Journal of Multidisciplinary Healthcare

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ORIGINAL RESEARCH

The Effect of Shift Work on Sleep Patterns of Paramedics in Saudi Arabia

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Purpose: Shift work poses significant sleep health challenges for paramedics, affecting their ability to respond effectively in emergencies. This study aimed to evaluate the impact of shift work on sleep parameters among paramedics in Saudi Arabia, identifying key factors influencing insomnia.

Patients and Methods: A cross-sectional, online survey was conducted, gathering data on sociodemographic characteristics, work-related factors, sleep duration, and insomnia among paramedics in Saudi Arabia. The Athens Insomnia Scale was used to define insomnia. The association between shift work and sleep parameters was examined. Predictors of insomnia were identified through logistic regression models by inspecting the adjusted odds ratio (aOR).

Results: 1076 Saudi paramedics were included, most of whom were 26–35 years old, males, married, had a Bachelor's degree, worked in hospital-based settings for private agencies in rural areas, and had 6–10 years of experience. Occupational stress was reported by 52.96% of paramedics. All shift work characteristics (working hours, number of shifts, work schedule, and off-work days) were significantly associated with insomnia (p=0.0001). The multivariate regression revealed that work setting (aOR=18.71, p=0.02), coffee consumption (aOR=36.83, p=0.01), work schedule (aOR=21.93, p=0.01), and time to bed (aOR=0.01, p=0.01), sleep duration (aOR=0.03, p=0.03), and occupation stress (aOR=9.31, p=0.001) were predictors for insomnia.

Conclusion: Our findings underscores the need for targeted interventions to mitigate the adverse effects of shift work on sleep health among paramedics.

Keywords: insomnia, sleep duration, paramedicine, predictors

Introduction

Shift work, characterized by irregular and unconventional working hours, presents significant challenges to healthcare professionals worldwide. Among these professionals, paramedics stand out due to the critical and demanding nature of their work.[1] The nature of paramedics' duties requires them to be alert and responsive at all hours, often leading to irregular and extended working hours.[2] This irregularity can disrupt their circadian rhythms, leading to various physiological and psychological burdens. The demanding nature of shift work among paramedics not only challenges their physical health but also places a significant strain on their mental well-being.[3] These challenges are compounded by the high-stress situations they frequently encounter, making the understanding of shift work's impact on their health a vital area of study.

Insomnia, characterized by difficulty in initiating and maintaining sleep, is a common complaint among shift workers, including paramedics.[4] In Saudi Arabia, where the healthcare system is rapidly evolving, the prevalence of insomnia among paramedics has not been extensively studied. This gap highlights the need for targeted research to understand the magnitude and characteristics of insomnia in this specific demographic, considering cultural, environmental, and occupational factors unique to the region.

Received: 8 January 2024
Accepted: 22 April 2024
Published: 12 June 2024

Shift work significantly impacts sleep duration and quality among paramedics. The erratic nature of their schedules—comprising night shifts, long working hours, and rotating rosters—can lead to a reduction in sleep duration and a deterioration in sleep quality.[5] This disruption in sleep patterns is closely associated with the development of insomnia. Understanding the relationship between shift work parameters and sleep among paramedics is crucial for developing strategies to mitigate these adverse effects.

While there is a growing body of literature on the impact of shift work on health professionals, there remains a notable gap regarding paramedics, especially in the context of Saudi Arabia.[6] This research aims to bridge this gap by focusing on the specific sleep-related challenges faced by Saudi Arabian paramedics, while highlighting the predictors of insomnia. This study hypothesizes that (1) worsened sleep parameters (defined as insomnia and reduced sleep duration) are prevalent among paramedics, (2) shift work parameters are significantly associated with insomnia, and (3) paramedics' characteristics are significant predictors of insomnia.

Materials and Methods

Study Setting and Population

This cross-sectional study was designed as an online, survey-based research aimed at investigating the impact of shift work on sleep parameters among paramedics in Saudi Arabia. The study protocol was approved by the Ethics Committee of King Abdullah International Medical Center (KAIMC). The research targeted all Saudi Arabian paramedics, inviting them to participate through a widely distributed online survey. All participants were informed about the purpose of the study and were mandated to sign a consent before completing the survey in an attempt to ensure a high participation rate. This study complies with the Declaration of Helsinki.

Inclusion and Exclusion Criteria

All paramedics living in Saudi Arabia were invited to participate in this research between March 23 and October 23, 2023. The invitation was done through online platforms. No restrictions were made regarding age, gender, years of experience, or work location. Meanwhile, non-paramedics or those who did not consent to participate were not included.

Data Collection Tool

Through a convenience sampling approach, paramedics all over Saudi Arabia were invited to participate and fill out the online survey through social media networks (ie, LinkedIn, Facebook, Instagram, and X). As the study of paramedics in Saudi Arabia is provided in English only, the study questionnaire was primarily written in English through Google Docs, and it was composed of four domains. The first part covered the baseline sociodemographic characteristics of paramedics, including age, gender, marital status, educational level, and coffee consumption (number of cups/day). The second part covered work-related data, such as work setting (hospital-based or station-based), place of work (government or private agency), geographical area (rural or urban), years of experience, working hours, number of total shifts, day shifts, and night shifts per month, and the number of non-working days, referred to as off-work days. The third part was related to sleep parameters, namely time to bed (during work and off-work days), sleep duration (during work and off-work days), and self-reported diagnosis of occupational stress. The final part included the Athens Insomnia Scale (AIS), which is a validated questionnaire aimed to diagnose insomnia.[7] The AIS scale contains eight questions, each of which is given a score of 0 to 3. The overall score can range from 0 to 24, with a score of 6 or more indicating the presence of insomnia.[8] Permission was gained from the original authors of the AIS scale to be used in this research.[8,9]

Questionnaire Validation

The questionnaire underwent content validation by two expert psychiatrists who agreed to the structure of the questionnaire. Then, a pilot study was carried out on 20 paramedics to test the clarity, relevance, and comprehensiveness of the survey questions. Feedback from this pilot was used to refine the questionnaire. Additionally, the AIS tool is a previously validated measure to define insomnia.

Outcome Measures

The primary outcome of this study was to determine the prevalence of sleep problems among Saudi paramedics, namely insomnia and sleep disturbance (sleep duration during work and off-work days). Secondary outcomes included: (1) determining the association between shift work patterns of paramedics with sleep parameters (duration and quality – insomnia) and (2) identifying potential predictors or risk factors of insomnia among paramedics.

Sample Size Calculation

Based on the findings of the recent meta-analytic study of Huang et al,[10] 100,080 paramedics were examined across 1119 studies, of which 28% were defined as having insomnia. The sample size was calculated based on the expected prevalence of insomnia among paramedics, with a confidence level of 95% and a margin of error of 5%. The minimum sample size was 328 participants. The calculation was done using Epi Info software,[11] and it considered the total number of paramedics in Saudi Arabia, ensuring statistical significance and representativeness of the results.

Data Analysis

All statistical tests were performed using STATA Software (Version 18). First, descriptive statistics were provided for all analyzed variables in the form of mean (standard deviation – SD) for continuous data and as numbers (percentages) for categorical variables. The normality of distribution was examined using the Shapiro–Wilk test. Second, the association between shift work parameters and sleep duration was tested using the Chi-Square test. Then, a univariate logistic regression analysis was performed to determine significant predictors of insomnia. The selection of the reference group was based on normative data. Variables exhibiting a potentially significant association (defined as P-value <0.25) were included in the multivariable logistic regression model. Data were reported as crude (for the univariate regression model) and adjusted (for the multivariable model) odds ratio (OR) along with its corresponding 95% confidence interval (CI). The multicollinearity amongst examined covariates (predictors) was investigated using the Variance Inflation Factor (VIF). Variables exhibiting a VIF score >10 were omitted from the analysis to maintain an adequate model fit. A p-value of <0.05 was deemed statistically significant.

Results

Baseline Sociodemographic Characteristics

A total of 1076 Saudi paramedics complete responses were analyzed (Table 1). Most respondents were male (776, 72.12%), married paramedics (725, 67.37%), who had 26–35 years of age (562, 52.23%). Most paramedics held a Bachelor's degree (1068, 99.25%). The majority of surveyed paramedics worked at hospital-based emergency medical services (600, 55.77%) for private agencies (602, 55.95%) in rural areas (580, 53.91%). In terms of professional experience, most paramedics had 6–10 years of expertise (469, 43.58%), with the majority of them working <24 hours per week (570, 52.97%). Most paramedics consumed 1–3 cups of coffee per day (767, 71.28%).

Shift Work Patterns

The details of the shift work patterns of included paramedics are provided in Table 2. Most paramedics worked 11–15 shifts per month (764, 71%), while only a minority worked <7 shifts (2.6%) or >15 shifts per month (0.75%). In the same context, most of them had 4–8 night shifts (578, 53.71%) and day shifts (476, 44.23%) per month. In terms of the work schedule, most paramedics worked 8-hour day shifts (570, 52.97%) followed by rotating (day, evening, and night) 12-hour shifts (464, 43.12%). Additionally, the majority of respondents had one day off work per week (320, 29.73%). Occupational stress was reported by 508 respondents, accounting for almost half of the surveyed paramedic population (47.22%).

Sleep Parameters

The characteristics of the sleep duration of paramedics are summarized in Supplementary Table 1. In summary, the time interval from bed to sleep ranged from 1 to >5 hours. During workdays, most paramedics reported spending one to five hours to fall asleep (time to bed before sleep) (537, 49.72%). However, during off-workdays, most of them reported

Table 1 The Baseline Sociodemographic Characteristics of Surveyed Paramedics

Variable	Category	Number	%
Age			
	18 to 25 years	41	3.8
	26 to 35 years	562	52.23
	36 to 45 years old	467	43.24
	46 to 55 years old	3	0.28
	More than 55 years	3	0.28
Gender			
	Male	776	72.12
	Female	300	27.88
Marital Status			
	Single	350	32.52
	Married	725	67.37
	Others	1	0.09
Educational Level			
	Diploma	2	0.19
	Bachelor	1068	99.25
	Master	6	0.57
	Ph.D. degree	0	0
Work Setting			
	Hospital-based EMS	600	55.77
	Station-based EMS	476	44.23
Place of Work			
	Government agency	474	44.05
	Private agency	602	55.95
Geographical Area of Work			
	Urban	496	46.09
	Rural	580	53.91
Caffeine (cups per day)			
	1 to 3 per day	767	71.28
	4 to 6 per day	302	28.06
	7–9 per day	6	0.57
	More than 9 per day	1	0.09

(*Continued*)

Table 1 (Continued).

Variable	Category	Number	%
Working Hours			
	Less than 24 hours per week	570	52.97
	24–48 hours per week	485	45.07
	48–72 hours per week	17	1.59
	More than 72 hours per week	4	0.37
Years of Experience			
	Less than 1 year	313	29.09
	1–5 years	287	26.67
	6–10 years	469	43.58
	11–15 years	4	0.37
	More than 15 years	3	0.28

Table 2 The Patterns of Shift Work, Work Schedule, and Occupation Stress Among Paramedics

Variable	Category	Number	%
Number of Shifts Per Month			
	Less than 7	28	2.60
	7–10 shifts	276	25.65
	11–15 shifts	764	71.00
	More than 15 shifts	8	0.75
Number of Night Shifts Per Month			
	Less than 4	13	1.2
	4–8 shifts	578	53.71
	9–12 shifts	477	44.33
	More than 12 shifts	8	0.74
Number of Day Shifts Per Month			
	Less than 4	271	25.18
	4–8 shifts	476	44.23
	9–12 shifts	319	29.64
	More than 12 shifts	10	0.95

(*Continued*)

Table 2 (Continued).

Variable	Category	Number	%
Work Schedule			
	Day shift 8 hours	570	52.97
	Evening and Night shift 8 hours	20	1.86
	Rotating shifts 8 hours (combination of day, evening, and night shifts)	11	1.03
	Day shift 12 hours	7	0.65
	Night shift 12 hours	4	0.37
	Rotating shifts 12 hours (combination of day, evening, and night shifts)	464	43.12
Off-Workdays Per Week			
	One day	320	29.73
	Two days	216	20.07
	Three days	267	24.81
	Four days	266	24.72
	Five days	7	0.65
Occupational Stress			
	No	568	52.78
	Yes	508	47.22

spending just one hour to fall asleep (533, 49.35%). The duration of sleep, during workdays, was reported by most respondents to range from 8–12 hours (584, 54.07%). That being said, 475 paramedics (43.98%) had insufficient sleep of 4–8 hours. The number of patients having sufficient sleep (8–12 hours) increased during off-workdays, reaching as high as 1042 respondents (96.48%).

A detailed description of paramedics' responses using the AIS is provided in Supplementary Table 2. In summary, the AIS score ranged from 0 to 19 with a mean score of 8.65 (SD=5.23). The number of paramedics being defined as having insomnia based on the cutoff point of 6 was 513, accounting for 47.67% of the studied population.

The Association Between Shift Work and Insomnia

The association between the rate of insomnia and the shift work patterns of paramedics is provided in Table 3. The number of working hours was significantly associated with insomnia ($p = 0.001$); the lower the number of working hours, the reduced likelihood of insomnia. For instance, the rate of insomnia among paramedics working <24 hours/week was very minimal (1.92%) compared to that observed among paramedics working 24–48 hours/week (99.38%), 48–72 hours/week (88.23%), and >72 hours/week (100%).

Similarly, the number of shifts per month was significantly associated with insomnia ($p = 0.001$). The rate of insomnia was remarkably high in paramedics working 11–15 (464, 60.81%) or >15 shifts/month (7, 87.5%). Importantly, we noted that even paramedics working <7 shifts/month had a greater likelihood of insomnia (25, 89.29%). The same observation was noted for the number of night shifts per month where those working <4 (12, 92.31%), 9–12 (475, 99.58%), and >12

Table 3 The Association Between Insomnia and Shift Work Patterns Among Saudi Paramedics

Variable	Insomnia		Total	P
	No	Yes		
Working Hours				
Less than 24 hours per week	562 (98.08)	11 (1.92)	573 (100)	0.0001
24–48 hours per week	3 (0.62)	483 (99.38)	486 (100)	
48–72 hours per week	2 (11.76)	15 (88.23)	17 (100)	
Number of Shifts Per Month				
Less than 7	3 (10.71)	25 (89.29)	28 (100)	0.0001
7–10 shifts	262 (94.93)	14 (5.07)	276 (100)	
11–15 shifts	300 (39.19)	464 (60.81)	764 (100)	
More than 15 shifts	1 (12.5)	7 (87.5)	8 (100)	
Number of Night Shifts Per Month				
Less than 4	1 (7.69)	12 (92.31)	13 (100)	0.0001
4–8 shifts	560 (96.74)	18 (3.26)	578 (100)	
9–12 shifts	2 (0.42)	475 (99.58)	477 (100)	
More than 12 shifts	1 (12.5)	7 (87.5)	8 (100)	
Number of Day Shifts Per Month				
Less than 4	261 (96.66)	10 (3.33)	271 (100)	0.0001
4–8 shifts	5 (1.04)	471 (98.96)	476 (100)	
9–12 shifts	300 (94.04)	19 (5.96)	319 (100)	
More than 12 shifts	1 (10)	9 (90)	10 (100)	
Work Schedule				
Day shift 8 hours	560 (98.26)	10 (1.74)	570 (100)	0.0001
Evening and Night shift 8 hours	2 (10)	18 (90)	20 (100)	
Rotating shifts 8 hours (combination of day, evening, and night shifts)	1 (9.1)	10 (90.9)	11 (100)	
Day shift 12 hours	0 (0)	7 (100)	7 (100)	
Night shift 12 hours	0 (0)	4 (100)	4 (100)	
Rotating shifts 12 hours (combination of day, evening, and night shifts)	0 (0)	464 (100)	464 (100)	
Off-Workdays Per Week				
One day	301 (94.72)	17 (5.28)	318 (100)	0.001
Two days	1 (0.5)	217 (99.5)	218 (100)	
Three days	1 (0.37)	266 (99.63)	267 (100)	
Four days	260 (97.74)	6 (2.26)	266 (100)	
Five days	0 (0)	7 (100)	7 (100)	

Notes: Data are presented as numbers (percentages). P: P-value.

shifts/month (7, 87.5%) had a significantly greater likelihood of insomnia. On the other hand, in terms of day shifts, the likelihood of insomnia was significantly higher among paramedics working 4–8 (471, 98.96%) and >12 (9, 90%) day shifts/month, respectively (p = 0.001) (Table 3).

In terms of work schedule, there was a significant association between it and insomnia (p = 0.001). In summary, paramedics working 8-hour day shifts had the lowest rate of insomnia (10, 1.74%), while those working 12-hour day (7, 100%), night (4, 100%), or rotating shifts (422, 90.94%) had the highest rate of insomnia. That being said, this should be carefully interpreted as the number of paramedics working 12-hour day and night shifts was too small (Table 3).

The number of off-work days was significantly associated with insomnia among paramedics (p = 0.001). Paramedics having one day (17, 5.28%), four days (6, 2.26%), and five days (0, 0%) off-work had the lowest likelihood of insomnia. Meanwhile, those having two days (217, 99.5%) and three days (266, 99.63%) off-work had the highest likelihood of insomnia (Table 3).

Risk Factors of Insomnia (Univariate and Multivariate Regression)

In the univariate logistic regression model, paramedics' age, gender, marital status, work setting, place of work, geographical region, coffee consumption, working hours, years of experience, the number of shifts (total, night, or day shifts) per month, work schedule, off-work days, time to bed (during workdays and off-workdays), sleep duration (during workdays and off-workdays), and occupational stress were significant predictors of paramedics' insomnia (Table 4).

However, after accounting for the confounding effect in the multivariable logistic regression model, the significant risk factors of paramedics' insomnia were work setting, coffee consumption, work schedule, workday time to bed, off-workday

Table 4 The Univariable and Multivariable Logistic Regression Analysis of Insomnia Risk Factors

Variable	Univariate Model				Multivariable Model			
	Coefficient	P	95% CI		aOR	P	95% CI	
Age	Reference group: 18–25 years							
26–35 years	−9.16	0.001	−10.35	−7.97	–	–	–	–
36–45 years	(omitted)	–	–	–	–	–	–	–
46–55 years	(omitted)	–	–	–	–	–	–	–
> 55 years	(omitted)	–	–	–	–	–	–	–
Gender	Reference group: Male							
Female	−5.67	0.001	−7.07	−4.27	–	–	–	–
Marital Status	Reference group: Single							
Married	2.50	0.001	2.15	2.85	–	–	–	–
Others	(omitted)	–	–	–	–	–	–	–
Education	Reference group: Diploma							
Bachelor	1.72	0.12	−0.43	3.87	–	–	–	–
Master	(omitted)	–	–	–	–	–	–	–
Ph.D.	(omitted)	–	–	–	–	–	–	–
Work Setting	Reference group: Hospital-based EMS							
Station-based EMS	8.95	0.001	6.96	10.94	18.71	0.02	2.70	129.77

(*Continued*)

Table 4 (Continued).

Variable	Univariate Model				Multivariable Model			
	Coefficient	P	95% CI		aOR	P	95% CI	
Place of Work	Reference group: Government agency							
Private agency	−8.20	0.001	−9.63	−6.77	–	–	–	–
Region	Reference group: Urban							
Rural	−7.69	0.001	−8.61	−6.78	–	–	–	–
Coffee Consumption	Reference group: 1–3 cups/day							
4–6 per day	5.27	0.001	4.27	6.27	36.83	0.01	2.35	57.75
7–9 per day	(omitted)	–	–	–	–	–	–	–
> 9 per day	(omitted)	–	–	–	–	–	–	–
Working Hours	Reference group: < 24 hours							
24–48 hours/week	8.02	0.001	6.82	9.21	–	–	–	–
48–72 hours/week	2.14	0.01	0.66	3.62	0.97	0.99	0.04	21.43
> 72 hours/week	(omitted)	–	–	–	–	–	–	–
Experience Years	Reference group: 18–25 years							
1–5 years	−2.85	0.001	−3.28	−2.41	–	–	–	–
6–10 years	(omitted)	–	–	–	–	–	–	–
11–15 years	(omitted)	–	–	–	–	–	–	–
> 15 years	(omitted)	–	–	–	–	–	–	–
Shifts per Month	Reference group: < 7 shifts							
7–10 shifts	−3.42	0.001	−3.98	−2.87	0.28	0.38	0.02	4.82
11–15 shifts	2.19	0.001	1.85	2.54	–	–	–	–
> 15 shifts	2.06	0.06	−0.04	4.16	–	–	–	–
Night Shifts per Month	Reference group: < 4 shifts							
4–8 shifts	−8.21	0.001	−9.29	−7.12	–	–	–	–
9–12 shifts	8.17	0.001	6.74	9.60	–	–	–	–
> 12 shifts	2.06	0.06	−0.04	4.16	–	–	–	–
Day Shifts per Month	Reference group: < 4 shifts							
4–8 shifts	7.25	0.001	6.31	8.19	–	–	–	–
9–12 shifts	−3.37	0.001	−3.86	−2.89	–	–	–	–
> 12 shifts	2.31	0.03	0.24	4.38	–	–	–	–
Work Schedule	Reference group: 8-hour day shift							
8-hour evening/night shifts	2.33	0.001	0.86	3.80	21.93	0.01	5.15	93.33
8-hour rotating shifts	2.42	0.02	0.36	4.48	23.93	0.001	8.39	68.28

(*Continued*)

Table 4 (Continued).

Variable	Univariate Model				Multivariable Model			
	Coefficient	P	95% CI		aOR	P	95% CI	
12-hour day shift	(omitted)	–	–	–	–	–	–	–
12-hour night shift	(omitted)	–	–	–	–	–	–	–
12-hour rotating shift	(omitted)	–	–	–	–	–	–	–
Off-Work Days	Reference group: 1 day							
2 days	6.03	0.001	4.06	8.00	0.46	0.65	0.02	13.84
3 days	6.41	0.001	4.44	8.38	–	–	–	–
4 days	−4.27	0.001	−5.09	−3.45	–	–	–	–
5 days	(omitted)	–	–	–	–	–	–	–
Workday Time to Bed	Reference group: 1 hour							
1–5 hours	0.33	0.01	0.09	0.57	–	–	–	–
> 5 hours	1.03	0.08	−0.14	2.19	0.01	0.01	0.00	0.25
Off-Workdays Time to Bed	Reference group: 1 hour							
1–5 hours	−0.35	0.01	−0.59	−0.11	–	–	–	–
> 5 hours	1.59	0.01	0.33	2.85	2.90	0.43	0.21	39.91
Workday Sleep Duration	Reference group: < 4 hours							
4–8 hours	8.11	0.001	6.69	9.54	–	–	–	–
8–12 hours	−7.60	0.001	−8.50	−6.69	–	–	–	–
> 12 hours	(omitted)	–	–	–	–	–	–	–
Off-Workdays Sleep Duration	Reference group: < 4 hours							
4–8 hours	1.50	0.02	0.23	2.78	0.03	0.09	0.00	1.76
8–12 hours	−2.04	0.001	−2.99	−1.10	0.03	0.03	0.01	0.72
> 12 hours	(omitted)	–	–	–	–	–	–	–
Occupational Stress	Reference group: Absent							
Present	8.97	0.001	7.79	10.16	9.31	0.001	5.60	15.53

Notes: - indicates that the variable was excluded from the model due to multicollinearity (defined as VIF score > 10).
Abbreviations: aOR, adjusted odds ratio; CI, confidence interval; P, p-value.

sleep duration, and occupational stress (Table 4). For example, paramedics working in station-based EMS had a nearly 19-fold increase in the risk of insomnia compared to those working in hospital-based settings (aOR = 18.71, p = 0.02). Compared to those drinking 1–3 cups, paramedics drinking 4–6 cups/day had approximately a 37-fold increase in the risk of insomnia (aOR = 36.83, p = 0.01). In terms of work schedule, compared to those working 8-hour day shifts, those working 8-hour night/evening shifts (aOR = 21.93, p = 0.01) or rotating shifts (aOR = 23.93, p = 0.001) were at higher risk of insomnia by approximately 22 and 24 folds, respectively. Paramedics who have >5 hours of time to bed during workdays had a slight increase in the risk of insomnia (aOR = 0.01, p = 0.01) compared to those having 1 hour of time to bed before sleep. Those who spend 8–12 hours of sleep had a slightly higher risk of insomnia compared to those who sleep for less

than 4 hours (aOR = 0.03, p =0.03). Finally, occupational stress was associated with a 9-fold increase in the risk of insomnia among paramedics (aOR = 9.31, p = 0.001).

Discussion

This study, conducted among Saudi Arabian paramedics, revealed insightful findings regarding the impact of shift work on sleep duration, quality, and the prevalence of insomnia. The results indicated a significant association between the number of working hours, shift patterns, and the likelihood of insomnia among paramedics. In particular, the reduced number of working hours aligned with a significant reduction in the likelihood of insomnia. The same applies to the number of day shifts, night shifts, and shifts per month. In addition, the nature of the work schedule was significantly correlated with insomnia. Our findings align with findings from international contexts, such as those observed in Australian paramedics.[12] Notably, the rate of insomnia was substantially higher among paramedics with longer working hours and more frequent night shifts, mirroring global trends in paramedic work environments.[13–15] Based on these observations of the Australian and Saudi populations,[6] it is evident that geographical and cultural differences may influence the extent to which shift work impacts sleep parameters. This aspect underlines the importance of context-specific studies, as work environments and cultural factors can significantly modulate the effects of shift work. Furthermore, in our study, we noted that the lower the number of off-work days, the greater the likelihood of insomnia. However, paramedics having four off-work days have a negligent risk of insomnia, accounting for 2.26% (6/266) of paramedics.

The univariable and multivariable logistic regression models in your study revealed significant predictors and risk factors for insomnia among paramedics. Particularly, the work setting (18-fold increase), coffee consumption (36-fold increase), work schedule (21-fold increase), and occupational stress (9-fold increase) were associated with a significantly higher risk of insomnia. On the other hand, the time to bed during workdays and sleep duration during off-work days were associated with a reduced risk of insomnia. The work setting can significantly impact insomnia. In hospital-based settings, paramedics might have more structured shifts and access to facilities that mitigate stress. Conversely, station-based paramedics often deal with more unpredictable schedules and may lack adequate rest facilities, contributing to disrupted sleep patterns and heightened stress levels.[16,17] Additionally, caffeine is a stimulant that can disrupt sleep patterns.[18] High consumption, especially later in the day, can prolong sleep latency, reduce total sleep time, and affect sleep quality.[19] Most paramedics (72.5%), particularly in Saudi Arabia, regularly consume more caffeine to cope with irregular shifts, inadvertently exacerbating insomnia.[20] Moreover, shift work, especially night and rotating shifts, disrupts the body's natural circadian rhythms, leading to poor sleep quality and duration.[21] This misalignment between the body's internal clock and work schedule can increase the risk of insomnia. In addition, high levels of occupational stress can trigger or exacerbate insomnia. Stressful work environments, such as those faced by paramedics, can lead to heightened arousal and anxiety, making it difficult to initiate or maintain sleep.[22] This relationship between stress and sleep disturbances is well-documented.[23]

The predictors and risk factors identified in our study, when juxtaposed with global findings, highlight both universal and region-specific challenges faced by paramedics. This comparison underscores the necessity of tailored interventions and policies that address these unique factors to improve paramedic well-being.

All of the aforementioned findings highlight the necessity to combat the increased burden of impaired sleep among paramedics. Improving paramedics' sleep health necessitates a multifaceted strategy, focusing on enhancing rest facilities and structuring shifts to reduce stress, alongside educating them about the effects of caffeine consumption and advocating for its reduction before bedtime. Additionally, the implementation of stress management programs like mindfulness-based stress reduction (MBSR)[24] and cognitive-behavioral therapy for insomnia (CBT-I),[25] combined with sleep hygiene training that emphasizes regular sleep routines and optimized sleep environments, has been shown to effectively decrease stress and combat insomnia. These evidence-based interventions collectively address the unique challenges of shift work, demonstrating significant potential to improve sleep quality among paramedics.

Despite the comprehensive approach of this research, several limitations must be acknowledged. First, the study predominantly focused on paramedics in Saudi Arabia, which may limit the generalizability of the findings to paramedics in different geographical or cultural settings. Second, the cross-sectional nature of the study restricts the ability to infer

causal relationships between shift work and sleep parameters. Third, the use of self-reported measures for sleep parameters (such as time to bed) and occupational stress may introduce bias, as these are subjective and can be influenced by individual perceptions. Fourth, while efforts were made to control for various factors, there may still be unaccounted confounders that could influence the relationship between shift work and sleep parameters. This is highlighted by the wide confidence interval observed in some of the reported risk factors. Other potential confounders that could affect insomnia, which might not have been analyzed in your research, include mental health status (ie, depression, anxiety),[26] lifestyle factors (ie, diet, physical activity levels, substance use),[27] personal stressors (ie, financial stress, family responsibility, personal relationships),[28] medical conditions (ie, chronic illnesses, pain),[29] and environmental factors (ie, noise levels, light exposure during sleep, and room temperature).[30] All of these factors have been reported to significantly influence sleep quality and are often correlated with insomnia. Addressing these limitations in future research will be crucial for deepening our understanding of the impact of shift work on the sleep health of paramedics.

Conclusion

Our study adds to the growing body of evidence on the adverse effects of shift work on sleep health among paramedics. It underscores the need for targeted strategies to mitigate these effects, considering the specific work settings, lifestyle factors, and regional differences. Future research should focus on intervention strategies and policies to improve the sleep health and overall well-being of paramedics.

Disclosure

The authors report no conflicts of interest in this work.

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