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Improving sleep quality among ICCU patients – evaluating the effectiveness of ear plug and eye mask interventions

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ABSTRACT

Introduction and aim. Sleep quality is crucial for patient recovery, particularly in critical care settings such as the Intensive Cardiac Care Unit (ICCU). This study aimed to investigate the effectiveness of using eye masks and earplugs in improving sleep quality among ICCU patients.

Material and methods. A quasi-experimental study was conducted using a one-group without control design. A total of 40 ICCU patients were provided with eye masks and earplugs for a minimum duration of three days. Sleep quality was assessed using the Richard Campbell Sleep Questionnaire (RSCQ) before and after the intervention. Data were analyzed using descriptive and inferential statistics.

Results. The use of eye masks and earplugs significantly improved sleep quality among ICCU patients ($p<0.05$). There was a notable increase in sleep duration, reduction in sleep onset latency, and improvement in sleep efficiency following the intervention. These findings support the efficacy of non-pharmacological interventions in enhancing sleep quality in critical care settings.

Conclusion. The findings highlight the importance of incorporating simple interventions such as eye masks and earplugs into routine care practices in ICCUs to improve patients' sleep quality.
Keywords. earplugs, eye masks, intensive cardiac care unit, sleep quality

Introduction

Sleep is one of the fundamental needs of humans to restore health, energy, and physical well-being. The serotonin hormone and growth hormone undergo chemical changes and cellular nutrition enhancement.[1,2] Sleep disturbances are often experienced by patients admitted to the ICCU, which can lead to increased blood pressure, heart rate, and other bodily metabolic changes.[3] The quantity of sleep for patients decreases, but sleep quality, influenced by environmental factors, is most affected.[4] The time patients spend in continuous sleep decreases, and circadian rhythm (a person's 24-hour sleep period) and normal sleep cycles (progressing from 'light' to 'deep') are disrupted.[5,6]

Sleep quality in critical care settings has been proven to be suboptimal, with associated factors including environmental conditions and patient-related factors.[7] Environmental factors such as light, noise, alarm sounds from monitoring devices, care activities, diagnostic examinations, and therapeutic procedures.[8,9] Patient-related factors include age, underlying diseases, pain, stress, psychological factors, circadian rhythm disturbances, and organ dysfunction.[5,10]

Disturbed sleep quality in critically ill patients can lead to psychological and physiological disturbances, affecting patient recovery and treatment.[11] Other conditions that may arise due to poor sleep quality include immunodeficiency function, inspiratory muscle endurance, weaning changes, and increased pain scale in critically ill patients.[4,12] Other studies suggest that sleep quality disturbances can result in psychological disturbances such as agitation, confusion, and delirium.[13,14]

Interventions can be provided to improve sleep quality both pharmacologically and non-pharmacologically.[15] Pharmacological interventions typically administered in ICCU include sedative and analgesic drugs that help improve patient sleep quality.[16] Pharmacological interventions may have side effects such as cognitive function impairment, dependency risks, decreased ventilation, and disruption of normal sleep function.[17,18]

Therefore, non-pharmacological interventions are needed to improve sleep quality in critically ill patients. Non-pharmacological interventions help reduce side effects such as dependency when pharmacological interventions are administered.[19] Non-pharmacological interventions that can be provided to improve sleep quality in the ICCU include providing physical aids such as earplugs and eye masks.[20] Other interventions that can be provided include relaxation techniques (massage and foot soaking), music therapy, quiet time, acupuncture, and aromatherapy.[21,22]

Various research results indicate that light and noise are causes of sleep disturbances in patients. Therefore, the use of earplugs and eye masks is chosen as one of the intervention methods to help reduce sleep

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disturbances, thus improving sleep quality for ICCU patients.[23] The use of earplugs and eye masks is safe for coronary heart patients. In addition to being safe, earplugs and eye masks are also proven to be effective in assessing patient sleep quality, cost-effective, easy to implement in large groups, and well-tolerated by the body.[24,25]

The use of a combination of eye masks and earplugs as a non-pharmacological intervention has not been specifically explored in intensive care settings such as the ICCU. Previous studies may have included single sleep interventions, such as the use of an eye mask or earplugs alone, but this study explores the synergistic effects of using both together.[26] Other research results also indicate that the implementation of earplugs and eye masks post-cardiothoracic surgery is efficient and straightforward.[27,28] Earplugs and eye masks improve sleep quality and patient satisfaction and can reduce pain intensity.[29] Additionally, earplugs and eye masks are proven to contribute to faster recovery, fewer morbidities, and reduced costs.

Aim

This research is conducted to the influence of providing eye masks and earplugs to improve the quality of sleep in ICCU patients.

Material and methods

Study design

This study employs a quasi-experimental research method with a one-group without control approach. The study investigates the influence of providing eye masks and earplugs to improve the sleep quality of ICCU patients. Patients receiving the treatment of eye masks and earplugs are examined. The sample is a portion of the total population with certain characteristics. Samples are representatives of the population being studied. Sampling is conducted using total sampling technique. The sample size for this study is 40 patients admitted to the ICCU with criteria including a minimum of 3 days of hospitalization, GCS score of 14−15, bedside monitor placement, and willingness to participate as respondents (Fig. 1). The patients taken were patients with heart problems and not post-operative patients. Additionally, patients with cardiac rhythm disorders, heart failure, recent Percutaneous Coronary Intervention, severe respiratory disorders, and severe neurological or psychiatric disorders were not included as respondents in the study. Midazolam therapy was stopped before the ear plug and eye mask intervention was given, this was to determine the maximum effect of the intervention given.

The respondents were provided with earplugs, made of silicone material, and eye masks, made of cotton material, during sleep for three days. The sleep quality of the respondents was measured before they were given earplugs and eye masks. Three days after the intervention, their sleep quality was measured again. Sleep quality observations were conducted daily, but the analyzed results focused on sleep quality before and after three days of earplug and eye mask usage.

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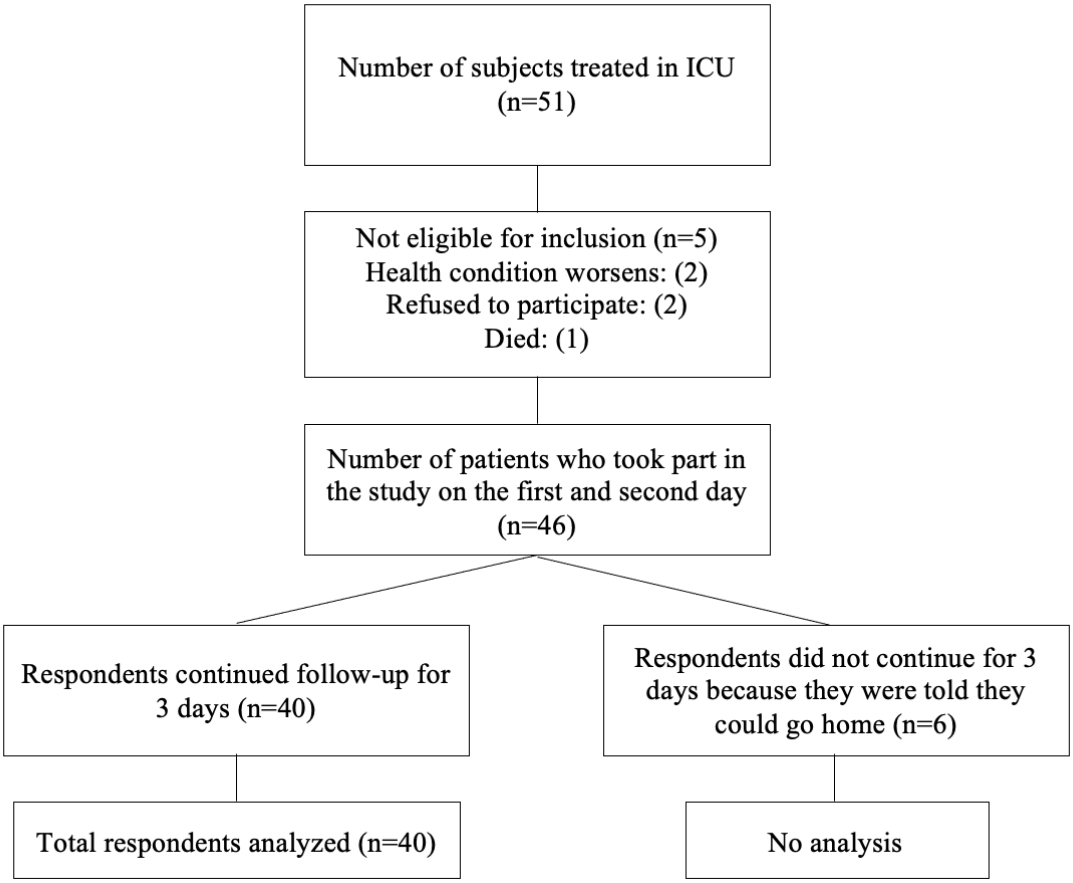

Fig. 1. Flow diagram for participant assignment in this study

Instruments

This study utilizes the Richard Campbell Sleep Questionnaire (RCSQ) to assess various aspects of an individual's sleep quality based on their experiences and perceptions. It comprises a series of questions designed to evaluate various aspects of sleep, such as sleep duration, difficulty falling asleep, sleep quality, and the impact of sleep on daily activities. The purpose of this questionnaire is to provide a comprehensive understanding of an individual's sleep quality, which can aid in the diagnosis, management, and evaluation of sleep disorders and provide useful information for intervention planning. The RCSQ consists of questions covering various aspects of sleep quality, including sleep duration, difficulty falling asleep, sleep quality, and the impact of sleep on daily well-being. Each response in the questionnaire is assigned a value based on a predefined scale. These values can then be summed or calculated in a specific manner to generate a total score reflecting overall sleep quality. Higher scores indicate better sleep quality (>50), while lower scores indicate poorer sleep quality (≤50).

Data analysis

The collected data will be analyzed using the Pearson correlation test in SPSS version 26 statistical software. This research uses the Wilcoxon test that there is an effect if the p value <0.05.

Ethical approval

The study has obtained ethical clearance with number 211.6/II.3.AU/F/KEPK/VII/2023 and received permission from the local health authorities. Adequate information for informed consent has been provided, and patient data confidentiality is maintained

Results

Table 1, indicates that several risk factors such as gender, excess body mass index (BMI), smoking history, alcohol consumption, medication use history, and sleep problem history have a significant association with sleep quality. Eye mask and ear plug have an impact on sleep quality in patients with a minimum duration of usage of three days, like Table 2.

Table 1. Characteristic of respondent (n=40)

	n	**%**	**Median (Min–Max)**	**Mean±SD**	**r**	**p**
Sex						
Male	26	65	1 (1–2)	1.35±0.48	0.39	0.013
Female	24	35				
Education						
No	17	42.5	2 (1–3)	1.72±0.71	0.92	0.571
Elementary–senior	17	42.5				
School	6	15				
College						
Chronic disease history	28	70	1 (1–2)	1.3±0.46	0.066	0.687
No	12	30				
Yes						
BMI	9	22.5	2 (1–3)	2.07± 0.72	0.647	<0.001
Underweight	19	47.5				
Normal	12	30				
Overweight						
Smoking history	17	42.5	2 (1–2)		0.239	0.038

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No	23	57.5		1.57±0.5		
Yes						
Alcohol consumption						
Never	22	55	1 (1–2)		0.414	0.008
Occasional	18	45		1.45±0.51		
History of medication use						
No	13	32.5	2 (1–2)		0.553	<0.001
Yes	27	67.5		1.67±0.47		
Sleep disorder history						
No	18	45	2 (1–2)		0.798	<0.001
Yes	22	55		1.55±0.51		

Table 2. Results of Wilcoxon test (n=40)*

	Median (Min–Max)	**Mean±SD**	**p**
Sleep Quality before EMEP	48 (38–72)	51.75 ± 9.98	<0.001
Sleep Quality after EMEP	60 (50–80)	62.2 ± 6.15	

* EMEP – eye mask and ear plug

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Discussion

Gender is a multifaceted construct that encompasses biological, psychological, and sociocultural dimensions. In the realm of sleep science, researchers have long been interested in understanding how gender influences sleep patterns, behaviors, and ultimately, sleep quality. The significance of gender in relation to sleep quality can be analyzed through both theoretical frameworks and empirical evidence.[30] Gender roles and expectations imposed by society can shape individuals' behaviors, including sleep habits. Differences in body structure between men and women, such as differences in body size and composition, can also influence comfort during sleep and the tendency to experience certain sleep disorders. Traditional gender norms may prescribe different sleep patterns and expectations for men and women.[31] For example, societal expectations regarding caregiving responsibilities and career demands may influence how individuals allocate their time for sleep.[32] Additionally, gender differences in coping strategies for stress and emotional regulation may impact sleep quality. Hormones such as estrogen and progesterone in women and testosterone in men have a role in regulating sleep cycles and sleep quality. These hormonal fluctuations can influence sleep patterns and sleep experiences between both sexes.

Education level serves as a key determinant influencing health outcomes, including sleep quality.[33] Higher education levels are often associated with greater access to resources, health literacy, and socioeconomic

status, which in turn may contribute to better sleep hygiene and overall well-being.[34] However, the relationship between education level and sleep quality may not always be straightforward.[35,36] Factors such as work-related stress, irregular schedules, and academic pressures may adversely affect sleep quality among individuals with higher education levels. Contrary to expectations, several studies have reported mixed or inconclusive findings regarding the relationship between education level and sleep quality.[27,29] While some studies suggest a positive association between higher education levels and better sleep quality, others have found no significant correlation or even a negative relationship. These discrepancies may be attributed to methodological differences, sample characteristics, and confounding variables not adequately controlled for in analyses.

Chronic disease history can impact sleep quality through various pathways. The presence of chronic conditions such as diabetes, cardiovascular disease, or respiratory disorders may lead to symptoms such as pain, discomfort, or nocturnal symptoms that disrupt sleep.[3,37] Additionally, the management of chronic diseases often involves medication regimens, which may have side effects or influence sleep patterns. Psychological factors such as stress, anxiety, and depression commonly co-occur with chronic illnesses and can further exacerbate sleep disturbances.[11,38] Similarly, the relationship between chronic disease history and sleep quality appears to be nuanced.[39] While certain chronic conditions, such as chronic pain syndromes or respiratory disorders, are commonly associated with sleep disturbances, the presence of other chronic diseases may not necessarily predict poor sleep quality.[40] Additionally, factors such as disease severity, comorbidities, and treatment adherence may influence the impact of chronic diseases on sleep.

Higher BMI levels are often associated with lifestyle factors such as poor dietary habits and sedentary behaviors, which can contribute to sleep disturbances such as obstructive sleep apnea and insomnia. Moreover, excess adiposity may lead to physiological changes, including alterations in hormonal regulation and inflammation, which can further impact sleep quality.[41] Numerous studies have provided empirical support for the significant relationship between BMI and sleep quality. Research consistently demonstrates that individuals with higher BMI levels are more likely to experience sleep disturbances, including sleep fragmentation, decreased sleep efficiency, and increased prevalence of sleep disorders such as obstructive sleep apnea.[18,42] Moreover, longitudinal studies have shown bidirectional associations between BMI and sleep disturbances, suggesting a reciprocal relationship between these factors over time.

Smoking behavior, on the other hand, is linked to various adverse health outcomes, including sleep disturbances. Nicotine, a key component of cigarettes, acts as a stimulant and can disrupt sleep architecture, leading to difficulties in falling asleep and maintaining sleep.[9] Additionally, smoking is associated with an increased risk of respiratory conditions such as chronic obstructive pulmonary disease and sleep-related breathing disorders, which can exacerbate sleep problems.[43] Smoking history has been consistently linked to poor sleep quality in empirical studies. Smokers are more likely to report difficulties falling asleep, waking up during the night, and experiencing non-restorative sleep compared to non-smokers.[44] Moreover,

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smoking cessation interventions have been shown to improve sleep quality among former smokers, further supporting the causal relationship between smoking behavior and sleep disturbances. Although it does not directly affect sleep depth, nicotine can cause lighter sleep and easier awakening, disrupting normal sleep patterns.

Social determinants of health theory offer valuable insights into the relationship between alcohol consumption, medication use, and sleep quality. Alcohol, as a central nervous system depressant, can initially induce feelings of relaxation and drowsiness, leading individuals to believe it aids in sleep.[45,46] However, alcohol disrupts sleep architecture by suppressing rapid eye movement sleep and increasing awakenings during the night, ultimately resulting in poorer sleep quality. Research consistently demonstrates that acute and chronic alcohol consumption are associated with sleep disturbances, including difficulties falling asleep, frequent awakenings during the night, and non-restorative sleep.[47] Moreover, longitudinal studies have shown that reducing alcohol consumption or abstaining from alcohol altogether can lead to improvements in sleep quality. The results of the analysis we carried out on the RSCQ questionnaire, in the domain we found that 22 respondents had a history of alcohol consumption. Although alcohol has an initial sedative effect that can speed up the time to sleep, consuming alcohol before bed often causes an increase in sleep latency as the alcohol begins to metabolize in the body. The stimulant effect of alcohol that lasts after a few hours can cause wakefulness in the middle of the night.

Medication use history, particularly the use of certain classes of drugs such as sedatives, antidepressants, or stimulants, can also influence sleep quality. Sedative medications, commonly prescribed for anxiety or insomnia, may lead to dependence and rebound insomnia, exacerbating sleep disturbances over time.[48] Conversely, stimulant medications used to treat conditions such as attention-deficit hyperactivity disorder can interfere with sleep onset and maintenance, leading to fragmented sleep patterns and reduced sleep quality. The result identified specific classes of medications, such as benzodiazepines, antipsychotics, and antihistamines, as having adverse effects on sleep quality.[49] Additionally, polypharmacy, or the concurrent use of multiple medications, has been associated with increased risk of sleep-related side effects and poor sleep outcomes.

Individuals learn from their experiences and observations, and their behaviors are influenced by cognitive processes such as attention, memory, and motivation. In the context of sleep disorders, individuals with a history of sleep disturbances may develop maladaptive sleep behaviors or negative beliefs about sleep, perpetuating the cycle of poor sleep quality.[18,31] Additionally, psychosocial factors such as stress, anxiety, and depression, which are commonly associated with sleep disorders, can further exacerbate sleep disturbances.

The Biopsychosocial Model of Health emphasizes the interaction between biological, psychological, and social factors in shaping health outcomes. Sleep disorders may arise from a combination of genetic predispositions, neurobiological abnormalities, and environmental triggers.[21] Biological factors such as

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alterations in neurotransmitter systems or disruptions in circadian rhythms can contribute to the development and maintenance of sleep disturbances. Psychological factors such as maladaptive coping strategies or dysfunctional beliefs about sleep can perpetuate sleep disorders. Social factors such as work schedules, familial responsibilities, and socioeconomic status can also influence sleep quality and exacerbate sleep disturbances.[19,22]

Individuals with a history of sleep disorders, such as insomnia, sleep apnea, or restless legs syndrome, are more likely to report poorer subjective sleep quality, increased sleep latency, and decreased sleep efficiency compared to those without sleep disorders. Objective measures, such as polysomnography, also reveal alterations in sleep architecture and sleep continuity among individuals with sleep disorders.[17] Persistent sleep disturbances can lead to long-term consequences such as daytime sleepiness, impaired cognitive function, mood disturbances, and decreased quality of life. Additionally, untreated sleep disorders are associated with an increased risk of comorbidities such as cardiovascular disease, diabetes, and psychiatric disorders, highlighting the importance of early detection and intervention.[8,30]

Optimizing the sleep environment can promote better sleep quality. External stimuli such as light and noise can disrupt sleep onset and maintenance. Eye masks provide a physical barrier to block out light, thereby creating a darker sleep environment conducive to sleep initiation and maintenance.[50,51] Similarly, earplugs reduce the transmission of external noise, minimizing disturbances that can disrupt sleep continuity and depth. Eye masks and earplugs can serve as behavioral strategies to modify sleep-related behaviors and promote healthier sleep patterns.[29] By incorporating these aids into bedtime routines, individuals can signal to their bodies that it is time to sleep, facilitating the onset of sleep and enhancing sleep efficiency.

Based on identification and analysis on the observation sheet using RSCQ. The domains contain sleep depth, sleep latency, awakening from sleep, ability to return to sleep when awakened and as an additional domain, namely noise. We analyzed that 22 respondents experienced a significant increase, except for the noise domain, considering that in the treatment room there was the sound of the tools used by the respondents.

One of the primary challenges in managing sleep quality in patients with heart disease is the sleep disturbances caused by physiological factors such as shortness of breath and difficulty finding a comfortable sleeping position. In this study, all patients received adequate oxygen therapy to ensure their oxygen needs were met during sleep. Additionally, patients in the ICCU were always carefully positioned to ensure maximum comfort and to prevent complications that might arise from uncomfortable positions. Proper sleep position adjustments, such as the semi-Fowler position, can help reduce symptoms of shortness of breath and improve patient comfort during sleep.

Research utilizing subjective measures such as self-reported sleep quality and objective measures such as polysomnography consistently show that individuals using these aids experience longer sleep duration, reduced sleep latency, and increased sleep efficiency compared to those without them.[26,29] Individuals who

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regularly use these aids report improvements in overall sleep satisfaction, daytime functioning, and mood regulation. Additionally, intervention studies involving randomized controlled trials have shown that the provision of eye masks and earplugs to individuals with sleep disturbances leads to significant improvements in sleep parameters compared to control groups. The research has not discussed environmental noise levels, lighting levels, and patient fatigue and stress levels, so this can be added when conducting further research

Conclusion

This study investigates the influence of using eye masks and earplugs on improving sleep quality among patients in the ICCU. It was found that the use of eye masks and earplugs significantly improves patients' sleep quality, as evidenced by an increase in sleep duration, reduction in sleep onset latency, and improvement in sleep efficiency. These findings support the theories of sleep environment and cognitive-behavioral interventions as approaches to enhancing sleep quality. The implications of this study are that providing eye masks and earplugs can serve as simple and effective non-pharmacological interventions to enhance patients' sleep quality in the ICCU.

Further relevant research includes conducting comparative studies between the use of eye masks and earplugs and other non-pharmacological interventions, such as relaxation or music therapy, to evaluate the relative effectiveness of each intervention in improving sleep quality. Additionally, investigating the effects of using eye masks and earplugs on patients with other critical conditions outside the ICCU would evaluate the generalizability of these findings to a broader population.

Declarations

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Author contributions

Conceptualization, B.W. and P.A.W.S.; Methodology, B.W. and W.U.; Validation, B.W. and E.R.; Formal Analysis, P.A.W.S. and W.U.; Investigation, F.K.; Resources, P.A.W.S. and E.R.; Data Curation, B.W.; Writing – Preparation of Original Draft, B.W. and P.A.W.S.; Writing – Review & Editing, B.W.; Visualization, P.A.W.S.; Supervision, B.W.

Conflicts of interest

All author declare have no conflict of interest.

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Ethics approval

This study was approved by the local ethics committee (Health Research Ethics Committee in Universitas Muhammadiyah Gombong, date: July 25, 2023 decision number: 211.6/II.3.AU/F/KEPK/VII/2023).

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