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Sleep Quality and Its Dimensions in Indonesian Shift and Non-Shift Workers

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ABSTRACT

Sleep quality is crucial in maintaining overall well-being, but is often disrupted by irregular working hours. Shift work, as an example of irregular working hours, has been linked to disrupted sleep due to circadian desynchronization. Previous studies worldwide on the difference in sleep quality between shift and non-shift workers have remained inconsistent, likely due to variations in work environments, behavioral and sociodemographic factors, and sample sizes. The objective of this study was to evaluate variations in sleep quality between shift and non-shift workers and to explore the underlying factors associated with sleep disruption in both groups. A cross-sectional study was conducted involving 218 workers (99 shift workers and 119 non-shift workers). The Pittsburgh Sleep Quality Index (PSQI) was applied to assess sleep quality, followed by statistical analyses to compare overall and individual component scores between groups. No significant difference was found in global PSQI scores between shift (8.75±3.01) and non-shift workers (8.22±2.8). However, when we evaluated sleep components between the two groups, shift workers showed significantly poorer subjective sleep quality ($p = 0.0375$) and lower sleep efficiency ($p = 0.04471$). Further analysis revealed significant associations between PSQI scores, shift frequency, and the number of diseases. Higher shift frequency and a greater number of diseases were associated with increased PSQI scores, indicating poorer sleep quality. These findings suggest that while overall sleep quality may not differ substantially by work schedule, specific components and individual factors, such as health status and workload frequency, contribute to variations in sleep quality.

1. Introduction

Good sleep quality is a vital biological process that supports recovery, immune regulation, metabolic stability, and cognitive function (Rajuskar & Badarke 2024). Disruptions in sleep quality can trigger dysfunction in many body systems, including metabolic disorders (Chasens *et al.* 2021), increased risk of cardiovascular diseases (Huang *et al.* 2020), neuropsychiatric disorders (Winkelman & de Lecea 2020), and decreased work productivity (Ishibashi & Shimura 2020). Sleep quality in working individuals is influenced not only by individual health status and lifestyle, but also by occupational demands, including shift work and irregular working hours (Tarhan *et al.* 2018).

Some shift work patterns require individuals to remain awake and active during night time and may

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contribute significantly to sleep quality disruption (Vetter *et al.* 2015). Numerous studies from several countries, such as Singapore and Turkey, have demonstrated that shift workers in day/night time experience poorer sleep quality compared to those working regular hours in daytime (Helvaci *et al.* 2020; Thach *et al.* 2020). However, studies in Indonesia have shown inconsistent findings, with some reporting significant differences between shift and non-shift workers (Saftarina & Hasanah 2014; Pratama & Wijaya 2019), while others found unclear distinction between the two groups (Rahmawati & Agustin 2023; Azzahra *et al.* 2024). These inconsistencies between previous studies from other countries and those conducted in Indonesia may be attributable to differences in work environments, behavioral, and sociodemographic factors, as well as sample sizes.

Many Indonesian studies have relied on relatively small sample sizes and have focused on workers within a single, homogeneous occupational setting, limiting the generalizability of their findings (Saftarina & Hasanah 2014; Pratama & Wijaya 2019; Rahmawati & Agustin 2023; Azzahra *et al.* 2024). In contrast, studies from other countries have often included larger and more diverse populations, with varied work schedules and over 200 respondents from a range of job types and occupational settings (Helvaci *et al.* 2020; Thach *et al.* 2020). The present study addresses these methodological gaps by including a larger and more diverse sample of Indonesian workers across multiple occupational sectors while also examining behavioral and sociodemographic correlates of sleep quality. The study therefore aims to evaluate and compare sleep quality between shift and non-shift workers, with particular emphasis on identifying the differences in sleep quality, and also behavioral and sociodemographic factors associated with sleep quality.

2. Materials and Methods

2.1. Time and Place of Study

This research employed a cross-sectional study design. The study was conducted in February 2025 using both physical questionnaires and an online Google Form. All collected data were analyzed at the Department of Biology, Faculty of Mathematics and Natural Sciences (FMIPA), IPB University, Bogor, Indonesia.

2.2. Subjects/Respondents

The participants of this study were selected randomly and consisted of both shift and non-shift workers. The eligibility criteria for participation included: (1) currently employed as a shift or non-shift worker, (2) willingness to participate by completing informed consent, and (3) ability to access and fill out the questionnaires either physically or online. The Google Form questionnaire consisted of two main sections: the first section is sociodemographic data collection, and the second section assessed sleep quality using the Pittsburgh Sleep Quality Index (PSQI).

The sociodemographic variables collected included sex, age, occupation, monthly salary, year of employment commencement, marital status, daily working hours, weekly working days, work system (categorized as shift and non-shift), and health conditions experienced in the past month. Information on health conditions was obtained through an open-ended question, with examples of diseases potentially related to sleep quality provided (e.g. digestive disorders, respiratory problems and neurological disorders such as headaches or migraines). Respondents could also report any conditions that were not listed. For respondents who were categorized as shift workers, supplemental information was collected regarding their work schedules, including day shifts and night shifts.

2.3. Measurement

2.3.1. Questionnaire Administration

This study was approved by the Ethical Commission of Health Research Southeast Sulawesi, Indonesia (ref: 228/KEPK-IAKMI/IX/2024). Before data collection, the researcher explained the study's purpose and interview procedures to all respondents. For the physical questionnaire, participants provided written informed consent before voluntarily participating. For the online questionnaire (Google Form), an introductory page presented the study's purpose, background, and researcher contact details, followed by a question asking whether the participant agreed to take part in the study. Only those who indicated agreement were able to proceed to complete the PSQI and sociodemographic questionnaire.

2.3.2. Sleep Quality Assessment

The quality of sleep was measured using the Pittsburgh Sleep Quality Index (PSQI). This questionnaire evaluates

sleep quality over the past month, consisting of seven components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Each component is scaled from 0 (no difficulty) to 3 (severe difficulty), except one component, about subjective sleep quality which scaled from 0 (very good) to 3 (very bad), resulting in a global PSQI score ranging from 0 to 21. Good sleep quality is indicated by a total PSQI score of <5, whereas poor sleep quality is indicated by a score >5 (Buysse *et al.* 1988). To assess the consistency of the items, a reliability test was conducted using Cronbach's alpha. In this study, the PSQI showed a Cronbach's α of 0.58, which can be considered acceptable given its multidimensional structure, where each component assesses different but related aspects of sleep quality (Buysse *et al.* 1988).

2.3.3. Statistical Analysis

Descriptive statistics were analyzed using RStudio version 2022.02.1 with R version 4.3.2. To determine which sociodemographic variables might be predictive of sleep quality, a generalized linear model (GLM) was used. The dependent variable was the PSQI score, and the independent variables included age, sex, marital status, working hours per day, working days per week, income monthly, number of shift work, and number of diseases. To examine whether there were significant differences in sleep quality between shift and non-shift workers, the Post Hoc and Mann-Whitney U test were performed due to the non-normal distribution of the PSQI data. A P-value of <0.05 was considered statistically significant.

3. Results

This study involved 218 respondents, consisting of 99 shift workers (45.41%) and 119 non-shift workers (54.59%). Post Hoc power analysis for the difference in proportions between the two groups indicated a small effect size (Cohen's h = 0.12) with a statistical power of 0.14 at α = 0.05, suggesting limited ability to detect small group differences. A total of 97 participants completed the physical questionnaire, with a mean PSQI score of 8.42, while 121 participants completed the online form, with a mean PSQI score of 8.49. The Mann–Whitney U test showed no significant difference between physical and online responses (p = 0.932); therefore, the data were combined for further analysis.

The majority of participants were male (53.21%). More than half of the participants (62.85%) worked <8 hours per day, and 51.83% worked five days per week (Table 1). Shift workers had a higher global sleep score (8.75±3.01) compared to non-shift workers (8.22±2.80), although the difference was not statistically significant (Mann-Whitney U test, P = 0.1686) (Table 2). Shift workers reported poorer subjective sleep quality (1.57±0.73) than non-shift workers (1.39±0.64; P = 0.0375), and had lower sleep efficiency (0.43±0.74 vs. 0.27±0.62; P = 0.04471) (Table 2). We found that poor sleep quality (PSQI > 5) was prevalent in both work system groups (Table 3). A total of 101 non-shift workers (84.9%) and 88 shift workers (88.9%) were classified as having poor sleep quality. The proportion of shift workers sleeping less

Table 1. Sociodemographic of the respondents

Variable	Category	Number of respondents (%) / Mean ± SD
Age (years)	Overall	26.3±7.51
	Shift workers	26.5±8.20
	Non-shift workers	26.1±6.92
Sex	Male	116 (53.21)
	Female	102 (46.79)
Marital status	Married	45 (20.64)
	Unmarried	173 (79.36)
Working hours per day (h)	< 8	137 (62.85)
	9-12	70 (32.10)
	>12	11 (5.05)
Working days per week	3	2 (0.92)
	4	4 (1.38)
	5	113 (51.83)
	6	87 (39.91)
	7	12 (5.50)
Income monthly (USD=16,517.30 IDR)	n < Rp. 1,500,000	43 (19.72)
	IDR. 1,500,001 < n < Rp. 3,500,000	56 (25.69)
	IDR. 3,500,001 < n < Rp. 5,500,000	46 (21.10)
	IDR. 5,500,001 < n < Rp. 7,500,000	35 (16.06)
	IDR. 7,500,001 < n < Rp. 9,500,000	22(10.09)
	IDR. 9,500,001 < n < Rp. 11,500,000	6 (2.75)
	IDR. n > 11,500,001	10 (4.58)
Work system	Shift	99 (45.41)
	Non-shift	119 (54.59)
Shift working	0 (non-shift)	118 (54.13)
	2 shift	47 (21.56)
	3 shift	35 (16.06)
	4 shift	18 (8.26)
Number of diseases	0	87 (39.91)
	1	101 (46.33)
	2	21 (9.63)
	3	8 (3.67)
	4	1 (0.46)

Table 2. Comparison of Pittsburgh Sleep Quality Index (PSQI) component scores and global score between shift and non-shift workers

Parameters	Shift worker (n=99) Mean ± SD	Non-shift worker (n=119) Mean ± SD	P-value[a]
Subjective sleep quality	1.57±0.73	1.39±0.64	0.0375*
Sleep latency	1.45±0.95	1.29±0.85	0.231
Sleep duration	1.82±1.13	1.59±1.07	0.1151
Sleep efficiency	0.43±0.74	0.27±0.62	0.04471*
Sleep disturbances	1.34±0.63	1.35±0.53	0.8673
Use of sleep medications	0.16±0.49	0.17±0.6	0.4317
Daytime dysfunction	1.97±0.83	2.15±0.82	0.08895
PSQI global score	8.75±3.01	8.22±2.8	0.1686

[a]P-value from the Mann-Whitney U test

Table 3. Poor sleep quality (PSQI > 5) by the work system

Work system	Total participants (n)	Poor sleep, n (%)
Shift	99	88 (88.9)
Non-shift	119	101 (84.9)

Table 4. Sleep duration categories among shift and non-shift workers

Work system	<5 hours (%)	5-6 hours (%)	>6 hours (%)
Non-shift	26.05	25.21	48.74
Shift	41.41	20.20	38.38

than five hours daily was higher (41.41%) than non-shift workers (26.05%). Conversely, a greater percentage of non-shift workers (48.74%) reported sleeping more than six hours (Table 4).

We identified sociodemographic factors associated with sleep quality (PSQI score) in both groups, shifts and non-shifts (Table 5). The number of shifts a worker has, the higher their PSQI score, indicating poorer sleep quality (Estimate = 0.36775, p = 0.00741). The more diseases a worker has, the higher their PSQI score, indicating poorer sleep quality (Estimate = 1.35935, p<0.001). Other variables such as age, sex, marital status, working hours per day, working days per week, and income showed no significant association with sleep quality.

Other than the number of diseases, we collected the data related to the kind of disease respondents have had in the last month. The most commonly reported conditions were neurological disorders (39%) and digestive disorders (24.3%) (Table 6). Neurological disorders in this study included complaints such as headaches, memory decline, and vertigo. Digestive problems primarily referred to symptoms like gastric discomfort, acid reflux, and other gastrointestinal disturbances. Cardiovascular disorders included hypotension, hypertension, anemia, and heart disease. Respiratory disorders consisted of asthma, sinusitis, flu, and sore throat. Physiological disorders were represented by anxiety and panic attacks.

4. Discussion

4.1. Comparison of Sleep Quality Between Shift and Non-Shift Workers

This study found that most respondents had poor sleep quality, with PSQI scores exceeding the threshold (>5) in 88.9% of shift workers and 84.9% of non-shift workers. This indicates that poor sleep was a common issue across the sample, with no statistically significant difference, regardless of work system (shift or non-shift) (Table 2). This finding aligns with a subset of Indonesian studies reporting no significant differences in sleep quality between the two groups (Rahmawati & Agustin 2023; Azzahra *et al.* 2024), though other prior studies have reported contrasting results. This study suggests that both shift and non-shift workers may be affected by factors, likely due to the combined impact of behavioral and environmental stressors, rather than shift work in itself.

4.2. Comparison of Sleep Quality Components Between Shift and Non-Shift Workers

This study found a significant difference in subjective sleep quality between shift and non-shift workers. Shift workers were more likely to rate their sleep as "bad" to "very bad", whereas non-shift workers tended to report more positive evaluations. These results are consistent with Alshahrani *et al.* (2017), who also reported poorer

Table 5. Coefficients of the generalized linear model (GLM) examining associations between sociodemographic factors and PSQI scores

Variable	Estimate	Std. Error	t Value	p Value	Significance
(Intercept)	5.73173	2.08220	2.753	0.00643	*
Age	0.05344	0.03645	1.466	0.14412	
Sex (Female)	0.62726	0.39645	1.602	0.11076	
Marital status (married)	-1.25615	0.64010	-1.962	0.05104	
Working hours per day	0.11582	0.09492	1.220	0.22377	
Working days per week	-0.13449	0.30074	-0.447	0.65519	
Income monthly	-0.17931	0.11342	-1.581	0.11539	
Number of shift work	0.36775	0.13599	2.704	0.00741	**
Number of diseases	1.35935	0.23338	5.825	2.14e-08	***

Generalized linear model. A P<0.05 indicates statistical significance

Table 6. Distribution of illnesses experienced by respondents in the past month

Type of illness	Number of respondents (%)
Neurological disorders	85 (39.00)
Digestive disorders	53 (24.30)
Cardiovascular disorders	11 (5.05)
Obesity/overweight	11 (5.05)
Respiratory disorders	9 (4.13)
Musculoskeletal disorders	4 (1.83)
Psychological disorders	3 (1.38)
Fever	1 (0.46)
Sleep disorders	1 (0.46)
High cholesterol	1 (0.46)
Inflammation	1 (0.46)
Frequent nighttime urination	1 (0.46)

subjective sleep quality among shift workers, while non-shift workers more often rated their sleep as "very good" to "fairly good". Such findings suggest that shift workers are aware of how irregular schedules disrupt their sleep patterns, which may influence their negative perception of sleep quality.

Sleep efficiency, defined as the proportion of time spent asleep relative to time spent in bed, was also lower among shift workers. They showed both reduced average sleep efficiency and greater variability compared to non-shift workers. This likely reflects the irregularity of shift schedules, which often shorten sleep duration and interfere with consistent rest. Within the past month, 41.4% of shift workers reported sleeping fewer than five hours per night, compared with 26.1% of non-shift workers. This difference underscores the higher prevalence of insufficient sleep among shift workers. Similar trends were reported by Alshahrani *et al.* (2017) and Niu *et al.* (2017), who found reduced sleep efficiency among rotating night-shift workers, and by Zhang *et al.* (2016), who noted that both current and former shift workers were more likely to experience poor sleep compared to those employed only during the day.

Taken together, these results suggest that shift workers experience poorer subjective sleep quality, lower sleep efficiency, and shorter sleep duration than non-shift workers. However, the observed reduction in sleep efficiency may also be influenced by factors not captured by the PSQI. Since this study focused primarily on work schedules, it did not explore daily activities or lifestyle factors that might further explain differences in sleep quality.

4.3. Sociodemographic Factors Associated with PSQI Scores

This study found that none of the examined sociodemographic variables—age, sex, marital status, income, working hours per day, or working days per week—showed a statistically significant association with sleep quality. The absence of significant associations between sociodemographic variables and sleep quality in this study may be partly explained by the characteristics of the respondents. The average age of participants was relatively young in both groups (26.5±8.20 years for shift workers and 26.1±6.92 years for non-shift workers), which is consistent with age ranges where nighttime screen use and other technology-related habits are common (Hapsari *et al.* 2024; Nitschke & Bartz 2023). Such behaviors have been shown to disrupt circadian rhythms by suppressing melatonin production, which may contribute to poor sleep quality (Thach *et al.* 2020; Cleary-Gaffney 2022). Moreover, the majority of participants were unmarried (79.36%), which may have reduced the power to detect effects related to marital status. Income distribution was also relatively concentrated in the lower to middle ranges, and working hours per day were predominantly under eight hours,

which may have attenuated differences in sleep quality attributable to these factors.

Our regression analysis revealed significant associations between poor sleep quality and both the number of reported diseases and the number of shifts. Consistent with our results, a population-based study in Japan reported a linear relationship between the number of diagnosed diseases and increased PSQI scores (Hayashino *et al.* 2010). Similarly, research from Sweden found that individuals with a higher number of health problems, particularly older adults, reported more frequent sleep complaints (Fagerström & Hellström 2011). Together, these studies suggest that an accumulation of physical diseases may impair sleep through both physiological discomfort and psychological distress.

In this study, the majority of reported health conditions were closely related to sleep quality, particularly those that can directly disrupt sleep through discomfort, pain, or other nocturnal symptoms. The most commonly reported conditions among respondents in the past month in this study were neurological disorders and digestive disorders. Prior research further highlights that neurological diseases are strongly associated with characteristic disruptions in sleep (Gao *et al.* 2020; Van Leeuwen *et al.* 2024; Almansour *et al.* 2025). In addition, large-scale studies have found strong associations between digestive symptoms and sleep disturbance, with conditions such as irritable bowel syndrome and gastroesophageal reflux disease frequently presenting with poor sleep quality due to symptoms like abdominal pain and heartburn (Han & Heitkemper 2019; Hyun *et al.* 2019).

In addition to disease burden, our findings also revealed that the number of shifts worked was associated with sleep quality. Specifically, individuals working within three-shift systems—typically involving 8-hour rotations—reported poorer sleep outcomes compared to those in two-shift systems with 12-hour rotations. Workers on two-shift schedules were found to experience better recovery between shifts and more opportunities for restorative rest (Hong *et al.* 2021). While longer shifts may lead to increased physical fatigue, they may also provide longer rest periods and more consistent sleep schedules, which can support better overall sleep quality.

This study offers valuable insights into the relationship between shift patterns, disease prevalence, and sleep quality. However, it is imperative to acknowledge the study's limitations. Due to the cross-sectional design of the study, it remains uncertain whether shift work or disease burden is the causative agent of the observed changes in sleep quality. In addition, while our dataset included workers from a 4-shift system, the small sample size of this group and the lack of supporting literature prevented us from conducting a detailed comparative analysis. As a result, our discussion focused primarily on 2- and 3-shift systems, which are more common and better represented in occupational health research. Future studies should include larger samples of 4-shift workers and apply longitudinal designs with objective sleep measures to better capture long-term effects of shift systems. In addition, accounting for behavioral and environmental factors such as caffeine intake, physical activity, bedroom environment, and light or noise exposure will be essential to more accurately assess the relationship between work schedules, health, and sleep outcomes.

Limitations of this study included the fact that data on participants' living locations and work arrangements (e.g., working from home, hybrid, or in the office) were not collected. This may limit the ability to account for contextual factors, such as travel time, environmental noise, and workplace flexibility, that may affect sleep quality. This study is also limited by the fact that it did not explore respondents' reasons for using or not using sleep medication. To determine whether this reflects behavioral differences between shift and non-shift workers, or is instead influenced by cultural factors in Indonesia. Future research should include these variables to provide a more comprehensive understanding of the factors influencing sleep.

We conclude that shift workers exhibited significantly poorer subjective sleep quality and sleep efficiency compared to non-shift workers, despite overall sleep quality scores being similar between the two groups. Moreover, higher shift frequency and greater numbers of self-reported diseases were associated with poorer sleep outcomes across both groups. These results underscore the importance of evaluating not only work schedules but also behavioral and health-related factors when addressing sleep quality in workers. Adapted interventions that account for shift intensity and individual health profiles are recommended to mitigate sleep disturbances in the workers.

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