep aids, and specific meal and beverage selection.<sup>8,9</sup> To date, no study has compared emergency medicine nurse and physician preferences regarding these factors, as well as their perception of fatigue during and after their night shift, risk of motor vehicle accidents while driving home, and their opinions on the potential emotional and physical health effects associated with working night shifts. The aim of our study was to determine whether differences existed between nurses, residents, and faculty working at the same ED.

## METHODS

This study was performed during the month of April 2017 at an urban, university-associated level I trauma center ED with an accredited residency program in emergency medicine, school of medicine, and school of nursing. The annual census of this ED is 80,000 visits, and it serves a population of 500,000 within its city

limits and 1.6 million in its surrounding area. The hospital also serves as a tertiary referral center for northern and central California and the *de facto* public hospital for the city, providing care for a significant number of uninsured and dispossessed patients, as well as those brought in by law enforcement from the street, jails, prisons, and detention centers. The night shift for nurses is a 12-hour period from 7:00 p.m. to 7:00 a.m. For residents and faculty, the duration of the night shift is 10 hours from 9:00 p.m. to 7:00 a.m., and 11 hours from 9:00 p.m. to 8:00 a.m., respectively.

Surveys were handed to each subject during their ED shift (nurses, residents, and faculty), or during an academic forum, journal club, or other official meeting (residents and faculty) by one of the study investigators and collected approximately one hour later. The surveys were voluntary and anonymous. Data from the completed surveys were then input into Microsoft Excel 2016 (Redmond, WA, USA). Statistical analysis with analysis of variance (ANOVA), Kruskal-Wallis, and Fisher exact test was performed using STATA ver. 14 (Stata Corp., College Station, TX, USA). Results are reported as mean  $\pm$  standard deviation unless otherwise stated. Statistical significance is assumed at a level  $P \leq 0.05$ . This study was approved by our medical system's institutional review board as an exemption, as the survey guaranteed anonymity and involved no identifying patient care details.

## RESULTS

A total of 90 nurses, 37 residents, and 47 faculty completed the survey (Supplementary Material 1). The survey response rate was 98% for nurses, 88% for residents, and 98% for faculty. There were significant differences in age between nurses ( $36.9 \pm 7.8$ ), residents ( $30.7 \pm 3.2$ ), and faculty ( $40.5 \pm 8.3$ ,  $P < 0.0001$ ). The age range for nurses was 24 to 59 years, residents 27 to 40 years, and faculty 30 to 66 years. There were significant gender differences between the three groups, with 56 (62%) female nurses, 17 (46%) female residents, and 17 (36%) female faculty ( $P = 0.01$ ). Nurses were asked how many years since graduation from nursing school and reported  $9.3 \pm 7.1$  years. Nurses were also queried about their years of experience in the ED and reported  $6.2 \pm 5.5$  years with a range of 1 month to 30 years, and 70 (78%) identified themselves as primarily working night shifts. Faculty reported  $12.4 \pm 8.6$  years and residents  $2.3 \pm 1.7$  years since graduation from medical school. Nine (19%) of faculty identified themselves as primarily working night shifts.

The majority (> 71%) of all three groups reported they had a pre-night shift routine (Table 1). There was no significant difference between the groups for the use of physical sleep aids such as ear plugs, background noise, special pillows, humidifiers, and

**Table 1.** Survey questions regarding demographics and sleep aids

Survey question	Nurse (n = 90)	Resident (n = 37)	Faculty (n = 47)	P-value <sup>a)</sup>
Age (yr)	36.9 ± 7.8	30.7 ± 3.2	40.5 ± 8.3	0.0001 <sup>b)</sup>
Female	56 (62.2, 51.9–71.6)	17 (45.9, 31.0–61.2)	17 (36.2, 23.9–50.5)	0.01
Do you have a pre-night shift routine?	64 (71.1, 60.6–80.2)	27 (72.9, 56.8–84.7)	37 (78.7, 64.9–88.2)	0.62
Do you use				
Blackout curtains	62 (68.9, 58.3–78.2)	22 (59.5, 43.5–73.6)	21 (44.7, 31.4–56.7)	0.02
Ear plugs	21 (23.3, 15.1–33.4)	12 (32.4, 19.5–48.6)	10 (21.2, 11.8–35.1)	0.45
Background noise	44 (48.9, 38.2–59.6)	14 (37.8, 24.0–53.9)	21 (44.7, 31.4–56.7)	0.52
Special pillow (anatomic, etc.)	5 (5.6, 1.9–13.2)	3 (8.1, 2.1–22.0)	5 (10.6, 4.2–23.0)	0.55
Humidifier	3 (3.3, 0.7–9.4)	2 (5.4, 0.6–18.6)	2 (4.3, 0.4–15.0)	0.86
Eye mask	8 (8.9, 3.9–16.7)	5 (13.5, 5.4–28.5)	6 (12.7, 5.6–25.6)	0.67
Preferred bedroom temperature (°F)	67.9 ± 3.2	67.0 ± 2.7	67.7 ± 2.4	0.43 <sup>b)</sup>
Routinely take sleep aids?	34 (37.8, 28.4–48.1)	14 (37.8, 24.0–53.9)	6 (12.7, 5.6–25.6)	0.03
Melatonin	13 (38.2, 23.8–55.0)	11 (78.6, 51.7–91.6)	2 (33.3, 9.3–70.4)	0.03
Diphenhydramine	10 (29.4, 16.7–46.3)	2 (14.3, 2.7–41.2)	3 (50.0, 18.7–81.2)	0.23
Doxylamine	4 (11.7, 4.1–27.2)	0	1 (16.6, 1.1–58.2)	0.27
Alcohol	2 (5.8, 0.6–20.0)	1 (7.1, 0.1–33.5)	0	1
Trazodone	2 (5.8, 0.6–20.0)	0	0	1
Zolpidem	1 (2.9, 0.1–16.2)	0	0	1
Eszopiclone	1 (2.9, 0.1–16.2)	0	0	1
Valerian root	1 (2.9, 0.1–16.2)	0	0	1
What sleep aids have you tried?				
Diphenhydramine	56 (62.2, 51.4–72.2)	17 (45.9, 31.0–61.6)	24 (51.1, 37.2–64.7)	0.18
Melatonin	52 (57.8, 46.9–68.1)	19 (51.4, 35.9–66.6)	16 (34.0, 22.1–48.4)	0.03
Alcohol	24 (26.7, 17.9–37.0)	11 (29.7, 17.4–45.9)	9 (19.2, 10.2–32.8)	0.49
Doxylamine	13 (14.4, 8.5–23.3)	4 (10.8, 3.7–25.3)	5 (10.6, 4.2–23.0)	0.82
Zolpidem	12 (13.3, 7.6–22.0)	6 (16.2, 7.3–31.5)	8 (17.0, 8.6–30.4)	0.81
Valerian root	6 (6.7, 2.8–14.1)	2 (5.4, 0.5–18.6)	1 (2.1, 0.1–12.1)	0.59
Eszopiclone	2 (2.2, 0.1–8.2)	0	2 (4.3, 0.3–15.0)	0.54
Trazodone	2 (2.2, 0.1–8.2)	0	0	0.71
Dimenhydrinate	3 (3.3, 0.7–9.7)	0	0	0.42
Temazepam	2 (2.2, 0.1–8.2)	0	0	0.71
Lorazepam	0	0	1 (2.1, 0.1–12.1)	0.48
Tramadol	1 (1.1, 0.1–6.6)	0	0	1
Cannabis	1 (1.1, 0.1–6.6)	0	0	1
Promethazine	1 (1.1, 0.1–6.6)	0	0	1
Herbal tea	1 (1.1, 0.1–6.6)	0	0	1

Values are presented as mean ± standard deviation or number (%; 95% confidence interval).

<sup>a)</sup>Fisher exact test. <sup>b)</sup>ANOVA.

masks. However, there was a significant difference ( $P=0.02$ ) in the use of blackout curtains in the bedroom between nurses (69%), residents (60%), and faculty (45%). All groups preferred a narrow bedroom temperature range, averaging from 67°F to 68°F. The routine use of pharmacologic sleep aids was next addressed. Faculty were least likely (13%,  $P=0.03$ ) to routinely utilize pharmacologic sleep aids compared to nurses (38%) and residents (38%). The most common routine sleep aids were all over-the-counter: melatonin, diphenhydramine, and doxylamine. Residents routinely utilized melatonin at a significantly higher rate (79%,  $P=0.03$ ) than nurses (38%) and faculty (33%). The next set of questions

involved which sleep aids had been tried in the past but not routinely used. Diphenhydramine, melatonin, alcohol, doxylamine, and zolpidem were the most commonly cited. Nurses reported having tried melatonin at a higher frequency (58%,  $P=0.03$ ) than residents (51%) or faculty (34%).

Pre-night shift meal habits were queried (Table 2), and faculty differed significantly (45%,  $P=0.04$ ) from residents (24%) and nurses (26%) in preferring to not eat prior to their night shift. In contradistinction, residents preferred a full meal (24%,  $P=0.05$ ) compared to nurses (12%) and faculty (6%). Coffee was overwhelmingly (> 72%) preferred by all groups as their beverage of choice

**Table 2.** Survey questions regarding meals, beverages, fatigue, and sleep

Survey question	Nurse (n = 90)	Resident (n = 37)	Faculty (n = 47)	P-value <sup>a)</sup>
Meal preference before a night shift				
No meal	23 (25.6, 17.6–35.5)	9 (24.3, 13.2–40.3)	21 (44.7, 31.4–58.8)	0.04
Snack	23 (25.6, 17.6–35.5)	9 (24.3, 13.2–40.3)	12 (25.5, 15.1–39.6)	0.9
Small meal	33 (36.7, 26.7–47.5)	10 (27.0, 15.2–43.1)	11 (23.4, 13.5–37.4)	0.23
Full meal	11 (12.2, 6.3–20.8)	9 (24.3, 13.2–40.3)	3 (6.4, 1.2–17.8)	0.05
Stimulant preference before/during a night shift				
Coffee	65 (72.2, 61.8–81.2)	28 (75.7, 59.7–86.8)	38 (80.9, 67.2–89.8)	0.53
Tea	9 (10.0, 4.7–18.1)	6 (16.2, 7.3–31.5)	5 (10.6, 4.2–23.0)	0.59
Energy drink/soda	17 (18.9, 11.4–28.5)	9 (24.3, 13.2–40.3)	6 (12.7, 5.6–25.6)	0.39
Caffeine tablets	3 (3.3, 0.7–9.4)	0	2 (4.2, 0.3–15.0)	0.7
Experience fatigue during night shift?	60 (66.7, 55.9–76.3)	22 (59.5, 43.5–73.7)	31 (65.9, 51.6–77.8)	0.72
When is your energy level lowest? (interquartile range)	4:00 a.m. (3–4)	4:00 a.m. (4–4)	4:00 a.m. (4–4)	0.21 <sup>b)</sup>
Estimate minimum hours of sleep needed prior to				
An isolated night shift (hr)	5.5 ± 1.9	5.9 ± 2.2	3.6 ± 2.3	0.0001 <sup>d)</sup>
Consecutive night shifts (hr)	6.2 ± 1.4	6.5 ± 1.2	6.6 ± 1.1	0.24 <sup>d)</sup>
Estimate your actual hours of sleep prior to				
An isolated night shift (hr)	4.8 ± 2.7	4.1 ± 2.9	2.8 ± 2.0	0.0002 <sup>d)</sup>
Consecutive night shifts (hr)	5.6 ± 1.4	6.2 ± 0.9	6.2 ± 1.5	0.03 <sup>d)</sup>
Time to sleep after arriving home from				
An isolated night shift (hr)	1.6 ± 1.4	1.4 ± 1.0	1.4 ± 0.9	0.52 <sup>d)</sup>
Consecutive night shifts (hr)	1.8 ± 1.3	1.5 ± 1.1	1.7 ± 1.1	0.43 <sup>d)</sup>
Ever fallen asleep driving home after a night shift?	29 (32.2, 22.7–42.9)	5 (13.5, 5.4–28.5)	19 (40.5, 27.9–54.7)	0.02
Ever had an accident while driving home after a night shift?	5 (5.6, 0.2–12.7)	1 (2.7, 0.1–15.0)	3 (6.4, 1.5–17.8)	0.72

Values are presented as number (%), 95% confidence interval) or mean ± standard deviation unless otherwise indicated.

<sup>a)</sup>Fisher exact test. <sup>b)</sup>Kruskal-Wallis test. <sup>c)</sup>ANOVA.

**Table 3.** Survey questions regarding perception of night shift work impact on physical and emotional health

Survey question	Nurse	Resident	Faculty	P-value <sup>a)</sup>
I enjoy working night shifts.	4 (2–5)	4 (2.5–4.5)	3 (2–4)	0.01
Night shifts do not alter my normal sleep cycle.	1 (1–3)	1 (1–2)	1 (1–2)	0.13
Career night shift workers have shorter life-spans than day shift workers.	4 (3–4)	4 (3–4)	4 (3–4)	0.74
Career night shift workers are more susceptible to illness than day shift workers.	4 (3–5)	4 (3–4)	4 (3–4)	0.49
Career night shift workers age faster than day shift workers.	4 (3–4)	4 (3–4)	4 (3–4)	0.08
Career night shift workers experience higher overall levels of stress in their personal lives than day shift workers.	3 (3–4)	3 (3–4)	3 (3–4)	0.39
Career night shift workers have a higher prevalence of depression than day shift workers.	4 (3–4)	3 (3–4)	3 (3–4)	0.32
Career night shift workers are more likely to depend on drugs and alcohol than day shift workers.	3 (2–4)	3 (3–4)	3 (3–4)	0.02

Values are presented as median (interquartile range). Likert scale: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree.

<sup>a)</sup>Kruskal-Wallis test.

before and during their night shift. Other beverages cited were tea, energy drinks, and soda, with 18 nurses (20%), 8 residents (22%), and 7 faculty (15%) reporting drinking more than one type of beverage during their night shift. The majority in all groups reported they experienced fatigue during their night shift, with 4:00 a.m. as the most commonly reported time at which their energy level reached a nadir. For isolated night shifts, faculty estimated the least amount of required and actual hours of sleep compared to nurses and residents (Table 2). Nurses estimated they slept less

actual hours than residents and faculty during consecutive night shifts. Faculty had a higher rate of falling asleep during their drive home after a night shift (41%,  $P=0.02$ ) than nurses (32%) or residents (14%). There was no significant difference in accident rate, which ranged from 3% to 6%.

Specific statements regarding the effect of night shift work on emotional and physical health were presented using a 5-point Likert scale (Table 3). There was agreement between nurses, residents, and faculty for all statements with exception of two. Fac-

ulty were less inclined ( $P=0.01$ ) than nurses and residents to agree with the statement, "I enjoy working night shifts." Nurses were less inclined ( $P=0.02$ ) than faculty and residents to agree with the statement, "Career night shift workers are more likely to depend on drugs and alcohol than day shift workers."

## DISCUSSION

At present, this survey study represents the first in which emergency medicine nurses, residents, and faculty from the same ED provided details regarding their night shift routines, habits, and preferences for comparison. It was not surprising the majority in all three groups had a pre-night shift routine, and this habit has been confirmed in prior surveys.<sup>7-9</sup> The use of physical sleep aids for pre- and post-night shift sleep and maintenance of a routine was also a common finding between the three groups. The main purpose of physical sleep aids is to minimize the disruptive effect of pre- and post-night shift sleep on circadian rhythm. This includes blocking light, mitigating sound, and creating an optimal bedroom temperature. Circadian rhythms are dependent on an internal clock located in the suprachiasmatic nucleus of the hypothalamus. Humans have a predictable circadian clock slightly longer than 24 hours that may be altered by career night shift work and exposure to "zeitgebers," or light-associated clues to time of day. The only significant difference between the three groups in our study was the use of blackout curtains by faculty compared to nurses and residents. This may be explained by the higher number of consecutive night shifts for nurses and residents compared to faculty. For the nine faculty who identified themselves as nocturnists, eight (89%) regularly used blackout curtains compared to non-nocturnists (34%). A review of the efficacy of physical sleep aids found no particular benefit for any one in particular.<sup>10</sup> However, careful regulation of light exposure using curtains, masks, and sunglasses pre- and post-night shift has been shown to enhance recovery, mood, and performance.<sup>7</sup> Circadian patterns also affect core body temperature, also regulated by the hypothalamus, which peaks in the afternoon and falls in the early hours of the morning. Low ( $<70^{\circ}\text{F}$ ) pre- and post-night shift bedroom temperature was preferred by all groups, most likely to mimic the early morning circadian pattern (Table 1).

In general, pharmacologic sleep aids were not routinely used by the majority in all three groups in our study. Melatonin as a routine sleep aid was most commonly used by all three groups, but significantly more so by residents relative to nurses and faculty. A Cochrane review from 2015 determined melatonin improves sleep length after a night shift, but the quality of evidence was low.<sup>11</sup> A randomized controlled trial of melatonin for 18 emergen-

cy physicians working nights showed melatonin improved gestalt day sleep and night alertness.<sup>12</sup> In another similar study, Wright et al.<sup>13</sup> and colleagues found no beneficial effect of melatonin on sleep quality, tiredness, or cognitive function in emergency physicians after a night shift. Antihistamines were the most commonly tried sleep aids for all three groups but ranked below melatonin for routine use. This may reflect the tolerance associated with repeated antihistamine use, and the undesirable side effects such as xerostomia, post-awakening sedation, and dizziness. Prescribed sleep aids such as zolpidem were commonly tried but not routinely used by all three groups. This may be explained by awareness of the addiction potential of prescribed sleep aids by ED staff commonly caring for prescription drug-addicted patients. Alcohol was tried by all three groups but not routinely used, likely reflecting the sleep stage fragmentation and awakening from diuresis associated with alcohol use as a sleep aid.<sup>1</sup> This finding was in contrast to a 2005 survey of Canadian emergency physicians, who reported higher past-month alcohol use as a sleep aid than any other medication class.<sup>14</sup> Another study of 602 emergency medicine residents reported 46% regularly used (in order of preference) antihistamines, sleep adjuncts, alcohol, benzodiazepines, or muscle relaxants to help them fall or stay asleep.<sup>15</sup> Sleep adjuncts were not further defined in their survey.

Regarding meal preference just before their night shift, faculty preferred not to eat more so than nurses and residents, whereas residents preferred a full meal compared to nurses and faculty. This may be explained by the higher years of experience for the nurse and faculty group compared to residents. Seasoned night shift health care workers have been noted to limit their food intake to avoid post-prandial fatigue from insulin surges and increased risk of obesity.<sup>16,17</sup> They may also be aware of the increased risk of diabetes mellitus associated with long-term night shift work.<sup>18</sup> During normal nighttime sleep, an insulin-resistant fasting state exists during which stored glucose is released, which is preferentially utilized by the central nervous system instead of muscle.<sup>19</sup> Eating during a night shift creates an exaggerated glucose and lipid response compared to day, which represents a risk for development of diabetes and cardiovascular disease.

For promotion of wakefulness, caffeinated beverages were widely utilized by all three groups in our study, with coffee as the clear favorite. There were no significant differences detected between nurses, residents, and faculty regarding choice of stimulant (coffee, tea, energy drink, etc.). These results parallel other studies of night shift healthcare workers.<sup>20,21</sup> Of note, not one subject reported the use of modafinil or amphetamine-like substances to enhance wakefulness during their night shift. Caffeine has been shown to enhance wakefulness, mood, and improve cognitive



performance during night shifts.<sup>22-24</sup> However, tolerance to caffeine develops rapidly, and habitual users lose its benefits.<sup>25</sup> Despite the use of caffeinated beverages and pre-shift routines, the majority of all three groups reported fatigue during their night shift, especially at 4:00 a.m., which represented the study median and correlates with the human circadian rhythm energy nadir. It has been shown that during this time period, the risk of major errors in judgment and performance is highest, as demonstrated by the industrial disasters at Bhopal, Three Mile Island, and Chernobyl.<sup>26</sup>

In our study, nurses reported their actual hours of sleep for consecutive night shifts were significantly lower than residents and faculty, and also lower than previously published reports.<sup>5,6,27-30</sup> The optimal amount of sleep to has been shown to be approximately 8.2 hours, and duration of less than 5 hours in the preceding 24 hours has been associated with performance impairment of common tasks.<sup>31</sup> Such sleep deprivation may lead to microsleeps, which are brief episodes lasting 3 to 15 seconds during which a person appears suddenly asleep.<sup>32</sup> This may reflect residents and faculty working fewer consecutive night shifts and less demand on daytime-scheduled activities necessitating an earlier wake-up time. All three groups reported going to sleep an average of 1 to 2 hours after arriving home from both isolated and consecutive night shifts. Another possible explanation is that nurses are required to take a mandatory one-hour break during their shift, during which time many do nap. The efficacy of naps for reducing night-shift fatigue has been established in several studies.<sup>33-35</sup> We did not specifically query subjects regarding naps, because the residents and faculty in our ED have no opportunity to nap during their shift. Emergency physician naps may be possible in certain low-volume rural EDs, or in EDs with greater than one physician on night duty. However, physicians trading naps during a shift involves patient handoffs, which may decrease efficiency and increase risk of medical error. Another difficulty with physician napping during an ED shift is sleep inertia, in which a period of disorientation and reduced cognition occurs immediately after waking and may take several minutes to resolve.<sup>33</sup>

Night shift work and sleep deprivation can have effects on mental alertness similar to ethanol intoxication, and with similar effects on motor performance such as driving.<sup>36</sup> Residents reported the lowest rate of falling asleep while driving home and having an accident compared to nurses and faculty; faculty reported the highest rate of falling asleep while driving home. This may be explained by the significantly shorter pre-shift sleep reported by faculty for isolated night shifts, resulting in greater post-shift fatigue. This may also be an age-related phenomenon, as faculty were significantly older than the other groups.<sup>37</sup> The falling asleep

and accident rates from our study paralleled prior studies of night shift healthcare workers.<sup>38-42</sup> The risk of motor vehicle accidents represents a serious occupational hazard to night shift workers, as well as nearby pedestrians and drivers. Drivers involved in sleep-related accidents often do not remember falling asleep, but recall being sleepy prior to the accident and that their driving was potentially dangerous. Once the driver reaches the stage of fighting to stay awake, the only safe counter-measure is to stop driving and take a short nap.<sup>36</sup>

There was remarkable agreement between all three groups for statements regarding the emotional and physical health effects associated with night shift work (Table 3). However, faculty were significantly less likely to enjoy working night shifts than nurses and residents, and none of the nocturnist faculty indicated neutrality or enjoyment. Possible explanations for this are that faculty must take responsibility for the treatment and disposition of up to 50 ill or injured patients during each night shift with multiple decision points, interruptions, and suboptimal pre-shift sleep. Nurses may have chosen to work night shifts voluntarily, have less total number of patients to care for than faculty, and are able to take a 1-hour break. A 1997 survey of residents determined an unexpected preference for evening over morning work, which may also account for the observed difference in our study.<sup>43</sup> The only other significant observed difference for the perception statement section of our survey involved residents and faculty more strongly agreeing that night shift workers are more likely to depend on drugs and alcohol than did nurses. A small number of studies have noted a higher rate of alcohol use and smoking in night shift workers, but none specifically involving the specialty of emergency medicine.<sup>44-47</sup> Given the discipline required to prepare and work through a busy night shift, intense scrutiny, and constant stream of drug and alcohol-related patient care issues ED nurses and physicians encounter, it seems unlikely that a healthcare worker with serious addiction issues could succeed in such an environment.

All three groups strongly disagreed that night shifts did not alter their normal sleep cycle, and agreed career night shift workers age faster and have shorter life-spans. Animal studies have demonstrated an association of shorter life spans with circadian disruption, but human studies have not.<sup>48,49</sup> There was agreement in our study that career night shift workers are more susceptible to illness. The deleterious effects of night shift work on overall health are well-known.<sup>50-52</sup> The circadian system and melatonin enhance the immune system and have antioxidant and anti-inflammatory effects beneficial to endothelial function.<sup>50</sup> During normal night sleep, the sympathetic nervous system is at its nadir. During a busy night shift in the ED, the converse is true: Studies of emergency

physicians working at night have shown elevated heart rate, blood pressure, stress response, and prevalence of tachydysrhythmias.<sup>53-55</sup> The association of night shift work and increased risk of certain cancers has led to the International Agency for Research on Cancer to classify shift work that involves circadian disruption as a probable human carcinogen.<sup>56,57</sup> The three groups were neutral regarding increased prevalence of depression with night shift work, although a recent meta-analysis suggested night shift work is associated with increased risk of depression.<sup>58</sup> Several nurse studies have also noted this association.<sup>5,27,30</sup> In their survey of 819 emergency physicians, Smith-Coggins et al.<sup>1</sup> reported night shift work negatively influenced 58% of respondents, with 29% indicating associated dysphoria. In their study, night shift work was a major deciding factor for 56% of participants who decided to retire early from emergency medicine. Another study of emergency physicians from this research group also noted negative impact on mood from night shift work.<sup>6</sup> Finally, in a systematic review of well-being in residency by Raj,<sup>59</sup> sleep loss and fatigue had a major negative impact on residents' mood and personal lives.

There are limitations to this survey study. First, it was performed over a 1-month period and as such, represents a "snapshot" in time of the opinions, preferences, and perceptions of the participating nurses, residents, and faculty. It is a single center study, and results may not be applicable to ED staff of other regional medical centers. Although our response rate was good, there is a potential for nonresponse bias. The results of the survey may not be generalizable to other types of night shift workers, such as factory workers, truck drivers, pilots, or perhaps even non-ED hospital staff.

Faculty, residents, and nurses share many characteristics regarding preparation, recovery and perception of night shift effects on mental and physical health. Most differences involved faculty, who tended to not use pharmacologic sleep aids, not eat prior to their night shift, fall asleep at a higher rate while driving home, and enjoy night shift work less compared to residents and nurses. Night shift work in the ED is mentally and physically challenging, with increased risk of medical errors, vehicular accidents, and downstream adverse psychological and physical health effects. As ED visits continue to increase each year, especially older patients with myriad acute problems and complex medical histories, the importance of adequate sleep to prepare for the many challenges of caring for patients is paramount.

## SUPPLEMENTARY MATERIAL

Supplementary Material 1 is available from: <https://doi.org/10.15441/ceem.17.270>.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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## Supplementary Material 1. Night shift sleep survey: nurses

*"This is a voluntary survey and is anonymous. Thank you very much for participating!"*

If you no longer work nights, please complete the survey based on your past experiences

1. Do you have a pre-night shift routine?    YES    NO
2. What *physical* sleep aids do you use? (Circle all that apply)  
Blackout curtains    Earplugs    Background noise (fan, music, etc)    Special pillows (anatomic)    Humidifier    Other? \_\_\_\_\_
3. What is your preferred bedroom temperature? (Write in or circle)  
\_\_\_\_\_ °Fahrenheit or No Preference
4. What pharmacological sleep aid do you use consistently *before* a night shift? (Circle one, if none leave blank)  
Benadryl    Unisom    Dramamine    Valerian    Melatonin    Ambien    Restoril    Lunesta    Sonata    Belsorma    Alcohol  
Other \_\_\_\_\_
5. What pharmacological sleep aids have you tried? (Circle all that apply)  
Benadryl    Unisom    Dramamine    Valerian    Melatonin    Ambien    Restoril    Lunesta    Sonata    Belsorma    Alcohol  
Other \_\_\_\_\_
6. Do you eat *just before* going to sleep? (Circle one)  
No meal    Snack    Small meal    Regular meal
7. After you wake up do you regularly use any of the following before or during your shift? (if none leave blank)  
Coffee    Tea    Energy Drink    Caffeine (tablet)    Provigil  
Other \_\_\_\_\_
8. Despite these preparations, do you consistently experience fatigue during a night shift?    YES    NO
9. What average time during a night shift would you estimate your alertness to be at its lowest level?  
\_\_\_\_\_ O'clock



## Pre-Isolated Night Shift

10. Please estimate the minimum hours of sleep you need to be mentally and physically functional for a non-consecutive (*isolated*) night shift \_\_\_\_\_ hours
11. How much average sleep do you get before an *isolated* night shift? \_\_\_\_\_ hours or (Circle) Don't sleep (skip to 12)
  - 11A. If you sleep, what is your preferred time of day to go to bed? \_\_\_\_\_ O'clock
  - 11B. If you sleep, what is your preferred time to wake up? \_\_\_\_\_ O'clock



## Post-Isolated Night Shift

12. Please estimate the minimum hours of sleep you need to be functional the day after an *isolated* night shift \_\_\_\_\_ hours
13. On average, how many hours elapse before you go to sleep after arriving home? \_\_\_\_\_ hours or (Circle) I don't sleep (Skip to 14)
  - 13A. If you sleep, how many hours do you estimate you get after an *isolated* night shift? \_\_\_\_\_ hours



## Between Consecutive Night Shifts

14. Please estimate the minimum hours of sleep you need to be functional between consecutive night shifts \_\_\_\_\_ hours
15. How much average sleep do you estimate you get between consecutive night shifts? \_\_\_\_\_ hours
16. What is your preferred time of day to go to bed? \_\_\_\_\_ O'clock
17. What is your preferred time to wake up? \_\_\_\_\_ O'clock
18. On average, how many hours elapse before you go to sleep after arriving home? \_\_\_\_\_ hours



19. Have you ever fallen asleep while driving home? YES NO
20. Have you ever been in a post-night shift accident? YES NO

21. I enjoy working night shifts. (Please circle answer)

<input type="radio"/> Strongly disagree	<input type="radio"/> Disagree	<input type="radio"/> Neutral	<input type="radio"/> Agree	<input type="radio"/> Strongly agree
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22. Night shifts do not alter my normal sleep cycle.

<input type="radio"/> Strongly disagree	<input type="radio"/> Disagree	<input type="radio"/> Neutral	<input type="radio"/> Agree	<input type="radio"/> Strongly agree
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23. Career night shift workers have shorter life-spans than day shift workers.

<input type="radio"/> Strongly disagree	<input type="radio"/> Disagree	<input type="radio"/> Neutral	<input type="radio"/> Agree	<input type="radio"/> Strongly agree
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24. Career night shift workers are more susceptible to illness than day shift workers.

<input type="radio"/> Strongly disagree	<input type="radio"/> Disagree	<input type="radio"/> Neutral	<input type="radio"/> Agree	<input type="radio"/> Strongly agree
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25. Career night shift workers age faster than day shift workers.

<input type="radio"/> Strongly disagree	<input type="radio"/> Disagree	<input type="radio"/> Neutral	<input type="radio"/> Agree	<input type="radio"/> Strongly agree
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26. Career night shift workers experience higher overall levels of stress in their personal lives than day shift workers.

<input type="radio"/> Strongly disagree	<input type="radio"/> Disagree	<input type="radio"/> Neutral	<input type="radio"/> Agree	<input type="radio"/> Strongly agree
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27. Career night shift workers have a higher prevalence of depression than day shift workers.

<input type="radio"/> Strongly disagree	<input type="radio"/> Disagree	<input type="radio"/> Neutral	<input type="radio"/> Agree	<input type="radio"/> Strongly agree
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28. Career night shift workers are more likely to depend on drugs and alcohol than day shift workers.

<input type="radio"/> Strongly disagree	<input type="radio"/> Disagree	<input type="radio"/> Neutral	<input type="radio"/> Agree	<input type="radio"/> Strongly agree
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29. About you:

The majority of my shifts are nights YES NO

Years after RN school: \_\_\_\_\_

Years ED experience: \_\_\_\_\_

Gender: FEMALE MALE

Age: \_\_\_\_\_

"THANK YOU!"