Sleep Health 000 (2022) 1–9

Contents lists available at ScienceDirect

Sleep Health

Journal of the National Sleep Foundation

journal homepage: sleephealthjournal.org

Sleep hygiene in paramedics: What do they know, and what do they do?

Alexandra E. Shriane, BNurs, BHealthSci (Paramedic), BPsyc (Hons)[a,b*], Alex M.T. Russell, BSc (Psych), GradDipSci (Psych), PhD[a], Sally A. Ferguson, BSc (Hons), MA, PhD[a], Gabrielle Rigney, BPsych (Hons), PhD[a], Grace E. Vincent, BSci (Hons), PhD[a]

[a] Central Queensland University, School of Health, Medical and Applied Sciences, Rockhampton, Queensland, Australia
[b] Queensland Ambulance Service, Brisbane, Queensland, Australia

ARTICLE INFO

Article History:
Received 5 October 2022
Accepted 19 October 2022
Available online xxx

Keywords:
Sleep hygiene
Sleep habits
Shift work
Non-standard work hours

ABSTRACT

Objectives: Shift workers routinely obtain inadequate sleep, which has major health and well-being consequences. Sleep hygiene describes a range of behaviors, lifestyle and environmental factors that can support optimal sleep. To date, limited research has examined sleep hygiene in shift workers. This study aimed to 1) assess the knowledge and understanding of sleep hygiene amongst shift working paramedics, as well as the perceived impact on sleep, and 2) investigate paramedics engagement with sleep hygiene practices.
Study Design: Participants completed an online, cross-sectional survey.
Participants: Queensland Ambulance Service paramedics (n = 184) who work shift work.
Measures: The online survey included questions from the Standard Shiftwork Index and Sleep Hygiene Index.
Results: Most participants reported little or no understanding or knowledge of "sleep hygiene" as a concept. Participants reported that sleep scheduling and bedroom environment (temperature, light, and noise) were the most impactful on sleep. Few participants reported nicotine and alcohol consumption, or daytime napping, whereas caffeine consumption and mentally-stimulating bedtime activities were more common. Participants who were young, single, and worked all shift types (day, afternoon, and night) as part of their regular rosters, demonstrated less knowledge regarding sleep hygiene, and were more likely to be exhibiting poor sleep hygiene engagement.
Conclusions: Paramedics demonstrated a limited level of understanding of sleep hygiene as a concept, and varied knowledge about the impacts of individual sleep hygiene factors. Further, paramedics demonstrated varied engagement with individual sleep hygiene practices. Future research should focus on the development of sleep hygiene interventions to optimize sleep in paramedics.

Introduction

The incidence of shift work is increasing in developed nations and represents 16% of the workforce in Australia.[1] While shift work contributes to economic growth, shift work is also associated with a number of adverse health and well-being outcomes. Research shows that engaging in shift work, particularly over a prolonged time period, can increase the risk of developing a range of cancers, gastrointestinal disorders, metabolic issues, psychological conditions and hormonal imbalances.[2,3] Further, shift work is associated with increased rates of workplace accidents and lower job satisfaction amongst employees.[4]

A major factor thought to underpin the adverse health and safety outcomes associated with shift work is inadequate sleep. Based on the nature of their employment, shift workers are awake at non-standard hours (ie, outside of traditional waking hours 6am-8pm), and consequently, sleep at non-traditional times. As such, they are not able to maintain regular sleep schedules, contributing to circadian misalignment,[5] and therefore inadequate sleep. During rostered work periods, shift workers obtain 2-3 hours less sleep over a 24-hour period during their rostered period of work compared to non-shift workers.[6] For shift workers, sleep duration is frequently the shortest (eg, 2-5 hours) between night shifts, and significantly longer during rostered days off (>8 hours).[7]

A wide range of interventions have been developed to support individuals to optimize their sleep, including practicing what is referred to as "sleep hygiene." Sleep hygiene describes behaviors, lifestyle and environmental factors that positively contribute to sleep,

DOI of original article: http://dx.doi.org/10.1016/j.sleh.2020.04.001.
*Corresponding author: Alexandra Shriane, Central Queensland University, Appleton Institute, 44 Greenhill Road, Wayville, SA, 5034, Australia, Tel: +61-411-543-796.
E-mail address: alex.shriane@cqumail.com (A.E. Shriane).

https://doi.org/10.1016/j.sleh.2022.10.008
2352-7218/

Table 1
Sleep hygiene factors, implementation advice, and sleep impact

Sleep hygiene factor	Implementation advice	Impact on sleep
Sleep schedule[9,10]	Go to bed/get up at roughly the same time each day, aim for 7-9 h sleep per night	Regulates circadian system
Daytime naps[9,11]	Limit daytime naps to 20 min	Reduces sleep pressure which may decrease drive to sleep at bedtime
Bedtime activities[9,12]	Avoid mentally-stimulating activities (eg, watching television) in favor of relaxing ones (reading, meditating etc.)	Electronic devices can imitate sunlight and limits onset of sleep-inducing phase
Alcohol consumption[9,13]	Limit 4 h prior to sleep	May induce sleepiness, but reduces restorative sleep
Caffeine consumption[9,14]	Limit 6 h prior to sleep	Half-life of 6-8 h, affects ability to initiate and maintain sleep
Nicotine consumption[9,15]	Abstain entirely, or limit 6 hours prior to sleep	Impacts ability to initiate/maintain sleep, cravings may interrupt sleep
Bedroom environment[9,16]	Limit light and noise in bedroom environment, and reduce temperature (ideally 18°C)	Limits external factors which may interrupt sleep, cool environment triggers sleep-inducing phase
Diet[9,17]	Maintain balanced diet, avoid eating large meal immediately prior to bed	A full stomach induces post-prandial fatigue, but eating too close to retiring can cause gastrointestinal reflux
Exercise[9,18]	Engage in regular, strenuous exercise	Multiple physiological pathways may lead to improved sleep quality

Note: These recommendations are designed for non-shift working individuals, and have been generated based in sleep hygiene recommendations from Australasian Sleep Association[61] and Sleep Health Foundation.[62] Additional references have been provided to demonstrate specific empirical evidence for each recommendation.

and may also be referred to as "good sleep habits" or "healthy sleep practices."[8] The most common aspects of sleep hygiene are: maintenance of a regular sleep schedule, consumption of a balanced diet, engaging in regular exercise, avoidance of caffeine within 6-8 hours of sleep, limiting alcohol intake before bed, avoidance of nicotine, engaging in relaxing bedtime activities (eg, reading, meditating etc.), avoiding mentally-stimulating bedtime activities (eg, watching television, browsing the internet, playing computer games etc.), and ensuring an appropriate bedroom environment with limited light and noise, and adequate temperature regulation (Table 1).[9-18]

The consumption of alcohol, nicotine, and caffeine in a sleep hygiene context has been investigated in shift workers, and found to greatly differ across studies, likely as a result of variations in sociocultural factors or differing measurement tools.[19] Diet and exercise in shift working populations have been researched extensively in contexts other than sleep hygiene, such as investigating the eating habits of shift workers, or understanding the use of exercise in fatigue management.[20] Further, there is little information about the use of environmental alterations (eg, bedroom light, noise and temperature) amongst shift workers. While some research has investigated sleep hygiene in shift workers, studies have not addressed all the factors described in sleep hygiene recommendations.[21]

Given the unavoidable nature of sleep disruptions associated with shift work, engagement in sleep hygiene could greatly benefit shift working populations, and in turn, their overall health, well-being, job safety and satisfaction. Therefore, the aims of this study were to 1) investigate the level of understanding of sleep hygiene, and perceived impact on sleep, and 2) understand the ways in which shift workers engage in sleep hygiene practices. The population utilized were Australian paramedics working for Queensland Ambulance Service (QAS), who are required to engage in shift work as part of their employment. Shift workers employed within the healthcare sector may be the most likely to have an understanding of, and engage with, sleep hygiene practices, given their underlying health knowledge. It was hypothesized that paramedics would express a familiarity with, and sound understanding of, sleep hygiene as a concept, and the importance of sleep hygiene for sleep. Furthermore, it was hypothesized that paramedics would actively engage in sleep hygiene practices to support their sleep.

Methods

Participants

Shift working paramedics from the QAS were recruited to complete an online, cross-sectional survey via their work email address, between December 21, 2018 and January 18, 2019. A convenience sampling strategy was utilized, with inclusion criteria including: being currently employed by QAS, an Australian resident, and 18 years or older. This study was granted ethics approval by the Central Queensland University Human Research Ethics Committee (reference 2018-081) and QAS Research and Innovation Unit (reference 18/01427) prior to recruitment.

A sample size calculation was conducted to ensure there was at least 80% power ($\alpha = 0.05$) to detect a difference of Cohen's d = 0.272. The Cohen's d estimate was based on 2 previous studies that utilized the Sleep Hygiene Index (which was adapted for use in the current study).[22,23] The resulting sample size required was 168 participants.

Procedures

An email was sent to participants including a web link providing access to the survey and information sheet. Participants were informed that their involvement was voluntary and would not impact their employment with QAS. Further, participants were advised the survey would take 10-15 minutes, and they could exit at any time. Participants then provided informed consent in order to continue.

Measures

The survey was delivered via email using Survey Monkey (Sydney, Australia), and divided into 3 sections; demographic information and work patterns, sleep habits, and sleep hygiene. The survey questions were framed in the context of sleep at home between shifts or on rostered days off, and did not address any sleep that may occur at work. As previously mentioned, this paramedic sample worked within an urban area with a high call volume, and as such, very little, if any time, is available to sleep while at work.

Demographic information and work patterns

Questions regarding age, gender, marital status, and household occupants preceded questions based on those utilized in the Standard Shiftwork Index, a self-report measure addressing concepts associated with shift work, which has demonstrated adequate construct validity.[24] Information on work rosters and employment status (full-time, part-time, casual), engagement in overtime (extra) shifts, and the number of clear days off between rostered periods of work was also obtained. QAS paramedics work varying rosters based on station location, employment status etc., and were therefore asked to nominate which shifts (day, afternoon, night) they worked as part of their

Please cite this article as: A.E. Shriane et al., Sleep hygiene in paramedics: What do they know, and what do they do?, Sleep Health (2022), https://doi.org/10.1016/j.sleh.2022.10.008

regular roster. These are the only 3 shift types that are utilized in rosters amongst this group of QAS paramedics.

Sleep habits

This section contained questions based on the Pittsburgh Sleep Quality Index,[16] which were posed across each shift type and rostered days off, and aimed to measure sleep duration, sleep onset latency, and time spent in bed. A copy of the study questionnaire is attached in supplement material for reference. The Pittsburgh Sleep Quality Index is frequently used to measure a range of sleep characteristics in adults and has demonstrated test-retest reliability and item validity.[27] Questions in this section also addressed sleep behavior across particular shifts and rostered days off, including bed and wake up times, and the average amount of time taken to fall asleep (sleep onset latency). Outcome measures for this section included time spent in bed (hour) and time taken to fall asleep (minute), which were used to calculate total sleep duration for participants. This was followed by questions about general sleep health relating to the diagnosis of specific sleep-related disorders, perceived difficulty sleeping, and subjective rating of sleep quality.

Sleep hygiene

The final section contained questions about specific sleep hygiene practices, based on those from the Sleep Hygiene Index[9]: daytime naps, exercise, diet, caffeine intake, alcohol consumption, nicotine use, mentally-stimulating bedtime activities (eg, television, internet browsing etc.), relaxing bedtime activities (eg, meditating, reading etc.), noise and light and temperature of bedroom environment. The Sleep Hygiene Index informed researchers as to what sleep hygiene practices should be included within the questionnaire. However, given that the Sleep Hygiene Index is designed for individuals who sleep at traditional times, questions were adapted for applicability to this cohort of shift workers. For example, the second question of the Sleep Hygiene Index regarding regularity of bedtimes was not posed to participants, given their bedtimes may differ from day-to-day based on shift times (see full questionnaire in supplemental material). This measure has demonstrated both concurrent and incremental validity for use in adults.[28,29] Given that the paramedics involved in this study are shift workers, and that the Sleep Hygiene Index was not specifically designed for shift workers, certain aspects of the Sleep Hygiene Index were adapted to ensure usability in this study. In adapting the measure, 2 questions regarding sleep scheduling (ie, going to bed and waking at the same time each day) were removed, given the inability of paramedics to maintain sleep schedules.

Participants were first asked to rate how often they engaged in each specific sleep hygiene practice ("never," "rarely," "often," and "always") and were then asked how they felt these practices impacted sleep ("no impact," "moderate impact," "significant impact"). Finally, participants were asked about their knowledge of the term "sleep hygiene," specifically, whether they were familiar with the term and how they would rate their level of understanding on a 3-point scale ("no understanding," "have heard the term before but have no solid understanding" and "have heard the term before and have a solid understanding"). The ordering of questions in this section of the survey, (ie, sleep hygiene practice engagement prior to sleep hygiene knowledge), was intentional, aiming to establish accurate engagement with sleep hygiene practices, prior to asking questions regarding participants' knowledge of sleep hygiene.

Data analysis

The main variables of interest related to sleep hygiene. First, these variables were reduced via factor analysis (described below). Then, the resulting 3 sleep hygiene factors and sleep hygiene knowledge were treated as dependent variables, with demographics and work factors as independent variables, to determine who was most impacted by each factor, and who had more knowledge about sleep hygiene. Following this, the sleep hygiene and knowledge factors were used as independent variables in models, with sleep variables (eg, sleep onset latency, amount of sleep across shift type, overall sleep quality) as dependent variables, to determine the impact of sleep hygiene and knowledge factors. Shift types (day, afternoon, and night) were utilized as dependent variables throughout. Working night shift as part of a regular roster, and the number of different shift types (between 1 and 3) in a regular roster were also utilized as dependent variables to determine their relationship, if any, with sleep hygiene practice engagement and understanding.

Categorical variables were treated as factors and continuous variables were scaled prior to analysis; thus, the reported coefficients are standardized. All analyses were conducted in R (v 3.6.1), using the glm function (gaussian family for continuous dependent variables, binomial for sleep hygiene knowledge and sleep disorders), and summary tables were constructed using the stargazer package.

Results

A total of 184 participants gave informed consent and began the survey. Twelve participants exited the survey after completing demographic questions and were therefore excluded from analysis. The final sample consisted of 172 participants ($n = 86$ males, $n = 85$ females, $n = 1$ preferred not to report their gender; see Table 2 for further demographic information and work characteristics). One participant completed all bar the final 2 sections, assessing subjective

Table 2
Demographic and work characteristics of participants (n = 172)

	Frequency (%)
Gender	
Male	86 (50.0%)
Female	85 (49.4%)
Other	1 (0.6%)
Age	
21-30 years	76 (44.2%)
31-40 years	41 (23.8%)
41-50 years	33 (19.2%)
51-60 years	17 (9.9%)
60+ years	5 (2.9%)
Marital Status	
Single	46 (26.7%)
De facto	55 (32.0%)
Married	59 (34.3%)
Separated/divorced	11 (6.4%)
Widowed	1 (0.6%)
Employment status	
Full-time	159 (92.4%)
Part-time	11 (6.4%)
Casual	2 (1.2%)
Shifts included in roster*	
Day shift	171 (99.4%)
Afternoon shift	144 (83.7%)
Night shift	126 (73.3%)
Overtime shifts	
No overtime worked	63 (36.6%)
1 shift/month	47 (27.3%)
2-3 shifts/month	55 (32.0%)
>3 shifts/month	7 (4.1%)

* This data illustrates the percentage of the total participant group ($n = 172$) that work each shift as part of their regular roster. Most participants worked more than 1 shift type as part of their regular roster.

Please cite this article as: A.E. Shriane et al., Sleep hygiene in paramedics: What do they know, and what do they do?, Sleep Health (2022), https://doi.org/10.1016/j.sleh.2022.10.008

impact on sleep hygiene practices and familiarity with/understanding of the terminology. The survey was disseminated to 719 QAS paramedics, with the sample size ($n = 172$) representing a 23.9% response rate. Participant age ranged from 21 to 65 years (Mean ± *SD*, 35.7 ± 11.1 years). Age was positively skewed, with 40% participants between the ages of 21 and 30 years. This sample is broadly representative of paramedics in Australia, in terms of both age and gender distribution,[20,21] however may not be representative of paramedics internationally.

Most paramedics (62.6%) worked all 3 shift types (day, afternoon, and night shifts) as part of their regular rosters, with the remainder of paramedics working rosters including 2 of these shift types (28.7%), and a small proportion (8.8%) working just 1 shift type. Most paramedics (63.4%) also engaged in at least 1 extra (overtime) shift in addition to their rostered period of work. Participants had, on average, 3 ± 0.8 days off between rostered periods of work.

Factor analysis of sleep hygiene variables

Given that there were 12 sleep hygiene variables, a factor analysis was conducted to determine if these could be reduced, using maximum-likelihood extraction with a varimax rotation. Three factors had eigenvalues >1, indicating a potential 3-factor solution. Forcing a 2- or 4-factor solution did not improve weighting or interpretability of factors, and therefore the 3-factor solution was deemed the most appropriate.

The rotated factor matrix is presented in Table 3. Daytime napping did not load on any factor above 0.2, while the weights for television in bed (representing mentally-stimulating bedtime activities) and reading in bed (representing relaxing bedtime activities) were considered too low, with the latter also crossloading.

Thus, 3 factors emerged. The first factor consisted of noise, light and temperature (of bedroom environment), and this factor was named "Environment." The second factor consisted of sleep scheduling, exercise and diet, all of which are behavioral, so this factor was named "Behaviors." The third factor consisted of caffeine, alcohol, and nicotine (consumption), with this factor being named "Substances."

Sleep

Sleep characteristics are illustrated in Fig. 1. Sleep onset latency was longest on day shifts (32.3 ± 27.3 minutes) and afternoon shifts (32.9 ± 30.4 minutes), and shortest on night shifts (28.4 ± 23.1 minutes) and rostered days off (26.3 ± 21.2 minutes). Sleep duration was shortest on night shift (6.4 ± 2.2 hours), slightly longer on day shifts (7.0 ± 1.0 hours) and afternoon shifts (7.2 ± 1.7 hours) and longest on rostered days off (8.6 ± 1.3 hours).

Over half of participants (53.8%) reported "often" or "always" experiencing difficulty sleeping, while 36.8% reported "rarely" and 9.4% reported "never." However, almost half of participants (46.2%) reported "good" or "very good" sleep quality, while 26.3% reported "poor" or "very poor" sleep quality. Diagnosed sleep disorders were reported in 15.8% participants (11.1% snoring, 1.8% insomnia, 1.8% restless legs syndrome, and 1.2% sleep apnea).

Table 3
Rotated factor matrix for factor analysis of sleep hygiene variables

	Factor		
Sleep hygiene variable	1	2	3
Nap impact			
Sleep Sched. impact		**0.445**	
Exercise impact		**0.825**	
Diet impact		**0.721**	
Caffeine impact			**0.646**
Alcohol impact			**0.624**
Nicotine impact			**0.553**
Television in bed impact	0.275		
Read in bed impact		0.290	0.332
Noise impact	**0.822**		
Light impact	**0.890**	0.201	
Temperature impact	**0.729**		

Note: Bold values indicated best loadings on factors. Factor 1 = Behaviors (sleep scheduling, exercise, diet); Factor 2 = Substances (caffeine, alcohol, nicotine); Factor 3 = Environment (bedroom noise, light, temperature).

Sleep hygiene impact on sleep

Perceived impact of sleep hygiene factors on sleep are described in Table 4. Most participants reported their sleep being impacted by Environment factors (temperature 87.7%, noise 84.8%, light 83.6%). Behaviors were also reported as impacting sleep, with a large proportion of participants (80.7%) reporting "moderate" or "significant" impact from sleep scheduling, exercise (76.0%), and diet (73.1%). Substances were reported as less impactful, particularly nicotine (29.2%), compared to caffeine (70.2%) and alcohol (69.0%).

Sleep hygiene engagement

Participants reported varied engagement with each sleep hygiene practice. Daytime napping was "never" or "rarely" engaged in by over half of participants (58.2%). Regular, strenuous exercise was common, with most (68.0%) reporting "often" or "always" engaging in this sleep hygiene practice. Consuming a healthy diet was less common, with over half of participants (55.8%) reporting doing this "never" or "rarely." Caffeine consumption was common, with the majority of participants (77.9%) reporting consuming this substance "often" or "always." Over half of participants (58.1%) "never" or "rarely" consumed alcohol, and very few (7.5%) consumed nicotine "often" or "always." Bedtime activities were "often" or "always" mentally-stimulating for most participants (66.3%), with fewer (42.5%) engaging in relaxing bedtime activities with the same frequency. Bedroom environmental factors were managed by some participants, with temperature being controlled for "often" or "always" by over half of participants (59.9%), with noise control (36.1%) and light control (47.1%) being less common.

Sleep hygiene knowledge and understanding

Of the 171 participants, 55.0% reported "no knowledge or understanding" of sleep hygiene as a concept, with 29.2% reporting "familiarity but no solid understanding," and 15.8% reporting "familiarity and solid understanding."

Sleep hygiene associations

Standardized regression coefficients were used to determine the associations between each of the demographic and work variables (independent) and each of the sleep hygiene impact and knowledge variables (dependent; Table 5). Paramedics who were most likely to report that the Environment impacted sleep were younger, single (vs. married), worked all 3 shift types as part of their regular roster, and worked night shift as part of their regular roster. Younger and single (vs. married) participants were also more likely to be impacted by Impact of Behaviors (sleep scheduling, diet, exercise). Impact of Substances (caffeine, nicotine, alcohol) did not differentially affect participants based on demographics or work status. Younger participants were significantly more likely to report no knowledge or understanding of sleep hygiene. No other associations were statistically significant.

Please cite this article as: A.E. Shriane et al., Sleep hygiene in paramedics: What do they know, and what do they do?, Sleep Health (2022), https://doi.org/10.1016/j.sleh.2022.10.008

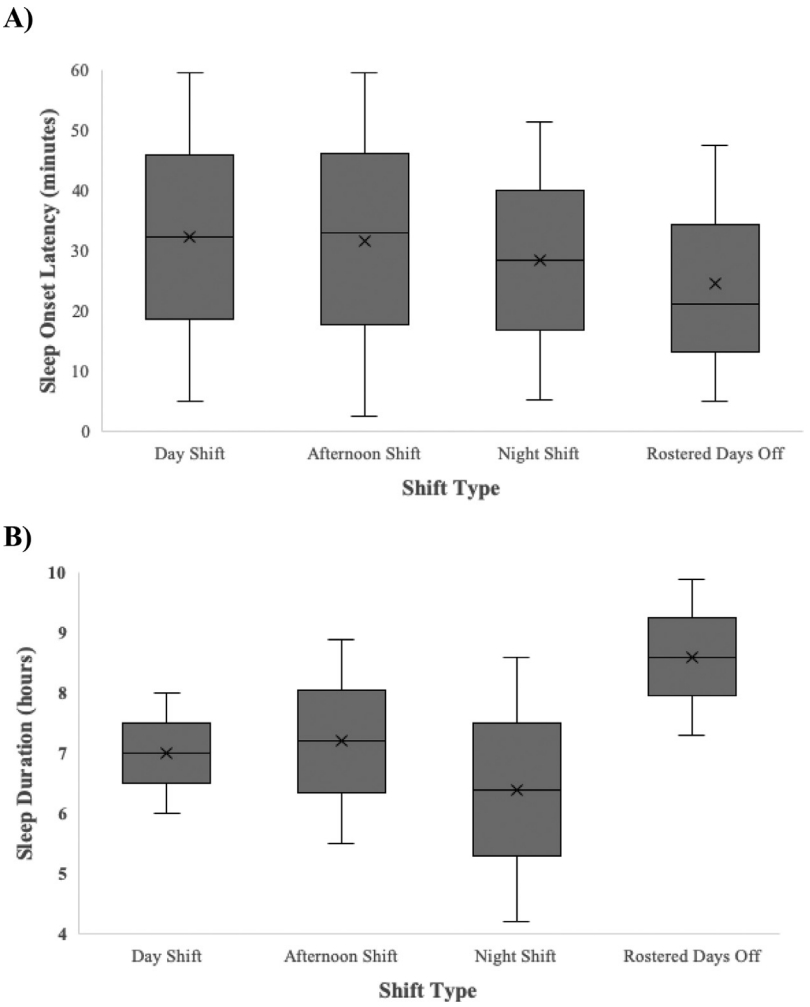

Fig. 1. Average length of A) sleep onset latency (minutes), and B) sleep duration (hours) across varying shifts.
Note: Error bars represent standard deviations.

Sleep hygiene knowledge was not associated with having diagnosed sleep disorders. Participants who reported Environment as more impactful on their sleep also reported longer sleep onset latency during rostered shifts and poorer sleep quality (Table 6). Those who reported greater impact from Behaviors reported longer sleep onset latency for afternoon and night shifts, but less difficulty sleeping. Finally, participants who reported greater impact from Substances did not report significant different sleep onset latency, sleep duration, sleep disorders, difficulty sleeping or sleep quality.

Table 4
Average perceived impact of sleep hygiene practices (n = 171)

	No Impact		Moderate		Significant		Chi-square
	n	%	n	%	n	%	$\chi^2(2)$
Daytime naps	85	**49.7**	71	41.5	15	8.8	48.1***
Sleep schedule	33	19.3	62	36.3	76	**44.4**	16.9***
Exercise	41	24.0	85	**49.7**	45	26.3	20.8***
Diet	46	26.9	76	**44.4**	49	28.7	9.6**
Caffeine	51	29.8	79	**46.2**	41	24.0	13.6***
Alcohol	53	31.0	73	**42.7**	45	26.3	7.3*
Nicotine	121	**70.8**	29	16.9	21	12.3	108.4***
TV in bed	48	28.1	90	**52.6**	33	19.3	95.6***
Read in bed	76	**44.4**	75	43.9	20	11.7	36.0***
Noise	26	15.2	71	41.5	74	**43.3**	25.4***
Light	28	16.4	66	38.6	77	**45.0**	23.2***
Temperature	21	12.3	56	32.7	94	**55.0**	46.8***

"TV in bed" represents mentally-stimulating bedtime activities (watching television, browsing the internet, playing computer games etc.) while "Read in bed" represents relaxing bedtime activities (reading, meditating etc.).
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 5
Average engagement with sleep hygiene practices (n =172)

	Never		Rarely		Often		Always		Chi-square
	n	%	n	%	n	%	n	%	$\chi^2(2)$
Daytime naps	23	13.4	77	**44.8**	63	36.6	9	5.2	73.37*
Exercise	2	1.2	53	30.8	89	**51.7**	28	16.3	95.86*
Diet	28	16.3	68	**39.5**	63	36.6	13	7.6	50.00*
Caffeine	17	9.9	21	12.2	66	38.4	68	**39.5**	53.81*
Alcohol	13	7.5	87	**50.6**	65	37.8	7	4.1	107.35*
Nicotine	147	**85.5**	12	7.0	5	2.9	8	4.6	335.95*
TV in bed	25	14.5	33	19.2	83	**48.3**	31	18.0	50.42*
Read in bed	40	23.2	59	34.3	67	**39.0**	6	3.5	51.40*
Noise	14	8.1	96	**55.8**	43	25.0	19	11.1	98.28*
Light	16	9.3	75	**43.6**	55	32.0	26	15.1	50.84*
Temperature	16	9.3	53	30.8	69	**40.1**	34	19.8	36.88*

"TV in bed" represents mentally-stimulating bedtime activities (watching television, browsing the internet, playing computer games etc.) while "Read in bed" represents relaxing bedtime activities (reading, meditating etc.).
* $p < .001$.

Please cite this article as: A.E. Shriane et al., Sleep hygiene in paramedics: What do they know, and what do they do?, Sleep Health (2022), https://doi.org/10.1016/j.sleh.2022.10.008

Table 6
Associations between demographics and work characteristics and impact of sleep hygiene factors and knowledge

Independent variables	Dependent variables			
	Environment	Behaviors	Substances	Sleep hygiene knowledge[1]
Demographics				
Gender[2]	0.092	-0.076	-0.170	0.138
	(0.154)	(0.154)	(0.154)	(0.309)
Age	**-0.170***	**-0.250*****	-0.142	**-0.403***
	(0.076)	**(0.075)**	(0.076)	**(0.165)**
Marital status[3]				
De facto	-0.055	0.170	-0.117	-0.148
	(0.196)	(0.192)	(0.200)	(0.402)
Married	**-0.574****	**-0.558****	-0.247	-0.307
	(0.192)	**(0.188)**	(0.196)	(0.395)
Divorced[4]	-0.368	-0.376	-0.593	-0.693
	(0.316)	(0.310)	(0.323)	(0.680)
Work Characteristics				
Full-time[5]	-0.144	-0.075	-0.068	-0.215
	(0.300)	(0.300)	(0.300)	(0.599)
Day shift in regular roster[6]	-0.003	-0.023	-0.215	0.502
	(0.584)	(0.584)	(0.584)	(1.235)
Afternoon shift in regular roster[6]	0.165	0.244	0.031	0.594
	(0.201)	(0.201)	(0.202)	(0.422)
Night shift in regular roster[6]	**0.399***	0.191	0.057	-0.393
	(0.170)	(0.172)	(0.173)	(0.346)
No. different shift types	**0.157***	0.112	0.019	0.021
	(0.076)	(0.076)	(0.077)	(0.154)
Overtime shifts[6]	-0.096	0.024	0.145	0.184
	(0.158)	(0.158)	(0.158)	(0.319)
No. shifts between rostered days off	0.046	-0.074	-0.059	0.076
	(0.078)	(0.078)	(0.078)	(0.157)

Note:
* $p < .05$
** $p < .01$
*** $p < .001$.
[1] (ref = none)
[2] (ref = male)
[3] (ref = single)
[4] (including separated, widowed)
[5] (vs. casual or part-time)
[6] (ref = no).

Discussion

This study hypothesized that 1) paramedics would express a familiarity with, and sound understanding of, sleep hygiene as a concept, and the importance of sleep hygiene for sleep, and 2) that paramedics would be actively engaging in sleep hygiene practices to support their sleep. Overall, most paramedics demonstrated a limited familiarity with, and understanding of "sleep hygiene" as a concept. Paramedics reported that sleep scheduling and bedroom environment were sleep hygiene practices with the greatest impact on sleep, with nicotine consumption reported as having the least impact. Paramedics demonstrated variable engagement with sleep hygiene

Table 7
Associations between sleep characteristics, impact of sleep hygiene factors on sleep, and knowledge about sleep hygiene

Independent variables	Dependent variables									
	Day shift (n = 169)		Afternoon shift (n = 144)		Night shift (n = 126)		Rostered days off (n = 171)		General (n = 171)	
	SOL	Sleep duration	SOL	Sleep duration	SOL	Sleep duration	SOL	Sleep duration	Difficulty sleeping	Sleep quality
Sleep hygiene knowledge	0.071	-0.027	-0.031	0.050	-0.115	-0.188	0.026	-0.122	-0.064	0.008
	(0.155)	(0.155)	(0.167)	(0.168)	(0.177)	(0.180)	(0.154)	(0.154)	(0.154)	(0.154)
Environment	**0.222****	-0.111	**0.193***	0.049	**0.213***	-0.064	**0.118***	0.188	**-0.305*****	**-0.160***
	(0.075)	(0.077)	**(0.084)**	(0.085)	**(0.093)**	(0.096)	**(0.076)**	(0.076)	**(0.073)**	**(0.076)**
Behavior	0.010	-0.065	**0.185***	0.044	**0.260****	-0.128	-0.036	0.109	**-0.193***	-0.053
	(0.078)	(0.078)	**(0.087)**	(0.088)	**(0.085)**	(0.089)	(0.077)	(0.076)	**(0.075)**	(0.077)
Substances	0.024	0.037	-0.014	0.062	-0.019	-0.060	-0.039	0.087	-0.070	-0.005
	(0.077)	(0.077)	(0.085)	(0.085)	(0.088)	(0.091)	(0.077)	(0.077)	(0.077)	(0.077)

SOL, sleep onset latency.
* $p < .05$.
** $p < .01$.
*** $p < .01$.

practices; limiting daytime napping, limiting alcohol and nicotine consumption, and engaging in regular exercise, were the most common sleep hygiene practices. Consuming a healthy diet, limiting caffeine consumption, engaging in relaxing bedtime activities, and controlling bedroom environment were engaged in less frequently.

Paramedics participating in this study obtained an average of 6.4 hours sleep between night shifts, close to 7 hours between day and afternoon shifts, and well over 8 hours on rostered days off. This finding is consistent with previous research, which has demonstrated that shift workers routinely obtain inadequate sleep during rostered periods of work (ie, less than the 7-9 hours recommended).[6,7] However, almost half of participants (46.2%) reported their sleep quality as "good" or "very good." This apparent misalignment between suboptimal sleep duration and good self-rated sleep quality may be attributed to participants feeling that the sleep they do get, despite being short in duration, is of good quality. It is worth noting, however, that over half of participants (53.8%) reported "often" or "always" experiencing difficulty sleeping.

Most participants (84.2%) reported limited, if any, understanding of "sleep hygiene" as a concept. This was contrary to expectations, given the underlying health knowledge possessed by paramedics. This may be explained by participants lacking familiarity with the term "sleep hygiene," but they may have some familiarity with individual aspects of sleep hygiene recommendations (eg, avoidance of caffeine prior to sleep). As such, recommendations have been made from experts within the sleep field suggesting that the terminology used to describe these practices be altered to something more self-explanatory, such as "healthy sleep practices."[32] In the current study, younger participants were less likely to have any knowledge or understanding of sleep hygiene. There are a number of potential explanations for this finding. First, previous research has shown that younger adults often experience a subconscious "invincibility" that can contribute to decreased engagement with health-related topics.[33] Second, young adults are usually free from chronic disease and experience their day-to-day life with minimal limitations from health problems, leading to a decreased prioritization of health-improving lifestyle behaviors, including engaging in sleep hygiene.[34,35] Third, younger adults can be more tolerant to the fatiguing effects of shift work, [25,26] and therefore may not consider it to be as significant an issue. As such, the incentive for young adults to self-educate in regards to health and well-being topics may be limited.

Specific sleep hygiene practices were reported to impact participants' sleep to varying degrees. Sleep scheduling was reported to be one of the sleep hygiene practices having the most impact on sleep, with 80.7% participants reporting that sleep scheduling had a "moderate" or "significant" impact on their sleep. This is not surprising, given the requirement for participants to engage in shift work. Most participants (92.5%) were employed on a full-time basis (ie, 76 hours per fortnight) and worked a combination of day (98.3%), afternoon (82.7%), and night shifts (72.3%). These work requirements therefore make the maintenance of a consistent sleep schedule (ie, going to bed and waking at the same time each day) very difficult.

Participants also reported that Environment factors (bedroom temperature, light, noise) significantly impacted sleep. This may be explained by the requirement for participants to sleep during the daytime (ie, following a night shift) when it is hotter, lighter, and noisier. Indeed, participants in the current study were from a regional subtropical climate where average temperatures ranged from 19.8°C to 29.4°C, with high humidity, during the data collection period (December to January).[36] As previously reported, most participants found Environment factors to impact their sleep to a "moderate" or "significant" degree, with bedroom temperature being the most problematic (87.7%), compared to bedroom light (83.6%), and bedroom noise (84.8%). As such, bedroom temperature was controlled for "often" or "always" by over half of participants (59.9%). However, while other Environment factors (light and noise) were reported to impact sleep to a similar degree, they were not controlled for as commonly (47.1% and 36.1% respectively). This may demonstrate an opportunity for education amongst paramedics regarding simple but effective measures available to control for light and noise (eg, ear plugs, eye masks).

Substances referenced in sleep hygiene recommendations (caffeine, nicotine, alcohol) were reported by participants to have a variable impact on sleep. Caffeine was the most impactful on sleep (46.2% reported a "moderate" impact on sleep), while nicotine was the least impactful (70.8% reported "no impact" on sleep). This may be attributed to the low rate of smoking in the sample (14.5%), and thus, a limited understanding of ways in which smoking behavior impacts sleep. Similarly, alcohol consumption was infrequent amongst paramedics (58.1% "never" or "rarely" consumed alcohol). This is consistent with previous research showing that alcohol consumption is linked with sociocultural factors rather than shift work specifically.[37,38] Contrary to the low rates of nicotine and alcohol consumption, caffeine consumption was common (77.9% "often" or "always" consumed caffeine). This is consistent with previous research demonstrating that shift workers consume caffeine at higher rates than their non-shift working peers.[39] As a central nervous system stimulant, caffeine can temporarily improve cognitive function, mood, and energy levels, and is often utilized by shift workers to combat the fatiguing effects of their work schedules.[40] As such, caffeine can be intentionally utilized as a fatigue-management tool. Consequently, it may be appropriate to determine sleep hygiene guidelines specific to shift workers, to allow for the appropriate incorporation of such practices. Given that all sleep hygiene practices included in this study have the ability to significantly impact sleep, the results of the current study demonstrate that the knowledge and understanding of paramedics related to sleep hygiene is not in line with current best-practices recommendations.

The current study showed that only 15% of participants had a familiarity with, and solid understanding of, sleep hygiene as a concept. This may be best explained by a limited education on the topic. While paramedics are required to have a broad knowledge base on a wide range of health-related topics,[30] sleep, and consequently sleep hygiene, may not be one of them. Further, in their daily pre-hospital management of injury and illness, few cases, if any, would be directly sleep-related.[41] However, while paramedics may not receive sleep-specific education during their tertiary studies, it is common for organizations that employ individuals working non-standard hours to offer fatigue risk management training (FRMT).[31] The provision of FRMT has been shown to improve employee safety (and patient safety in healthcare settings), decrease subjective levels of fatigue and workplace accidents.[42,43] Research has demonstrated that FRMT is most effective when it addresses certain factors, including: napping for fatigue management, nutrition, light exposure, roster scheduling (in relation to chronotype), and lifestyle adaptation training.[44] However, organizations will often develop their own FRMT resources, and may not incorporate all relevant aspects, or may focus only on some fatigue-related topics.[45] This is the case amongst this sample, where FRMT is developed and delivered by Queensland Ambulance Service in the form of a mandatory, self-guided training package. However, given the findings of this research, FRMT in this cohort may not be effective, or may not be focusing on all aspects of sleep hygiene. As such, it is recommended that the current FRMT be updated to address sleep hygiene components that lack understanding amongst this cohort (napping, caffeine intake, bedroom environment), with consideration given to altering delivery method or frequency.

Similar to the perceived impact of sleep hygiene practices on sleep, actual engagement with sleep hygiene practices varied in this sample. Paramedics demonstrated appropriate use of certain sleep hygiene practices (nicotine and alcohol consumption, daytime

Please cite this article as: A.E. Shriane et al., Sleep hygiene in paramedics: What do they know, and what do they do?, Sleep Health (2022), https://doi.org/10.1016/j.sleh.2022.10.008

napping, exercise), and poor engagement in others (diet, bedtime activities, bedroom environment). Paramedics reported engaging in both relaxing and mentally-stimulating bedtime activities, however, mentally-stimulating activities (eg, watching television, browsing the internet, playing computer games) were more prevalent (66.3%). This aligns with almost half of participants (44.4%) reporting that they believed relaxing bedtime activities had "no impact" on sleep. This is concerning given that the use of electronic devices in bed can significantly contribute to difficulties initiating and maintaining sleep.[46,47] Furthermore, this may explain, in part, why over half of the study sample reported "often" or "always" experiencing difficulty falling asleep.

The varied engagement that paramedics have demonstrated across sleep hygiene practices may stem from their lack of understanding of, and knowledge about, sleep hygiene. To date, no research has investigated how much paramedics know about sleep hygiene, and the ways in which they engage with the full cohort of practices. However, studies across general population groups have demonstrated that knowledge of, and consequent engagement with, sleep hygiene is varied.[48,49] This is despite the fact that sleep hygiene has been recommended as a simple, cost-effective solution to improve sleep, even in individuals who may not consider themselves to be poor sleepers.[50] Further to this, the varied sleep hygiene engagement demonstrated in paramedics may be influenced by occupational culture. In workplaces where employees are required to work long or non-traditional hours, individuals who prioritize their well-being, particularly their sleep, may be viewed as unsuitable for the job, or could potentially remove themselves from the occupation if it misaligns with their lifestyle.[51,52]

It is important to note that, while paramedic knowledge of and engagement with sleep hygiene practices could be improved, the current recommendations are not designed for shift work cohorts. As such, some of the sleep hygiene recommendations available may be ineffectual at improving paramedic sleep, or in some cases, detrimental to their sleep and fatigue levels. The most obvious such cases are daytime napping and caffeine intake. Currently, sleep hygiene recommendations advise avoidance of daytime naps, or restriction to 20 minutes in length, and the avoidance of caffeinated beverages in the 6 hours preceding sleep.[9,11,14] However, both daytime napping and caffeine consumption are actively encouraged by sleep and shift work researchers as safe and effective fatigue management strategies.[53–55] This demonstrates the requirement for the review of sleep hygiene recommendations in a shift working context, and the adaptation of advice so that it can be safely and appropriately applied to this population.

There are some limitations of the study that should be acknowledged when interpreting these results. First, the paramedics that participated in this survey were recruited from the Metro South Local Ambulance Service Network of QAS ($n = 719$), which comprises 18% of all QAS staff ($n = 3996$).[56] This is the largest Local Ambulance Service Network within Queensland, in terms of population and call volume, spanning an urban geographical location. As such, most participants work and reside in busy and densely-populated areas.[57] Therefore, their understanding of, and engagement with, sleep hygiene practices may differ from paramedics working in regional or rural locations. However, the sample group was otherwise broadly representative of paramedics across Australia, based on mean age (35.7 years) and even gender distribution (49% female).[51,56] Second, this study utilized self-report measures of sleep behavior and sleep hygiene. This carries the inherent risk of unintentionally inaccurate reporting by participants, who may under- or over-estimate their sleep quality, quantity, and engagement with sleep hygiene factors.[58] Sleep hygiene data, while still self-report in nature, may have been more accurately measured if collected longitudinally, for example, as a "sleep hygiene diary" and/or utilizing objective measures of sleep (eg, wrist actigraphy). Utilizing such measures in future research would provide greater detail and a more thorough understanding of sleep practices in paramedics.

This research, undertaken amongst shift working paramedics, demonstrates a lack of knowledge regarding sleep hygiene as a concept, and consequently, varied engagement with sleep hygiene practices in this group. As such, paramedics may not be benefiting from the sleep optimization that can occur as a result of implementing good sleep hygiene practices. Sleep hygiene educational tools should be employed to 1) address the lack of understanding regarding sleep hygiene, 2) provide advice on how to incorporate recommendations within a shift working lifestyle, and 3) contribute to a positive discourse surrounding sleep prioritization. This could be achieved by implementing electronic- and mobile-health sleep hygiene interventions, which have been previously shown to be effective in other populations.[59,60] In settings where further resources and greater time is available, the development of individualized sleep hygiene plans, whereby habits and lifestyles factors are assessed and tailored advice given may be effective. In such circumstances, further research is required to address the individual factors that contribute to inadequate sleep and shift work-associated fatigue in this cohort (eg, call volume, shift duration etc.). In relation to paramedics, these results suggest that sleep hygiene practices surrounding bedtime activities, bedroom environment, and consumption of a healthy diet should be addressed as a priority.

Disclosures

Alexandra E. Shriane, Alex M. T. Russell, Sally A. Ferguson, Gabrielle Rigney, and Grace E. Vincent declare no conflicts of interest in relation to this manuscript.

Acknowledgments

The authors wish to acknowledge the Queensland Ambulance Service paramedics who participated in this study, sacrificing their time to better our understanding of their sleep hygiene.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.sleh.2022.10.008.

References

1. Australian Bureau of Statistics. *Australian Labour Market Statistics: Shift Workers*. 2019. Available at: http://www.abs.gov.au/ausstats/abs@.nsf/featurearticlesbyCatalogue/5461A9DAE97FF759CA2578C300153388?OpenDocument. Accessed date January 2020.
2. Knutsson A. Health disorders of shift workers. *Occup Med*. 2003;53:103–108.
3. Haus E, Smolensky M. Biological clocks and shift work: circadian dysregulation and potential long-term effects. *Cancer Causes Control*. 2006;17:489–500.
4. Wagstaff AS, Lie JS. Shift and night work and long working hours – a systematic review of safety implications. *Scand J Work Environ Heal*. 2011;37(3):173–185.
5. Baron KG, Reid KJ. Circadian misalignment and health. *Int Rev Psychia*. 2014;26(3):139–154.
6. Akerstedt T. Shift work and disturbed sleep/wakefulness. *Occup Med*. 2003;53(2):89–94.
7. Knauth R, Landau K, Droge C, Schwitteck M, Widynski M, Rutenfranz J. Duration of sleep depending on the type of shift work. *Int Arch Occup Environ Heal*. 1980;46(2):167–177.
8. Stepanski EJ, Wyatt JK. Use of sleep hygiene in the treatment of insomnia. *Sleep Med Rev*. 2003;7(3):215–225.
9. Mastin DF, Bryson JB, Corwyn R. Assessment of sleep hygiene using the Sleep Hygiene Index. *J Behav Med*. 2006;29(3):223–227.
10. Manber R, Bootzin RR, Acebo C, Carskadon MA. The effects of regularising sleep-wake schedules on daytime sleepiness. *Sleep*. 1996;19(5):432–441.
11. Milner CE, Cote KA. Benefits of napping in healthy adults: impact of nap length, time of day, age, and experience with napping. *J Sleep Res*. 2009;18(2):272–281.
12. Means MK, Lichstein KL, Epperson MT, Johnson CT. Relaxation therapy for insomnia: nighttime and daytime effects. *Behav Res Therap*. 2000;38(7):665–678.

13. Feige B, Gann H, Brueck R, et al. Effects of alcohol on polysomnographically recorded sleep in healthy subjects. *Alcoholism*. 2006;30(9):1527–1537.
14. Drake C, Roehers T, Shambroom J, Roth T. Caffeine effects on sleep taken at 0, 3, or 6 hours before going to bed. *J Clin Sleep Med*. 2013;9(11):1195–1200.
15. McNamara JP, Wang J, Holiday DB, et al. Sleep disturbances associated with cigarette smoking. *Psychol Health Med*. 2014;19(4):410–419.
16. Kim M, Chun C, Han J. A study on bedroom environment and sleep quality in Korea. *Indoor Built Environ*. 2010;19(1):123–128.
17. Peuhkuri K, Sihvola N, Korpela R. Diet promotes sleep duration and quality. *Nutr Res*. 2012;32(5):309–319.
18. Youngstedt S. Effects of exercise on sleep. *Clin Sports Med*. 2005;24:355–365.
19. Trinkoff AM, Storr CL. Work schedule characteristics and substance use in nurses. *Am J Indus Med*. 1998;34(3):266–271.
20. Persson M, Martensson J. Situations influencing habits in diet and exercise among nurses working night shift. *J Nurs Manag*. 2006;14(5):414–423.
21. Greenwood KM, Rich WJ, James JE. Sleep hygiene practices and sleep duration in rotating-shift shiftworkers. *Work Stress*. 1995;9(2):262–271.
22. Gipson C, Chilton J, Dickerson Z, Alfred D, Haas B. Effects of a sleep hygiene text message intervention on sleep in college students. *J Am Coll Health*. 2018;67(1):32–41.
23. Hershner S, O'Brien L. The impact of a randomised sleep education intervention for college students. *J Clin Sleep Med*. 2018;14(3):337–347.
24. Barton J, Spelten E, Totterdell P, Smith L, Folkard S, Costa G. The Standard Shiftwork Index: a battery of questionnaires for assessing shiftwork-related problems. *Work Stress*. 1995;9(1):4–30.
25. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psych Rev*. 1989;28(2):193–213.
26. Hays RD, Martin SA, Sesti AM, Spritzer KL. Psychometric properties of the Medical Outcomes Study Sleep measure. *Sleep Med*. 2005;6(1):41–44.
27. Carpenter JS, Andrykowski MA. Psychometric evaluation of the Pittsburgh sleep quality index. *J Psychosom Res*. 1998;45(1):5–13.
28. Cho S, Kim GS, Lee JH. Psychometric evaluation of the sleep hygiene index: a sample of patients with chronic pain. *Health Qual Life Outcom*. 2013:(213):11.
29. Paramedics Australasian. *Paramedics in the 2011 Census*. Available at: https://www.paramedics.org/content/2012/11/Paramedics-in-the-2011-census-final.pdf. Accessed date January 2020.
30. Australian Industry and Skill Committee. *Ambulance and Paramedics*. Available at: https://nationalindustryinsights.asic.net.au/industries/health/ambulance-and-paramedic. Accessed date January 2020.
31. Blunden SL, Chapman J, Rigney GA. Are sleep education programs successful? The case for improved and consistent research efforts. *Sleep Med Rev*. 2012;16:355–370.
32. Sansom-Daly UM, Lin M, Robertson EG, et al. Health literacy in adolescents and young adults: an updated review. *J Adol Young Adult Oncol*. 2016;5(2):106–118.
33. Hargreaves DS, Sizmur S, Viner RM. Do young and older adults have different health care priorities? Evidence from a national survey of English patients. *J Adol Health*. 2012;51(5):528–532.
34. Reilly T, Waterhouse J, Atkinson G. Aging, rhythms of physical performance, and adjustment to changes in the sleep-activity cycle. *J Occup Environ Med*. 1997;54(11):769.
35. Focht BC, Knapp DJ, Gavin TP, Raedeke TD, Hickner RC. Affective and self-efficacy responses to acute aerobic exercise in sedentary older and younger adults. *J Aging Physic Activ*. 2007;15(2):123–138.
36. Australian Government Bureau of Meteorology. *Climate statistics for Australian locations: Brisbane regional office*. 2019. Available at: http://www.bom.gov.au/climate/averages/tables/cw_040214.shtml. Accessed date January 2020.
37. Head J, Stansfeld SA, Siegrist J. The psychosocial work environment and alcohol dependence: a prospective study. *Occup Environ Med*. 2004;61:219–224.
38. Buchvold HV, Pallesen S, Oyane NM, Bjorvatn B. Associations between night work and BMI, alcohol, smoking, caffeine and exercise – a cross-sectional study. *BMC Pub Health*. 2015:(1112):15.
39. Ker K, Edwards PJ, Felix LM, Blackhall K, Roberts I. Caffeine for the prevention of injuries and errors in shift workers. *Cochrane Syst Rev*. 2010:5.
40. Smits M, Francissen O, Weerts M, Janssen K, Van Grunsven P, Giesen P. Emergency ambulance call-outs often provide primary care. *Dutch J Med*. 2014:158.
41. Lerman SE, Eskin E, Flower D, et al. Fatigue risk management in the workplace. *J Occup Environ Med*. 2012;54(2):231–258.
42. Barger LK, Runyon MS, Renn ML, et al. Effect of fatigue management on safety, fatigue, and sleep in emergency medical services personnel and other shift workers: a systematic review and meta-analysis. *Prehosp Emerg Care*. 2018;22(1):58–68.
43. James L, Samuels CH, Vincent F. Evaluating the effectiveness of fatigue management training to improve police sleep health and wellness. *J Occup Environ Med*. 2018;60(1):77–82.
44. Richter K, Acker J, Adam S, Niklewski G. Prevention of fatigue and insomnia in shift workers – a review of non-pharmacological measures. *EPMA*. 2016;7(1):16.
45. Fournier PS, Montreuil S, Brun JP. Fatigue management by truck drivers in real life situations: some suggestions to improve training. *Work*. 2007;29(3):213–224.
46. Fossum IN, Nordnes LT, Storemark SS, Bjorvatn B, Pallesen S. The association between use of electronic media in bed before going to sleep and insomnia symptoms, daytime sleepiness, morningness, and chronotype. *Behav Sleep Med*. 2014;12(5):343–357.
47. Lacks P, Rotert M. Knowledge and practice of sleep hygiene techniques in insomniacs and good sleepers. *Behav Res Ther*. 1986;24(3):365–368.
48. Brown FC, Buboltz WC, Soper B. Relationship of sleep hygiene awareness, sleep hygiene practices, and sleep quality in university students. *J Behav Med*. 2002;28(1):33–38.
49. Gellis LA, Lichstein KL. Sleep hygiene practices of good and poor sleepers in the United States: an internet-based study. *Behav Ther*. 2009;40(1):1–9.
50. Chatzitheochari A, Arber A. Lack of sleep, work and the long hours culture: evidence from the UK Time Use survey. *Work Employ Soc*. 2009;23(1):30–48.
51. Paramedicine Board of Australia. 2019. *Registrant data*. Available at: https://paramedicineboard.gov.au/News/Statistics.aspx. Accessed date January 2020.
52. Martin JE, Sinclair RR, Lelchook AM, Wittmer JL, Charles KE. Non-standard work schedules and retention in the entry-level workforce. *J Occup Organ Psych*. 2011;85(1):1–22.
53. Barger LK, Lokley SW, Rajaratnam SM, Landrgan CP. Neurobehavioural, health, and safety conseuqnces associated with shift work in safety-sensitive professions. *Curr Neurol Neurosci Rep*. 2009;9:155–164.
54. Smith MR, Eastman CI. Shift work: health, performance and safety problems, traditional countermeasures, and innovative management strategies to reduce circadian misalignment. *Nat Sci Sleep*. 2012;4:111–132.
55. Sadeghniiat-Haghighi K, Yazdi Z. Fatigue management in the workplace. *Ind Psychiatry*. 2015;24(1):12–17.
56. Department of Health. 2019. *Annual report 2017-2018*. Available at: https://www.health.gov.au/_data/assets/pdf_file_0031-728374/doh-annual-report-2017-2018.pdf. Accessed date January 2020.
57. Queensland Ambulance Service. 2018. *Local ambulance service networks*. Available at: https://www.ambulance.qld.gov.au/LASN.html. Accessed date January 2020.
58. Krystal AD, Edinger JD. Measuring sleep quality. *Sleep Med*. 2008;9(1):10–17.
59. Luik AI, Kyle SD, Espie CA. Digital cognitive behavioural therapy (dCBT) for insomnia: a state-of-the-science review. *Curr Sleep Med Rep*. 2017;3(2):48–56.
60. Ritterband LM, Thorndike FP, Gonder-Frederick LA, et al. Efficacy of an internet-based behavioural intervention for adults with insomnia. *Arch Gen Psychiatry*. 2009;66(7):692–698.
61. Australasian Sleep Association. *Tips & facts about sleep*. 2019. Available at: https://sleep.org.au/Public/Resource-Centre/F-C-Info/Tips-and-Facts-about-sleep.aspx. Accessed date January 2020.
62. Sleep Health Foundation. *Good sleep habits*. 2011. Available at: https://www.sleephealthfoundation.org.au/pdfs/Good-Sleep-Habits.pdf. Accessed date January 2020.

Please cite this article as: A.E. Shriane et al., Sleep hygiene in paramedics: What do they know, and what do they do?, Sleep Health (2022), https://doi.org/10.1016/j.sleh.2022.10.008