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Research article

The effect of cumulative night shift duties on insomnia, fatigue, and mental health in intensive care unit

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ABSTRACT

Background: Night shift duties are crucial in the ICU to ensure care continuity, where critically ill patients require round-the-clock care. However, cumulative night shift duties may disturb circadian rhythm, insomnia, fatigue, and depression, and require further elucidation.
Objectives: This study aims to examine the negative consequences of various night shift patterns on insomnia, fatigue, and mental health of ICU Workers.
Methods: A cross-sectional study examined how cumulative night shift duty affects insomnia, fatigue, and mental health in critical care providers (CCPs).
Results: A total of 1006 participants completed this study between June 2022 and March 2023, including 54.5 % males. About 35 % were between 20 and 30 years of age, and Respiratory Therapists accounted for approximately 46.5 % of the entire sample. Most of our respondents (476; 47 %) reported working night shifts, with a monthly range of 8–15 nights. The prevalence rates for moderate to severe clinical insomnia, fatigue, and moderate to severe depression were 42 %, 48 %, and 32 %, respectively. CCPs working 8–15 nights had a 2-fold risk of clinical

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insomnia than those working fewer than eight nights with (AOR) and 95 % (CI) of 2.12 and 1.41–3.20, while those working ≥16 nights per month had a greater incidence of clinical insomnia compared to those working <8 nights per month, AOR (CI): 3.09 (1.90–5.03). Only those working ≥16-night shifts per month had a substantially higher fatigue risk compared to those working < 8-night shifts per month, with an AOR (CI) of 1.92 (1.19–3.08). Working 8–15-night shifts per month increases depression risks by 34 % compared to the <8-night shifts group, AOR (CI): 1.34 (0.87–2.08). Those working ≥16-night shifts per month showed a higher depression risk than those working <8-night shifts, AOR (CI): 2.53 (1.53–4.19).

Conclusion: A cumulative night shift above eight nights per month is linked with an increased risk of insomnia, fatigue, and depression. The risk of these conditions was significantly directly proportional to the number of night shifts performed per month.

1. Introduction

Night shifts have become increasingly prevalent in various professions, including healthcare, where providing round-the-clock care is crucial. Nevertheless, working at night can disrupt the natural circadian rhythm, leading to potential detrimental effects on both physical and mental well-being [1,2]. Studies have shown that night shift workers are more susceptible to sleep disturbances, including insomnia, compared to their counterparts who work during the day [3,4]. This disruption can be attributed to the misalignment between the internal circadian rhythm and external environmental cues, resulting in difficulties in both falling and staying asleep during the day [1,3]. The resulting sleep deprivation can contribute to fatigue, which not only impacts one's quality of life but also compromises the safety and performance of ICU workers [5].

In addition to sleep disturbances, night shift work has been associated with an increased risk of developing mental health issues, particularly depression [6,7]. Disruption of the circadian rhythm can potentially result in the dysregulation of different neurotransmitters and hormones, including serotonin and cortisol, which play a crucial role in mood regulation [3]. Prolonged night shift work has been found to increase the likelihood of experiencing depressive symptoms [7,8]. Furthermore, ICU workers face additional challenges that further exacerbate the effect of night shift work, primarily because of the unique nature of the ICU environment. A high level of patient acuity, complex medical interventions, and frequent emergency situations make ICUs extremely stressful and demanding environments [9,10]. The work in ICUs necessitates vigilance, rapid decision-making, and the ability to manage life-threatening situations. The combination of these factors with the disruptive nature of night shift work further contributes to the physical and mental strain experienced by ICU workers [11].

Although previous studies have investigated the effects of night shift work on various health outcomes [12,13], limited research has focused on the cumulative effects of consecutive night shifts on insomnia, fatigue, and mental health with a specific focus on ICU workers. For instance, a previous study by Garde et al. investigated the effect of consecutive night shifts but only in police officers. Also, another study assessing the effect of the night shift specifically in health care workers does not assess it as a cumulative effect and involves a single category of health care workers (nurses) not necessarily in the ICU setting [14]. Indeed, the general work dynamic in the ICU is fast-paced with the need for timely and accurate decision-making and takes a different toll on workers' mental health. In sum, there is a notable research gap regarding the impact of night shift duties on ICU workers globally and indeed, in the context of Saudi Arabia, where cultural and social factors may impact the work experience at night shift duties. Understanding the cumulative effect of night shift work on insomnia, fatigue, and depression among ICU workers is of extreme importance. Sleep disturbances, fatigue, and depression can impair cognitive function, decision-making abilities, and overall job performance, potentially compromising patient safety and outcomes [15,16]. Therefore, identifying the negative impacts of various night shift duties on ICU workers, particularly in Saudi Arabia, can contribute to the formulation of interventions and policies to mitigate the effects of night shifts on healthcare workers. This, in turn, can result in improved patient care. Thus, this study aimed to assess the effect of cumulative night shift duties on the sleep pattern, fatigue, and mental health of ICU workers in Saudi Arabia.

2. Methods

➢ *Study Design and Study Population*

A cross-sectional study was undertaken to evaluate the impact of night shift duty on the likelihood of experiencing insomnia, fatigue, and mental health issues among critical care providers all over Saudi Arabia, spanning the period from June 2022 to March 2023. The recruitment of participants for this study was conducted with careful consideration of their suitability, considering the major regions within the kingdom. All participants willingly participated and provided their consent before commencing the questionnaire. The purpose of the research was explicitly outlined before the commencement of the survey. The inclusion criteria comprised actively employed respiratory therapists, nurses, and physicians presently working within intensive care units (ICUs) in Saudi Arabia irrespective of the years of experience. The inclusion of diverse groups of healthcare workers was to allow a comprehensive understanding of the effect of cumulative night shifts across different responsibilities to provide a blanket understanding across the board. Participants were recruited via various methods described further below. The Institutional Review Board of Prince Sultan Military College of Health Sciences provided ethical approval for this research (IRB-2022-RC-030). Completing the survey was considered consent. Personal information was anonymized and set to be erased as soon as it was processed. The research was carried out in line with the

Helsinki Declaration.

➢ ***Survey tool and distribution.***

We collected demographics and other information concerning specialty, years of clinical experience, and number of night shift duties per month in the last year. We have also used validated questionnaire tools to assess the risk of insomnia, fatigue, and mental health among those critical care providers.

To evaluate insomnia, the Insomnia Severity Index (ISI) was utilized. The ISI is a validated index that has been shown to be effective for the measurement of insomnia in various settings [17,18]. This index is a self-report questionnaire consisting of seven items that assess the characteristics, intensity, and effects of insomnia. It uses a 5-point Likert scale to evaluate and rate each item, with 0 indicating "No problem" and 4 suggesting "Very severe problem". This scoring system produces a total score that ranges from 0 to 28. The total score is interpreted in the following manner: absence of insomnia (0–7), sub-threshold insomnia [8–14], moderate clinical insomnia [15–21], and severe clinical insomnia [22–28].

We also explore fatigue using PROMIS Short Form v1.0 13a (Functional Assessment of Chronic Illness Therapy [FACIT]-Fatigue) instrument [19]. The instrument is a well-validated 13-item tool used to assess fatigue, considering a 7-day recall period and its effects on daily activities [20]. Furthermore, depression severity was investigated using the Patient Health Questionnaire-9 (PHQ-9) [21]. There are nine items used to assess the presence of depression symptoms within the past two weeks. Each item is scored on a scale of 0–3, resulting in a total score ranging from 0 to 27. Scores of 1–4 are classified as minimal depression, 5–9 as mild depression, 10–14 as moderate depression, 15–19 as moderately severe depression, and 20–27 as severe depression. The tools were chosen because of their suitability for survey and validated effectiveness in previous studies [18,20].

The survey employed a multi-channel methodology to effectively engage participants, encompassing both online platforms such as social media and WhatsApp groups, as well as offline dissemination within hospital settings. Specifically, the offline method was used to reduce the risk of exclusion of participants not on social media platforms. The risk of clinical insomnia was operationally defined as those who obtained scores $\geq$15. Similarly, the risk of experiencing fatigue was operationally defined as those who obtained scores >33. Lastly, the risk of depression was operationally defined as those who obtained scores $\geq$15. The operational criteria for defining levels of insomnia, fatigue, and depression based on the instrument/scores used were described as originally defined by the proponents of the instruments.

➢ ***Power calculation***

Given an assumed number of critical care providers of approximately 20,000 in Saudi Arabia, a confidence interval of 95 %, a margin of error of 3 %, and a presumed response rate of 60 %, it was deduced that the minimum sample size required for this study is 975. The relatively low margin of error is below the acceptable level of 5 % as well as the confidence interval of 95 % [22] and was chosen to ensure a high level of reliability in the reported outcome. The response rate of 60 % was based on that reported in previous studies conducted in Saudi Arabia [23,24].

➢ ***Statistical analysis***

Descriptive statistics were employed to construct a comprehensive profile of those who participated in the study. Specifically, participants' demography including age, gender, and region were descriptively presented. Also, medical specialties, regions of professional practice, years of professional experience, and number of night shifts performed per month were categorized in terms of the percentage of overall participants. One-way ANOVA was performed to compare night shift duties' influence on insomnia, fatigue, and depression scores i.e. to test if there is a significant difference in insomnia, fatigue, and depression scores between participants that performed different cumulative night shift duties. Multiple logistic regression analysis models were used to ascertain the associations between various night shift duties and the occurrence of insomnia, fatigue, and depression i.e., to assess if the various night shift duties are associated with increased probability/risk of insomnia, fatigue, and depression among the participants. The previous models were utilized to generate both crude and adjusted odds ratios (AOR's) with the model adjusted for age, gender, geographical region, specialty, and years of experience. After running the data via IBM SPSS 28, we determined that a p-value of less than 0.05 indicated statistical significance.

3. Results

➢ ***Demographic characteristics***

A total of 1006 participants completed this survey, achieving a completion rate of 100 %. The regions that were most represented were the eastern region, representing 29 % of the total, and the central region, accounting for 26 %. On the other hand, the northern and southern regions have the lowest representation. Most respondents (35 %) fell within the 20 to 30 age range. Additionally, the survey found that males made up 55 % of the respondents. RTs accounted for approximately 47 % of the entire sample, while approximately 35 % of the participants had 1–2 years of clinical experience. Most of our respondents (476; 47 %) reported working night shifts, with a monthly range of 8–15 shifts, Table 1.

➢ ***Fatigue, insomnia, and depression risks among the critical care providers***

Almost half (42 %; 422) of the sample suffered from moderate to severe clinical insomnia, with 31 % suffering from moderate and 11 % suffering from severe insomnia. The sample's mean insomnia score was 13.43 ± 6.7, suggesting subthreshold insomnia, with no significant difference in the mean score across specialized groups ($p > 0.05$). Table 2 displays the fatigue score, which was 33 ± 11.6 and did not vary substantially within specialized groups. Around 481 (48 %) got a higher score than the whole sample's mean score, indicating a fatigue risk. In the whole sample, the prevalence of moderately severe to severe depression was 32 %. The sample's mean depression score was 11.14 ± 7.2, suggesting moderate depression. The distribution of depression categories throughout the whole sample is also shown in Table 2.

➢ ***Comparison between night shift groups and risk of insomnia, fatigue and depression***

A one-way ANOVA compared night shift duties' effect on insomnia, fatigue, and depression scores. There was a significant difference in insomnia scores among the three-night shift duties ($p < 0.001$). Post Hoc analysis showed significant differences in insomnia scores between individuals who work < 8-night shifts per month and those with 8–15-night shifts per month ($p < 0.001$), as well as those who work ≥16-night shifts per month ($p < 0.001$), as shown in Fig. 1. There was a significant difference in insomnia risk between those who work 8–15 night shifts per month and those who work ≥16-night shifts per month ($p = 0.03$).

When comparing the three groups that did nighttime work, there was a statistically significant difference in the fatigue index ($p < 0.001$). Post hoc analysis found significant differences in fatigue scores between those who work <8-night shifts per month and those with 8–15-night shifts per month ($p = 0.008$), as well as those who work ≥16-night shifts per month ($p < 0.001$), see Fig. 1. There was no significant difference between those with 8–15-night shifts per month and those who work ≥16-night shifts per month ($p = 0.23$). Finally, there was a significant difference in depression scores among the three-night shift groups ($p < 0.001$). No difference was found between those who work <8-night shifts per month and those with 8–15-night shifts per month ($p = 0.87$). Professionals with ≥16-night shifts per month had higher depression scores compared to those with <8-night shifts per month and those with 8–15-night shifts per month ($p < 0.001$).

➢ ***Association of different night shift duties with insomnia, fatigue, and depression***

Critical care providers who are working 8–15 had a 2-fold higher risk of clinical insomnia than those who worked less than 8-night shifts, adjusted odds ratio (95 % confidence interval); AOR (95 % CI): 2.12 (1.41–3.20). Those who worked ≥16-night shifts per month were at higher risk of developing clinical insomnia than those with <8-night shifts per month, AOR (95 % CI): 3.09 (1.90–5.03). Table 3 presents the other risk factors associated with the risk of developing clinical insomnia.

Table 1
Demographics data and characteristics of the respondents (n = 1006).

Variable	N (%)
Gender	
Male	548 (54.5 %)
Female	458 (45.5)
Region	
Central Region	259 (25.7)
Western Region	169 (16.8)
Eastern Region	296 (29.4)
Southern Region	141 (14.0)
Northern Region	141 (14.0)
Age Groups	
20–30	355 (35.3)
31–40	243 (24.2)
41–50	221 (22.0)
≥51	187 (18.6)
Specialty	
Nurse	298 (29.6)
Respiratory Therapist	468 (46.5)
Physician	240 (23.9)
Years of clinical experience	
1–2 years	355 (35.3)
3–5 years	243 (24.2)
6–9 years	221 (22.0)
≥10 years	187 (18.6)
Number of Night shifts per month	
<8	294 (29.2 %)
8-15	476 (47.3 %)
≥16	236 (23.5 %)

Table 2
Insomnia, Fatigue and Depression risks among the critical care providers.

Variable	N (%)
Insomnia	
No clinically significant insomnia	205 (20.3 %)
Subthreshold insomnia	379 (37.6 %)
Clinical insomnia (moderate severity)	307 (30.5 %)
Clinical insomnia (severe)	115 (11.4 %)
Insomnia score	13.43 ± 6.7
Fatigue	
Fatigue score	33 ± 11.6
Cut off mean score >33	481 (48 %)
Depression	
None-minimal	177 (17.5 %)
Mild	329 (32.7 %)
Moderate	174 (17.2 %)
Moderately Severe	200 (19.8 %)
Severe	126 (12.5 %)
Depression Score	11.14 ± 7.2

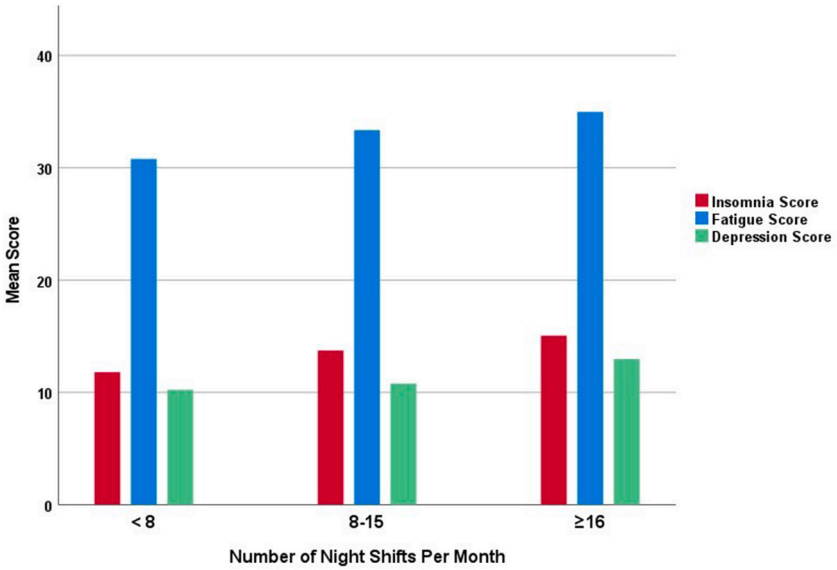

Fig. 1. Risk of insomnia, fatigue, and depression among night shift groups.

Compared to those with <8-night shift duties, fatigue risk was significantly associated with only those who work ≥16-night shift duties per month with an AOR (95 % CI) of 1.92 (1.19–3.08). RTs had a 67 % higher risk of developing fatigue than other specialties, AOR (95 % CI): 1.67 (1.10–2.51), Table 4.

Our results show that depression risk is associated with a higher number of night shift duties. Compared to the <8-night shifts group, working 8–15-night shifts per month significantly increases the odds to have depression by 32 %, AOR (95 % CI): 1.34 (0.87–2.08). Those who work ≥16-night shift duties per month had a greater risk of developing depression than those with <8-night shifts group, AOR (95 % CI): 2.53 (1.53–4.19). Table 5 indicates the additional risk factor associated with the risk of depression.

4. Discussion

This study provides a link between cumulative night shift duties and chronic insomnia, tiredness, and depression in a group of ICU workers in Saudi Arabia. Specifically, our results show a general increase in the risk of fatigue, insomnia, and depression in workers with cumulative night shifts of over 8 days a month (8–15 and ≥ 16 nights) compared with those who had less than 8 cumulative night shift duties per month. To the best of our knowledge, this is the first study to assess the effect of cumulative night shift duties on the physical (fatigue and insomnia) and mental health (depression) of ICU workers in the Kingdom of Saudi Arabia.

Like our findings, a previous study of healthcare workers in Saudi Arabia reported a significantly lower sleep quality in night shift workers compared with day shift workers. However, there was no report of the cumulative night shift performed and the authors did not establish the presence of insomnia, fatigue, or depression [25]. Our result also supports previous similar findings from other studies

Table 3
Univariable and multivariable logistic regression models to assess Clinical Insomnia Risk.

Descriptor	OR (95 % CI)	Fully adjusted OR (95 % CI)
Clinical Insomnia risk		
Gender		
Female	1	1
Male	0.87 (0.67–1.21)	0.68 (0.49–0.95)
Age		
20–30	1	1
31–40	0.55 (0.39–0.77)	0.39 (0.24–0.64)
41–50	1.12 (0.79–1.58)	0.66 (0.37–1.19)
≥51	1.58 (1.05–2.36)	0.73 (0.34–1.57)
Geographical region		
Central Region	1	1
Western Region	0.79 (0.56–1.11)	0.83 (0.54–1.28)
Eastern Region	0.49 (0.32–0.77)	0.62 (0.36–1.07)
Southern Region	1.23 (0.81–1.85)	1.11 (0.63–1.97)
Northern Region	0.96 (0.65–1.43)	0.97 (0.62–1.54)
Speciality		
Physician	1	1
Nurse	1.25 (0.87–1.78)	0.76 (0.48–1.19)
Respiratory Therapist	1.80 (1.30–2.49)	1.88 (1.24–2.85)
Working Experience		
1–2 Years	1	1
3–5 Years	0.78 (0.55–1.09)	1.05 (0.67–1.66)
6–9 Years	1.20 (0.85–1.68)	1.71 (1.01–2.92)
≥10 Years	1.53 (1.07–2.18)	1.69 (0.92–3.09)
Night Shift Groups		
<8-night shifts	1	1
8–15-night shifts	1.32 (0.97–1.78)	2.12 (1.41–3.20)
≥16-night shifts	1.91 (1.35–2.72)	3.09 (1.90–5.03)

The multivariable logistic regression model was adjusted for gender, age, and geographical region, specialty, working experience, and number of night shifts.
Abbreviations: OR: odds ratio.

performed elsewhere [26,27]. For instance, sleep quantity and quality were previously found to be affected by night shift work in a survey of nurses in the United states [28]. Similarly, Khan et al. reported an increased risk of insomnia, fatigue, anxiety, symptoms of post-traumatic stress disorder and depression among paramedics with night shift duties in Australia. Further, it was found that the main driver of the observed risks was insomnia and fatigue [29]. That sleep disturbance is the main driver of the negative effect of night shift duties was further supported by another study of over 16,000 participants, where authors reported a link between fixed night shift duties and sleep and mental health problems [30].

The importance of good sleep for good mental health and general well-being cannot be overemphasized. Indeed, while short-term effects may manifest in the form of poor cognition, alertness, and performance deficit, chronic sleep deprivation has been linked with various cardiovascular diseases, hypertension, dyslipidemia, type 2 diabetes, and other metabolic syndromes in otherwise healthy individuals [31]. Further, sleep deprivation especially linked with social jetlag has been shown to be associated with various negative behavioral patterns such as smoking, drinking, and increased stimulant intake [32], all of which may predispose to further health problems.

Interestingly, we also found in this study that a maximum of 8 shift duties per month was not associated with the risk of fatigue, insomnia, and depression. Thus, providing the basis for future policies around the optimum number of permitted night shift duties that do not compromise workers' health and safety, while maintaining quality services in the ICU. Indeed, various studies have explored the need for the introduction of policies, and various coping mechanisms aimed at reducing the somatic and mental effects of night shift duties such as intermittent napping, exposure to bright light, caffeine consumption, rotation of shift to avoid permanent night shift duties, extended workdays, and avoiding quick change over [33,34]. Furthermore, other authors have suggested the need to align workers' chronotypes to the type of shift offered, whereby ICU workers with late chronotypes (night owls) are prioritized for night shift duties [35,36]. Initially, the findings by various authors including the American Academy of Sleep Medicine show that not all night-shift workers will develop physical or mental disorders [37–39]. Indeed, Vetter et al. showed in a study of 114 night shift workers that a chronotype-based night-shift schedule significantly improved sleep quality and quantity as well as up to 1-h reduction in social jetlag [35]. Thereby supporting the need for chronotype-based scheduling to reduce the health impact of night shift duties as reported and suggested by various other studies [40]. Indeed, the idea of circadian scheduling has been suggested to drive more efficient leadership based on better decision-making [41,42], a feature that is needed in the fast-paced ICU environment to drive better patient outcomes. Aside from the health implications of insomnia, fatigue, and depression, various studies have reported reduced quality of care offered and higher error rates among healthcare workers that worked night shifts compared with those who work mainly day shifts [13,43,44].

Chronotype, which describes the physiological preference for sleep and activity times is a feature that varies between individuals. Generally, early chronotypes (morning larks) tend to go to bed early and are more active in the early hours of the day while late

Table 4
Univariable and multivariable logistic regression models to assess fatigue risk.

Descriptor	OR (95 % CI)	Fully adjusted OR (95 % CI)
Fatigue risk		
Gender		
Female	1	1
Male	0.83 (0.65–1.07)	1.08 (0.77–1.51)
Age		
20–30	1	1
31–40	0.51 (0.36–0.70)	0.39 (0.24–0.63)
41–50	1.41 (0.99–2.00)	0.89 (0.51–1.59)
≥51	1.61 (1.07–2.42)	1.55 (0.72–3.35)
Geographical region		
Central Region	1	1
Western Region	0.63 (0.45–0.88)	0.87 (0.57–1.33)
Eastern Region	0.49 (0.32–0.75)	0.61 (0.36–1.04)
Southern Region	0.96 (0.64–1.46)	0.86 (0.49–1.51)
Northern Region	1.09 (0.74–1.62)	1.45 (0.92–2.26)
Specialty		
Physician	1	1
Nurse	1.38 (0.98–1.96)	0.82 (0.53–1.28)
Respiratory Therapist	1.66 (1.21–2.28)	1.67 (1.10–2.51)
Working Experience		
1–2 Years	1	
3–5 Years	0.90 (0.63–1.25)	1.62 (1.03–2.54)
6–9 Years	1.65 (1.17–2.32)	2.21 (1.30–3.74)
≥10 Years	1.28 (0.90–1.83)	1.12 (0.61–2.06)
Night Shift Groups		
<8-night shifts	1	
8–15-night shifts	0.98 (0.73–1.32)	1.31 (0.88–1.95)
≥16-night shifts	1.90 (134–2.69)	1.92 (1.19–3.08)

The multivariable logistic regression model was adjusted for gender, age, gender, and geographical region, specialty, working experience, and average of night shifts.
Abbreviations: OR: odds ratio; PFT: pulmonary function testing.

chronotypes (night owls) find it difficult to wake up early and are more active into the night [45]. Much of the general population falls between the early and late chronotypes. While the circadian rhythm (the cyclical oscillation in the physiological process every 24 h) is mainly regulated by neurons in the suprachiasmatic nucleus (SCN, i.e., circadian pacemaker) in response to environmental zeitgebers (stimuli), variation in chronotype is genetically determined [46]. Specifically, the chronotypes are linked with a group of genes called "*CLOCK*" genes. Specifically, various alleles of this gene (*PER or 3111C, ARNTL2*) have been shown to be associated with the various sleep-activity preferences of the different chronotypes [46]. Social jetlag, which refers to disruption in circadian rhythm and sleep cycle due to a mismatch between social requirements such as work, and chronotype, may result in chronic insomnia and the loss of cognitive performance which is needed for optimum performance in ICU settings.

Shift work disorder (SWD) is a form of social jetlag in ICU workers resulting in insomnia and excessive sleepiness due to disruption of the circadian rhythm and has been reported to be linked with negative health effects and poor quality of life [47]. Indeed, as shown by a study by Gumenyuk et al., night duties result in physiological delay in circadian pacemaker (SCN) activation (determined by the circadian rhythms of salivary melatonin) in night-shift workers who are asymptomatic while workers with SWD show a significant mismatch between their natural sleep time and their sleep schedule [48].

Contrary to our findings, other studies have reported differing results. In a survey of over five thousand Norwegian nurses, Oyane et al., found no association between a 12-month cumulative night shift and insomnia, anxiety, and depression [49]. However, the authors reported a mean night shift duties of approximately 26 days (approximately 2 shifts per month) which is significantly lower than those in this study. Also, another study by Skipper et al., reported that while night shift duties were linked with lower job performance, authors did not find any association between night duties and physical or mental health [28]. However, the authors did not provide the cumulative number of night shift duties performed by participants for comparison.

This study has various strengths and limitations. Firstly, the inability to specifically provide a causal link between the night shift duties and the somatic/mental effects given that other socioeconomic and personal factors may also result in insomnia, fatigue, and depression (see Refs. [50,51]) is a major limitation of this study. Secondly, surveys may be associated with a significant level of recall error which may affect some findings. Lastly, response bias due to the Hawthorne effect [52,53], whereby participants may behave differently because of the knowledge of being studied is strong, especially in Saudi Arabia, and may limit the generalizability of the result of this study. However, this is the first and largest survey coming out of Saudi Arabia investigating the link between cumulative shift work and somatic and mental disorders in ICU workers, and it prepares the ground for future studies on the topic and policy changes to improve ICU workers' health as well as efficiency. Specifically, future studies could expand into the mechanism of association between increased cumulative night shifts and increased risks of insomnia, fatigue, and depression especially in ICU workers as well as the effect of chronotype scheduling on insomnia, fatigue, and depression. Also, the exploration of various interventions to improve the mental health of ICU workers needs to be evaluated in comprehensively designed studies and could guide further studies

Table 5
Univariable and multivariable logistic regression models to assess Depression Risk.

Descriptor	OR (95 % CI)	Fully adjusted OR (95 % CI)
Depression risk		
Gender		
Female	1	1
Male	1.39 (1.06–1.82)	1.12 (0.78–1.60)
Age		
20–30	1	1
31–40	0.38 (0.35–0.57)	0.41 (0.24–0.72)
41–50	1.71 (1.20–2.44)	1.66 (0.89–3.09)
≥51	1.93 (1.28–2.91)	1.36 (0.61–3.05)
Geographical region		
Central Region	1	1
Western Region	0.55 (0.38–0.78)	0.66 (0.41–1.04)
Eastern Region	0.45 (0.28–0.73)	0.42 (0.23–0.76)
Southern Region	1.09 (0.72–1.66)	0.89 (0.48–1.66)
Northern Region	0.79 (0.27–0.53)	0.89 (0.54–1.45)
Speciality		
Physician	1	1
Nurse	1.26 (0.85–1.87)	0.48 (0.28–0.81)
Respiratory Therapist	2.16 (1.52–3.08)	1.89 (1.21–2.96)
Working Experience		
1–2 Years	1	1
3–5 Years	0.70 (0.48–1.02)	1.18 (0.73–1.90)
6–9 Years	1.28 (0.89–1.82)	1.13 (0.63–2.01)
≥10 Years	1.61 (1.11–2.33)	1.17 (0.61–2.24)
Night Shift Groups		
<8-night shifts	1	1
8–15-night shifts	0.79 (0.57–1.09)	1.34 (0.87–2.08)
≥16-night shifts	1.91 (1.34–2.73)	2.53 (1.53–4.19)

The multivariable logistic regression model was adjusted for gender, age, gender, and geographical region, and specialty, working experience, and average of night shifts.
Abbreviations: OR: odds ratio.

and policies in the far future.

5. Conclusion

Cumulative night shift duties of over eight days a month are linked with an increased risk of insomnia, fatigue, and depression in ICU workers in the Kingdom of Saudi Arabia and this risk tends to increase with an increasing number of night shift duties performed. Insomnia, fatigue, and depression could reduce the quality of life as well as the ability to deliver quality healthcare to patients in the short term and possibly increase the risk of other chronic disease in the long term. Regulating the number of cumulative night shift duties allowed per healthcare worker could help reduce the negative somatic and mental effects of this mode of work while improving the quality of care ICU patients receive. Also, other approaches such as mental health support as well as wellness training and programs targeted at ICU workers may provide further alleviation for the effect of high cumulative night shifts while also helping to maintain standard quality of care. This reduction in night shifts performed per month will need to be balanced against a strategy to train more healthcare professionals to cater to the gaps in care that will be potentially created by such reduction, for any implementation to be useful.

Data availability statement

Data included in article/supp. material/referenced in article.

CRediT authorship contribution statement

Jaber S. Alqahtani: Writing – review & editing, Visualization, Validation, Methodology, Investigation, Data curation, Writing – original draft, Supervision, Formal analysis, Conceptualization. **Abayomi Arowosegbe:** Writing – review & editing, Writing – original draft, Visualization. **Tope Oyelade:** Writing – review & editing, Writing – original draft, Visualization, Validation, Investigation, Formal analysis. **Abdulelah M. Aldhahir:** Writing – review & editing, Visualization, Supervision, Methodology, Investigation, Formal analysis, Data curation. **Saeed M. Alghamdi:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Formal analysis, Data curation. **Abdullah A. Alqarni:** Writing – review & editing, Methodology, Investigation. **Rayan A. Siraj:** Writing – review & editing, Visualization, Validation, Supervision, Software, Methodology, Investigation, Data curation. **Meshal Alenezi:** Writing – review & editing, Validation, Methodology, Writing – review & editing, Visualization, Validation, Supervision, Data curation. **Leen Y. Alnaam:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Ibrahim A. AlDraiwiesh:** Writing –

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e31066.

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