

Study of sleep quality among patients admitted to the respiratory intensive care unit

Doaa M. Magdy, Ahmed Metwally, Hoda A. Makhoul

Background Several factors may cause sleep disruption among critically ill patients. Determination of these factors that interfere with patients' quality of sleep is very important in the treatment process to ensure normal sleep process.

Objective The aim was to assess the quality of sleep among critically ill patients admitted to the respiratory intensive care unit (RICU) and identify the risk factors.

Materials and methods This observational study was carried out on all patients who were admitted to the RICU. Patients' age, gender, duration of ICU stay, cause of admission, and scores for the severity of illness on admission including Acute Physiology and Chronic Health Evaluation II and Sequential Organ Failure Assessment were done. A Freedman questionnaire was determined twice: at the RICU and at home to evaluate sleep quality and the contributing factors.

Results One hundred patients were enrolled in this study. The mean ICU stay was 5.41 ± 2.03 days; 82% of them were admitted for the first time to the RICU. The mean score of sleep quality of patients at the RICU was 4.38 ± 1.83 , which was significantly reduced compared with the mean score at home post-admission 8.30 ± 1.09 ($P < 0.001$). Noise (7.60 ± 1.40) was the main sleep disruptive factor in the RICU;

Introduction

Sleep disturbance is common in critically ill patients [1]. Sleep in the ICU exhibits a considerable decrease in rapid eye movement and slow-wave sleep and in more arousals and awakenings than normal [2,3]. Although the total sleep time may be normal or even increased, the quality of sleep is poor. Accordingly, impaired sleep quality resulting in cardiorespiratory, neurological, immunological, and metabolic consequences increases the morbidity [4,5].

Hospitalized patients usually have difficulties in meeting the need for sleep and this may be due to the changes in their sleeping and resting phase behaviors and habits. However, these patients have less sleep due to many factors that cause sleep disorders such as environment and the surrounding conditions. Such lack of sleep and rest can increase the cardiovascular risk consequences. It increases the sympathetic system activity resulting in a rise in blood pressure and heart rate [6].

Sleep disturbances seem to be due to factors related to the ICU itself, such as care routines and environmental stimuli; intrinsic factors related to the patients, the acute nature of their condition; and factors related to the treatments administered.

hospital staff conversations (7.77 ± 1.38) and medical staff pagers and phones (7.42 ± 1.53) were the maximum noises. Frequent use of light is the second influential factor for sleep disruption (6.82 ± 1.31), followed by nursing interventions and blood sampling.

Conclusion Due to the poor sleep quality during hospitalization and due to the presence of a wide range of sleep disturbing factors such as noise, light, and nursing activities, nursing education, using eye shields, and ear plugs might reduce environmental noise and improve sleep quality.

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Department of Chest Diseases, Faculty of Medicine, Assiut University, Assiut, Egypt

Correspondence to Dr. Doaa Mohamed Magdy, MD in chest diseases & tuberculosis and sleep medicine, Chest, Faculty of Medicine, Assiut University Hospital, Assiut University, Assiut, 71515, Egypt.

Tel: +201006261010; fax: 0882413708;

e-mail: doaamagdy_2020@aun.edu.eg

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The purpose of this study was to assess the quality of sleep among the critically ill patients admitted to the respiratory intensive care unit (RICU) and to identify the risk factors.

Materials and methods

This observational study was carried out on 100 patients admitted to the RICU at a tertiary hospital from November 2016 till January 2017. An informed consent was obtained from the patients. The study was approved by the Faculty of Medicine ethics committee.

Inclusion criteria

Selection criteria include age greater than or equal to 18 years, fully conscious patients (Glasgow coma score=15) and patients who were not intubated or with a tracheostomy and who are able to communicate and admitted to the RICU with a minimum duration of 3 days.

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Exclusion criteria

Patients who received any hypnotics or sedative drug over the last 24 h, history of any major organ failure that may be associated with impaired conscious level and patients with sleep apnea were excluded.

All patients were subjected to full history taking including symptoms related to sleep-disordered breathing, routine laboratory workup, and arterial blood gas analysis. Patient's age, sex, duration of stay in the ICU, and cause of admission were recorded. Also, presence of comorbidity (hypertension or diabetes) was reported.

Assessment of illness severity

Illness severity scores from an Acute Physiology and Chronic Health Evaluation II (APACHE II) [7] and Sequential Organ Failure Assessment (SOFA) [8] score were recorded on admission for each patient.

The Freedman questionnaire

A 1–10 point scale self-reported questionnaire was used twice: at the RICU and at home to determine the sleep quality and the factors contributing to sleep disruption among these patients [9]. The questionnaires were asked on the patients discharge from the ICU. Sleep quality was evaluated on a scale of 1–10 (1=poor, 10=excellent) at home and in the ICU. Degree of daytime sleepiness was asked over the duration of their ICU stay on a scale of 1–10 (1=unable to stay awake, 10=fully alert and awake). The effect of environmental stimuli including pain, noise, light, nursing interventions (bathing, etc.), diagnostic tests, evaluation of vital signs, blood sampling, and the administration of medications were measured on a scale of 1–10 (1=no disruption, 10=significant disruption). Also, the effects of different ICU noises on sleep disruption were assessed using a scale of 1 (no disruption) to 10 (significant disruption).

Statistical analysis

Statistical package for the social sciences (SPSS version 15; SPSS Inc., Chicago, Illinois, USA) software was used to evaluate the data obtained from the study. The statistics were presented as mean±SD and frequency tables. Correlations between the quality of sleep and other variables were determined using Pearson's correlation coefficients analysis. A *P* value of less than 0.05 was accepted as statistically significant.

Results

Table 1 shows the characteristics of the 100 patients recruited to the respiratory ICU with a mean age group of 54.03±11.37 years. Of these, 63% of patients were

men and 37% were women. It was found that 70% of patients had been referred to the RICU due to COPD exacerbation, 13% due to interstitial lung diseases, 11% due to bronchial asthma, and 6% had been referred due to pulmonary embolism; the mean duration of RICU stay was 5.41±2.03 days.

It was observed that 82% of the patients had first time admission to the RICU; on the other hand 18% had previous admission in the RICU. The severity of the disease was determined on the first day of admission by using APACHE II score with a mean value of 16.97±6.33 and the mean SOFA score was 8.18±4.79.

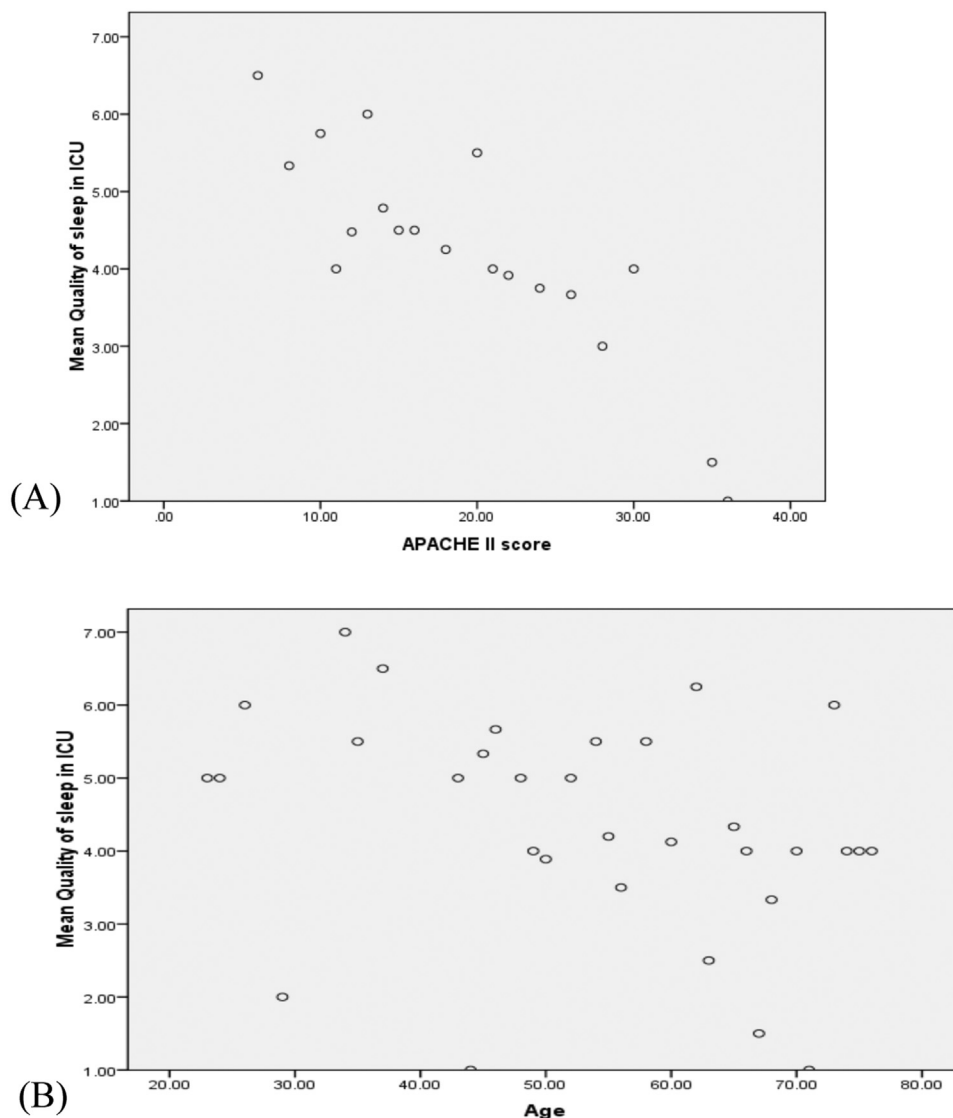
This study demonstrated that 48% of the patients admitted to the RICU had poor sleep quality. Table 2 shows the distribution of sleep quality. The mean score of sleep quality of patients at the RICU was 4.38±1.83, which was significantly reduced compared with the mean score at home 8.30±1.09 (*P*<0.001). The mean score of sleep quality on the first day of admission to the RICU was 3.43±1.67 and 4.63±1.36 at the end of RICU stay before discharge. Regarding daytime sleepiness assessment, the overall degree of daytime sleepiness among the patients admitted to the RICU was 5.60±1.11. The state of being sleepy was found to be 4.24±1.45 on the first day while at the end of the RICU it was 5.26±1.24.

Table 1 Baseline patient characteristics

Patients' characteristics	
Age (years)	
Mean±SD	54.03±11.37
Range	23–76
Sex	
Male	63 (63)
Female	37 (37)
Cause of admission	
COPD exacerbation	70 (70)
Bronchial asthma	11 (11)
Pulmonary embolism	6 (6)
ILDs	13 (13)
Length of ICU stay	5.41±2.03
Comorbidity	
Yes	39 (39)
No	61 (61)
Previous ICU admission	
Yes	18 (18)
No	82 (82)
Severity of illness on the first day of admission	
APACHE II score	16.97±6.33
SOFA score	8.18±4.79

Data expressed as mean±SD and number percentage. APACHE II, Acute Physiology and Chronic Health Evaluation II; COPD, chronic obstructive pulmonary disease; ILDs, interstitial lung diseases; SOFA, sequential organ failure assessment.

Figure 1



(a) Correlation between quality of sleep in the ICU and APACHE II score ($r=-0.381, P=0.000^*$) and (b) correlation between quality of sleep in the ICU and age in years ($r=-0.233, P=0.019$). APACHE II, Acute Physiology and Chronic Health Evaluation II.

Table 2 Sleep quality among patients in the respiratory ICU

Variables	Minimum	Maximum	Means±SD
Sleep quality at home	5	10	8.30±1.09
Sleep quality in the RICU	1	8	4.38±1.83
Overall sleep quality in the ICU on the following days			
On first night in the RICU	1	7	3.43±1.67
During middle of RICU stay	1	7	4.22±1.55
End of RICU stay	1	7	4.63±1.36
Overall degree of daytime sleepiness	3	8	5.60±1.11
On first night in the RICU	1	7	4.24±1.45
During middle of RICU stay	1	8	4.98±1.28
End of RICU stay	2	8	5.26±1.24

Data expressed as mean±SD.

Table 3 shows the distribution of patients' sleep quality in both RICU and at home. The most sleep-destructive activities in the RICU were the noise (7.60±1.40), light (6.82±1.31) followed by nursing interventions (5.50±1.44) and blood

sample collection (5.17±1.30). On the other hand hospital staff conversations (7.77±1.38) and doctors/nurses pagers and phones (7.42±1.53) were the maximum noises disrupting sleep at the RICU (Tables 4 and 5).

Table 3 Comparison between distribution of patients' sleep quality in both RICU and at home post-discharge

Sleep quality	Sleep at home	Sleep in ICU
Poor (1–4)	0 (0)	48 (48)
Fair (5–6)	6 (6)	41 (41)
Good (7–8)	47 (47)	11 (11)
Excellent (9–10)	47 (47)	0 (0)

Data expressed as *n* (%).

Table 4 Sleep disruptive activities during RICU stay

Variables	Minimum	Maximum	Means±SD
Pain	1	5	1.89±1.09
Noise	4	10	7.60±1.40
Light	4	10	6.82±1.31
Nursing interventions	1	8	5.50±1.44
Diagnostic testing	2	8	5.17±1.30
Vital signs measurement	2	9	5.27±1.25
Blood samples	2	7	5.04±1.17
Administration of medicines	2	7	4.76±1.04

Data expressed as mean±SD.

Furthermore, the correlations between the sleep quality with age, duration of RICU stay, and the severity of the disease showed a significant negative correlation with APACHE II score ($r=-0.381$, $P<0.001$) and SOFA score ($r=-0.386$, $P<0.001$). Also, it showed a significant correlation with age ($r=-0.233$, $P=0.019$) Fig. 1(A&B). Lastly, there was no correlation with the duration of ICU stay ($r=-0.075$, $P=0.459$).

Discussion

Sleep is universally recognized as essential for physical and psychological healing and the restoration of overall well-being throughout the ages. Thus, restorative sleep is very important among the critically ill patients [1]. Hence, in the current study sleep quality and factors causing sleep disruption among respiratory critically ill patients were evaluated. The present study demonstrated that the quality of sleep in RICU patients was significantly decreased when compared with that at home. These findings are in concordance with that of Freedman *et al.* [9] who evaluated the sleep quality in different ICUs (surgical and medical) using a similar evaluation method, and reported decreased sleep quality in the ICU compared with that at home. Moreover, Mahmoud *et al.* [5] studied the quality of sleep in acutely ill patients admitted to the RICU and found that 71% of patients admitted to the ICU suffered from poor sleep quality.

Also, Li *et al.* [10] have investigated the quality, duration of sleep, and factors affecting sleep

Table 5 The effects of different ICU noises on sleep disruption

	Minimum	Maximum	Means±SD
Heart monitor alarm	1	7	3.67±1.70
Ventilator alarm	1	8	3.59±1.83
Oxygen finger probe	1	4	1.91±0.93
Talking	4	10	7.77±1.38
IV pump alarm	1	6	2.68±1.56
Nebulizer	1	7	3.86±1.22
Doctors/nurses pagers and phones	3	10	7.42±1.53
Bedside phones	1	6	2.52±1.25

Data expressed as mean±SD.

experienced by the adult patients in the ICUs and reported poor sleep at the ICU as compared with sleep at home. The ICU environment is not favorable for sleep. Noise, frequent care-related activities, and continuous lighting in the ICU were found to be correlated with interruption to patients' sleep. Other studies, demonstrated that patients who are admitted to the hospital experienced changes in their sleeping habits [11,12].

In the current study, noise is considered as the first influential factor contributing to sleep disturbance among the RICU patients. The principal sources of such noise are talking by the staff and doctors/nurses' pagers, and phones. Similarly, Freedman *et al.* [3] reported that environmental noise is in part responsible for sleep-wake abnormalities among the ICU patients. Moreover, the findings of the present study are in agreement with Taslıstan *et al.* [13] who studied the effects of intensive care environment on sleep quality and reported that the most influential factor in the patients' sleep was noise [13]. Another study by Uğras and Öztekin [14] which investigated the environmental factors and the nursing interventions which affect the patients' sleep in the neurosurgery ICU reported that 78.6% of the patients experienced sleep disturbances and the most important factors for sleep disturbances were 'being immobile and the noisy environment.' In a study conducted by Atar *et al.* [11] who studied the sleep quality on 107 patients and reported a poor quality of sleep in 55.1% of patients and 23% had sleeping disturbances due to environmental noise.

Noise negatively affects the people's perception, can disrupt their physiological and psychological balance, and have several adverse effects. All of these decrease productivity, hearing, increases gastric secretions, negatively affects the cardiovascular stimulation, stimulates the pituitary and the adrenal glands,

suppresses the response to infection, and destroys the serenity and the pleasant environment [15]. In concordance with our study, several studies have shown noise to be the most important factor that negatively affects sleep in the ICU. In addition to patient-related factors (e.g. disease severity) environmental factors (e.g. continuous exposure to light and noise, around-the-clock care, and medications) are all contributing factors for bad quality of sleep [12,15,16].

In this study, the second contributing factor of sleep disturbance among patients in the RICU was continuous lighting followed by nursing interventions. Similarly, Dunn *et al.* [17] demonstrated that patients in the ICU were mostly exposed to light related to obtaining samples for laboratory tests and that exposure to light increased usually at the beginning and the end of the nurse shifts. However, several studies have reported that light is the least disturbing sleep factor than are care activities or environmental noise [9,18].

In concordance with a previous study evaluating nursing care on the night shift among critically ill patients it has been stated that 20% of patient care activities result in arousals, which accounted for 7% of sleep disruption in that patient population [19]. Also, Çelik *et al.* [20] who investigated the nursing interventions and their types which is performed at night in ICU patients demonstrated that a mean of 51 interventions were performed overnight per patient.

Our results demonstrated significant correlations between sleep quality and each of severity of the disease and age. No correlation was found between sleep quality and length of ICU stay. Surprisingly, Bihari *et al.* [21] reported that the severity or type of illness, length of stay in the ICU, and ICU interventions were all not correlated with sleep quality in the ICU. This possibly was explained by using anesthetic drugs in those patients who require multiple invasive interventions, which may affect the recall potential [21].

This study had its limitations; polysomnography which is considered the gold standard method for evaluating sleep should be performed to accurately quantify total sleep times and define sleep architecture. This may have contributed to the cost of polysomnography, as well as the practical difficulties in performing it in critically ill patients.

Conclusions

However, ICU patients continue to suffer from poor sleep during hospitalization; this is attributed to a wide range of sleep disturbing factors such as noise, light, and nursing activities. This suggests that nurses need to be better educated and trained to minimize sleep disturbing factors and to improve the sleep quality of inpatients. Also, using eye shields or goggles and ear plugs may help in reducing such environmental noise produced by phone sounds and loud conversations.

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Conflicts of interest

There are no conflicts of interest.

References

- Parthasarathy S, Tobin MJ. Sleep in the intensive care unit. *Intensive Care Med* 2004; **30**:197–206.
- Cooper AB, Thornley KS, Young GB, Slutsky AS, Stewart TE, Hanly PJ. Sleep in critically ill patients requiring mechanical ventilation. *Chest* 2000; **117**:809–818.
- Freedman NS, Gazendam J, LevanL, Pack AI, Schwab RJ. Abnormal sleep/wake cycles and the effect of environmental noise on sleep disruption in the intensive care unit. *Am J Respir Crit Care Med* 2001; **163**:451–457.
- Leung RS, Bradley TD. Sleep apnea and cardiovascular disease. *Am J Respir Crit Care Med* 2001; **164**:2147–2165.
- Mahmoud MI, Morsi T, Gharraf H, ElHady H. Study of sleep-related breathing disorders in patients admitted to respiratory intensive care unit. *Egypt J Chest Dis Tuberc* 2016; **65**:89–98.
- Fontana CJ, Pittiglio LI. Sleep deprivation among critical care patients. *Crit Care Nurs* 2010; **33**:75–81.
- Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. *Crit Care Med* 1985; **13**:818–829.
- Arts DG, de Keizer NF, Vroom MB, de Jonge E. Reliability and accuracy of Sequential Organ Failure Assessment (SOFA) scoring. *Crit Care Med* 2005; **33**:1988–1993.
- Freedman SN, Kotzer N, Richard JS. Patient perception of sleep quality and etiology of sleep disruption in the intensive care unit. *Am J Respir Crit Care Med* 1999; **159**:1155–1162.
- Li SY, Wang TJ, Vivienne Wu SF, Liang SY, Tung HH. Efficacy of controlling night-time noise and activities to improve patients' sleep quality in a surgical intensive care unit. *J Clin Nurs* 2011; **20**:396–407.
- Atar NY, Kırbıyık E, Turan N, Pallos A, Eskimez Z. Patients' sleep quality and factors affecting sleep in surgery clinic of one university hospital. *J Nurs Sci* 2012; **4**:74–84.
- Lei Z, Qiongjing Y, Qiuli W, Sabrina K, Xiaojing L, Changli W. Sleep quality and sleep disturbing factors of inpatients in a Chinese general hospitals. *J Clin Nurs* 2009; **18**: 2521–2529.
- Taşlıstan S, Ünver V, Dıyigün E, Dıysoy A. Study on effects of intensive care environment on sleep state of patients. *Anatol J Clin Investig* 2010; **4**:5–10.
- Uğras GA, Öztekin SD. Patient perception of environmental and nursing factors contributing to sleep disturbances in a neurosurgical intensive care unit. *Tohoku J Exp Med* 2007; **212**:299–308.
- Xie H, Kang J, Mills GH. Clinical review: the impact of noise on patients sleep and the effectiveness of noise reduction strategies in intensive care units. *Crit Care* 2009; **13**:2–8.
- Drouot X, Cabello B, d'Ortho MP, Brochard L. Sleep in the intensive care unit. *Sleep Med Rev* 2008; **12**:391–403.
- Dunn H, Anderson MA, Hill PD. Nighttime lighting in intensive care units. *Crit Care Nurse* 2010; **30**:31–37.

- 18 Bihari S, Doug McEvoy R, Matheson E, Kim S, Woodman RJ, Bersten AD. Factors affecting sleep quality of patients in intensive care unit. *J Clin Sleep Med* 2012; **8**:301–307.
- 19 Gabor JY, Cooper AB, Crombach SA, Lee B, Kadikar N, Bettger HE, Hanly PJ. Contribution of the intensive care unit environment to sleep disruption in mechanically ventilated patients and healthy subjects. *Am J Respir Crit Care Med* 2003; **167**:708–715.
- 20 Çelik S, Oztekin D, Akyolcu N, İşsever H. Sleep disturbance: the patient care activities applied at the night shift in the intensive care unit. *J Clin Nurs* 2005; **14**:102–106.
- 21 Bihari S, McEvoy RD, Matheson E, Kim S, Woodman RJ, Bersten AD. Factors affecting sleep quality of patients in intensive care unit. *J Clin Sleep Med* 2012; **8**:301–307.