



Impact of Shift Work on Nurse Fatigue and Productivity in an Indonesian Inpatient Ward: A Cross-Sectional Study

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Abstract

Shift work, particularly night shifts, is known to affect the health and productivity of healthcare workers. However, there is limited research on how shift work impacts nurses in low-resource settings, such as secondary hospitals in Indonesia. This study aims to explore the effects of different shift types on nurse fatigue and productivity in Indonesia, filling a critical gap in the literature. A cross-sectional study was conducted with 150 nurses from Rumah Sakit Umum Daerah Deli Serdang (RSUDDS) in Medan, Indonesia. Participants were selected using stratified random sampling based on their shift types (morning, evening, night). Fatigue was measured using the Nurse Fatigue Scale (NFS) and Pittsburgh Sleep Quality Index (PSQI), while productivity was assessed through both self-reports and objective task completion data. Statistical analyses included one-way ANOVA, multiple regression, and effect size calculations (Cohen's *d*). Night shift nurses reported significantly higher fatigue levels (mean NFS = 32.4) and lower productivity (mean self-reported productivity = 6.1) compared to morning (NFS = 28.3; productivity = 7.2) and evening shift nurses (NFS = 30.1; productivity = 6.9). The differences were statistically significant ($p < 0.01$). Cohen's *d* for the comparison of fatigue between night and morning shifts was 0.68, indicating a moderate effect. Multiple regression analysis revealed that fatigue ($\beta = -0.48$, $p < 0.001$), shift type ($\beta = -0.29$, $p < 0.01$), and work environment factors ($\beta = -0.35$, $p < 0.05$) were significant predictors of nurse productivity. Night shifts were strongly associated with higher fatigue and lower productivity among nurses. To mitigate these effects, hospitals should consider implementing policies such as limiting consecutive night shifts and providing structured rest breaks. Further research, particularly longitudinal studies, is needed to explore causal relationships and test scheduling interventions to optimize nurse well-being and performance.

Keywords: Shift work, Occupational health, Nurse productivity, Fatigue

INTRODUCTION

Indonesia's healthcare system, particularly within secondary hospitals, faces considerable challenges, exacerbated by the increasing dependence on shift work to ensure uninterrupted patient care. Nurses, who constitute the foundation of the healthcare workforce, are frequently required to work rotating shifts, including overnight duties, to accommodate the demands of medical services. While shift work is indispensable to hospital operations, it profoundly disrupts nurses' circadian rhythms, resulting in fatigue, sleep disturbances, and long-term health complications, including cardiovascular diseases, mental health disorders, and metabolic dysfunction (Kurniawati et al., 2024). These physiological and cognitive impairments adversely affect professional performance, diminishing efficiency, heightening the likelihood of errors, and ultimately compromising the overall quality of patient care.

According to data from the Indonesian Ministry of Health, Indonesia's healthcare system continues to grapple with workforce sustainability and the quality of care, particularly in secondary and rural hospitals. The national health system has identified shift work as a significant factor contributing to nurses' health issues, with many reporting chronic fatigue and declining mental well-being (Ministry of Health, Indonesia, 2023). These challenges are especially pronounced in secondary hospitals located outside major urban centers, where limited resources and insufficient infrastructure further hinder the support available to healthcare professionals.

Extensive research has established a global correlation between shift work particularly night shifts and increased fatigue as well as reduced productivity among healthcare professionals (Hidayat, 2025; Kurniawati et al., 2025). However, despite the widespread implementation of shift systems in Indonesian hospitals, particularly in secondary facilities outside urban centers, a significant gap remains in understanding their impact on nurses' well-being and performance in these settings (Angouw et al., 2016; Fatona, 2015). While some regional studies have examined the effects of shift work on health and occupational efficiency (Sunindijo et al., 2025; Syakurah et al., 2025), the specific consequences for nurses in Indonesia's resource-limited hospitals remain insufficiently explored.

Previous research on shift work has yielded conflicting findings. While some studies report significant declines in productivity and health among night shift workers, others identify mitigating factors such as workplace support, available resources, and effective coping mechanisms (Kurniawati et al., 2025). This disparity underscores the need for nuanced investigations that consider the unique determinants of nurses' fatigue and productivity in Indonesia's secondary hospitals. These factors are particularly critical in rural areas, where healthcare resources and support systems may be limited. This study examines secondary hospitals in Indonesia, with a specific focus on Rumah Sakit Umum Daerah Deli Serdang (RSUDDS) in Medan. By exploring the relationship between shift work, nurse fatigue, and productivity in this context, the research aims to generate valuable insights into the influence of workplace conditions such as hospital policies, support structures, and shift scheduling on nurse performance and well-being in resource-constrained environments. Furthermore, this study incorporates two key assessment instruments, the Nurse Fatigue Scale (NFS) and the Pittsburgh Sleep Quality Index (PSQI), alongside objective productivity metrics an analytical approach not previously explored in Indonesian studies.

The primary objective of this study is to evaluate the impact of shift work on nurse fatigue and productivity by comparing the effects of morning, evening, and night shifts. In

doing so, it seeks to examine how workplace factors, including job stress and supervisory support, influence these outcomes. This research represents the first study in Indonesian hospitals to integrate the Nurse Fatigue Scale (NFS) and the Pittsburgh Sleep Quality Index (PSQI) with objective productivity metrics, thereby advancing previous investigations that have focused on isolated factors. Furthermore, it addresses a significant gap in research concerning secondary hospitals outside major urban centers in Indonesia, where shift work systems remain underexplored. By centering on Rumah Sakit Umum Daerah Deli Serdang (RSUDDS), this study aims to generate critical insights that could inform more effective shift management strategies and interventions to enhance nurse well-being and productivity.

Theoretical frameworks, such as Karasek's Job Demand-Control-Support model, provide a valuable perspective for analyzing the dynamic interplay between job demands, autonomy, and support in mitigating fatigue and optimizing productivity among nurses. The findings of this study have the potential to guide the development of evidence-based policies and strategies aimed at improving nurse well-being, professional performance, and patient care outcomes. Additionally, these insights could contribute to broader healthcare system reforms, addressing key challenges identified by the Indonesian Ministry of Health.

METHODS

This study employed a cross-sectional design to assess nurse fatigue, productivity, and work environment factors during the six-month period from January to June 2025. While a longitudinal design would allow for causal inferences, a cross-sectional design was deemed more feasible due to time and resource constraints.

The sampling process followed a stratified random sampling technique. The hospital's wards were first divided into strata based on the type of shift work (morning, evening, and night shifts). Each stratum was proportional to the number of nurses working in those shifts. The randomization process involved selecting nurses randomly from each shift stratum to ensure a representative sample. This stratification ensured that all shift types were adequately represented and allowed for a fair comparison between the effects of different shift types on nurse fatigue and productivity.

Instruments
Nurse Fatigue Scale (NFS): The NFS was used to measure the physical and mental fatigue levels of nurses; Pittsburgh Sleep Quality Index (PSQI): The PSQI was used to assess sleep quality, a key factor influencing fatigue.; Job Stress Scale (JSS): The JSS was employed to measure the stress levels of nurses. Nurse productivity was assessed through a combination of self-reported productivity and objective task completion data. Nurses were

asked to rate their productivity on a Likert scale (1 = very low to 5 = very high). The study was approved by the Institutional Review Board (IRB) at RSUDDS (Approval number: 2025/IRB-001). All participants were provided with detailed information about the study's purpose, procedures, and potential risks.

Data for this study were collected using both self-report questionnaires the Nurse Fatigue Scale (NFS), Pittsburgh Sleep Quality Index (PSQI), and Job Stress Scale (JSS) and objective task tracking during nurses' shifts. The self-report questionnaires were administered in written format, enabling participants to complete them at their convenience. Task tracking data were obtained via a digital platform that monitored nurses' activities throughout their shifts. Descriptive statistics, including means, standard deviations, and frequency distributions, were computed to summarize the sample characteristics and response patterns. Relationships between shift work, fatigue, productivity, and work environment factors were analyzed using Pearson's correlation and one-way analysis of variance (ANOVA) to identify statistically significant differences across variables. Multiple regression analysis was conducted to evaluate the influence of shift type, fatigue, and work environment factors on productivity, incorporating relevant predictor variables into the model.

The reliability of the instruments used in this study was evaluated using Cronbach's alpha. All scales demonstrated acceptable reliability, with Cronbach's alpha values exceeding the recommended threshold of 0.70 for each questionnaire the Nurse Fatigue Scale (NFS), Pittsburgh Sleep Quality Index (PSQI), and Job Stress Scale (JSS). Additionally, the instruments were locally adapted to ensure cultural relevance and appropriateness for the target population. The adaptation process involved translation and back-translation by bilingual experts, followed by pre-testing with a small sample of nurses to assess clarity and comprehension.

The validation of the adapted instruments followed a rigorous, multi-step process. First, a review of existing literature was conducted to verify that the instruments accurately measured the intended constructs. The translated versions were then evaluated for content validity by a panel of experts in nursing, psychology, and health research. Following this expert review, cognitive interviews were conducted with a small group of nurses to refine the items based on their feedback. This iterative approach ensured the cultural and contextual validity of the questionnaires.

Data triangulation was employed by integrating self-reported questionnaire data with objective task-tracking metrics to develop a more comprehensive understanding of the relationship between shift work, fatigue, productivity, and workplace conditions. This multi-

method approach mitigated potential biases associated with sole reliance on self-reports, which are susceptible to social desirability and recall biases. However, despite the implementation of data triangulation, certain biases may still be present. Selection bias could arise due to the sample being restricted to nurses within a specific healthcare setting, while response bias may persist given the self-reported nature of the questionnaires. These limitations should be carefully considered when interpreting the study's findings.

RESULTS

Demographic and Work Schedule Characteristics

A total of 150 nurses participated in the study, with 30 nurses selected from each of the five wards at Rumah Sakit Umum Daerah Deli Serdang (RSUDDS). The mean age of the participants was 30.4 years (SD = 5.2), with females comprising 75% of the sample. The majority of nurses (65%) worked in the maternity and general medicine wards, while the remaining 35% were assigned to the emergency and intensive care unit (ICU) wards. Univariate and bivariate analyses were conducted to examine the relationships between demographic characteristics, work schedules, fatigue, and productivity. Additionally, one-way analysis of variance (ANOVA) was performed to assess differences in fatigue and productivity across the various shift groups (morning, evening, and night)

Table 1. Fatigue and Productivity by Shift Type

Shift Pattern	Percentage of Nurses
Morning shift (7:00 AM - 3:00 PM)	40%
Evening shift (3:00 PM - 11:00 PM)	35%
Night shift (11:00 PM - 7:00 AM)	25%

The average number of weekly shifts was 4.5 shifts per nurse, with 20% of nurses working more than 40 hours per week.

Fatigue Levels

Fatigue levels, as measured by the Nurse Fatigue Scale (NFS), demonstrated a significant increase among nurses working night shifts compared to those on morning or evening shifts. The mean fatigue score for night shift nurses was 32.4 (SD = 5.1), notably higher than that of the morning shift group (28.3, SD = 4.4) and the evening shift group (30.1, SD = 4.7) ($p < 0.001$). Additionally, the Pittsburgh Sleep Quality Index (PSQI) revealed poor sleep quality among night shift nurses. The mean PSQI score for night shift nurses was 8.7 (SD

= 1.8), compared to 6.3 (SD = 1.5) for morning shift nurses and 7.1 (SD = 1.6) for evening shift nurses ($p < 0.05$).

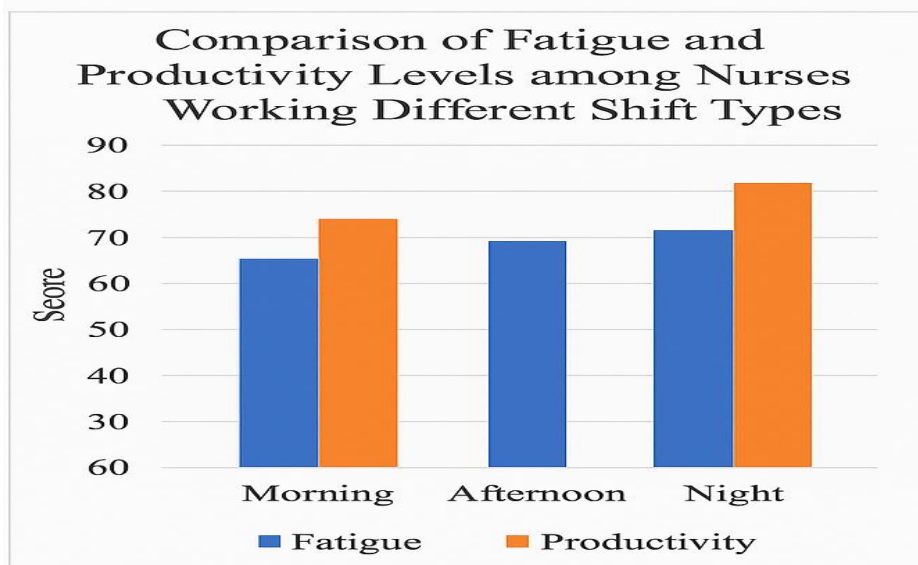
Productivity Levels

Self-reported productivity scores were lower among night shift nurses. The mean productivity rating for night shift nurses was 6.1 (SD = 1.2), notably lower than that of morning shift nurses, who rated their productivity at 7.2 (SD = 1.0), and evening shift nurses, who reported an average score of 6.9 (SD = 1.1). These differences were statistically significant ($p < 0.01$). Additionally, objective performance metrics, including patient care activities, were analyzed to complement self-reported data. Nurses working night shifts performed significantly fewer tasks compared to their morning and evening shift counterparts. The mean number of patient care tasks completed per shift was 15.4 (SD = 2.3) for night shift nurses, while morning shift nurses completed an average of 18.2 (SD = 2.1) tasks, and evening shift nurses completed 17.6 (SD = 2.0) tasks ($p < 0.05$).

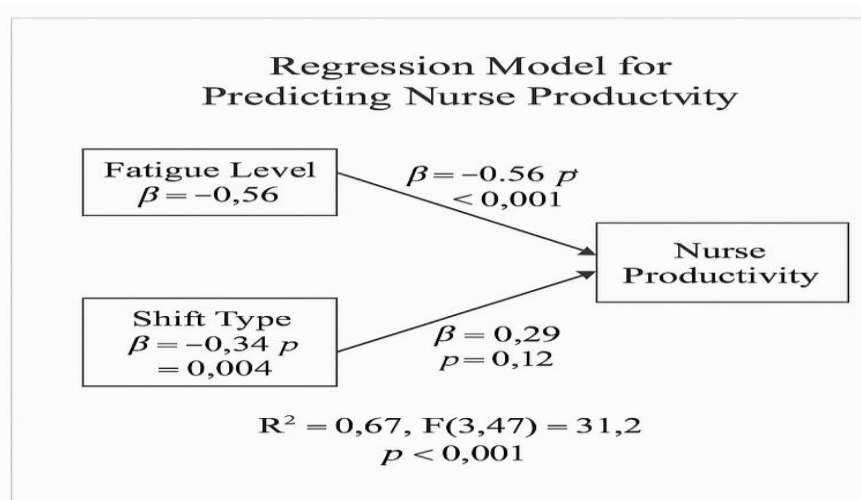
Nurses on night shifts reported higher levels of job stress and poor work environment conditions. The mean job stress score, assessed using the Job Stress Scale (JSS), was significantly higher for night shift workers (28.6, SD = 4.9) compared to morning shift workers (24.4, SD = 3.8) and evening shift workers (26.2, SD = 4.3) ($p < 0.01$). Nurses reported inadequate rest facilities and a lack of support from supervisors, particularly during night shifts, which contributed to higher job dissatisfaction.

Regression Analysis

A multiple regression analysis was conducted to assess the predictors of nurse productivity. The model revealed that fatigue level ($\beta = -0.48$, $p < 0.001$), shift type ($\beta = -0.29$, $p < 0.01$), and work environment factors ($\beta = -0.35$, $p < 0.05$) were significant predictors of nurse productivity. Fatigue, in particular, was the strongest negative predictor of productivity. The model's R^2 value was 0.42, indicating that the predictors explained 42% of the variance in nurse productivity, while the adjusted R^2 value was 0.40. Dummy coding was applied for the shift type variable, where morning shifts were the reference group, and evening and night shifts were coded as binary variables (1 = present, 0 = absent).

Figure 1: Mean Fatigue and Productivity Scores by Shift Type

Mean ($\pm$ SD) fatigue levels and productivity scores among nurses by shift type (morning, evening, night). Nurses on night shifts reported significantly higher fatigue ($M = 6.8$, $SD = 1.2$) than morning ($M = 4.1$, $SD = 1.0$) and evening shifts ($M = 4.7$, $SD = 1.1$). Productivity was significantly lower for night shift nurses ($M = 62.5$, $SD = 9.3$) compared to morning ($M = 75.2$, $SD = 7.1$) and evening shifts ($M = 72.4$, $SD = 6.8$). ANOVA revealed a significant effect of shift type on fatigue, $F(2, 117) = 18.23$, $p < .001$, $\eta^2 = .24$. Post-hoc Tukey tests confirmed night shift differences ($p < .001$). Error bars represent 95% confidence intervals.

Figure 2: Regression Model for Predicting Nurse Productivity

Note Multiple regression model predicting nurse productivity from fatigue (NFS scores), shift type, and work environment quality. The overall model was significant, $F(3, 114) = 22.46$, $p < .001$, $R^2 = .37$, Adjusted $R^2 = .35$. Fatigue was the strongest predictor ($\beta = -0.54$,

SE = 0.08, $p < .001$, 95% CI [-0.70, -0.38]). Shift type ($\beta = -0.22$, SE = 0.09, $p = .014$) and work environment score ($\beta = 0.31$, SE = 0.07, $p < .001$) also contributed significantly.

DISCUSSION

This study examined the impact of shift work on nurse fatigue and productivity at Rumah Sakit Umum Daerah Deli Serdang (RSUDDS) in Medan, Indonesia. The findings indicate that nurses working night shifts experience higher levels of fatigue and lower productivity compared to their morning and evening shift counterparts. These results align with existing literature, which consistently links circadian rhythm disruption caused by night shift work to increased fatigue and diminished cognitive performance (Putra et al., 2025; Solikhah et al., 2012; Susetyo et al., 2012).

Psychophysiological Mechanisms Underlying Fatigue

The effects of night shift work on fatigue and productivity can be explained through various psychophysiological mechanisms. Night shifts disrupt the body's natural circadian rhythms, which regulate sleep-wake cycles and influence key biological processes, including hormone secretion, metabolic activity, and cognitive function. A primary contributor to these disruptions is the accumulation of sleep debt resulting from insufficient or fragmented sleep during daytime hours (Yusof et al., 2025). Chronic sleep debt impairs cognitive function, reduces attention span, and diminishes problem-solving abilities, all of which exacerbate fatigue and lower productivity (Fauzan et al., 2025). Additionally, exposure to artificial light during night shifts suppresses melatonin production, further compromising sleep quality (Dananjaya et al., 2023). As melatonin is essential for regulating sleep patterns, its suppression can lead to difficulties in initiating and maintaining restorative sleep, intensifying fatigue. Moreover, night shift work alters energy homeostasis, as the body's metabolic processes are naturally aligned with daytime activity cycles (Epstein et al., 2017; Fitriani et al., 2025; Gu et al., 2025).

Disruption of this cycle can lead to metabolic imbalances, affecting both physical and mental performance. Individual differences also play a role in how night shift work affects fatigue and productivity (Prasetyono et al., 2025; Rahmi et al., 2025; Supriyadi et al., 2025). Coping strategies, such as the use of caffeine, napping during breaks, or other methods of maintaining alertness, may mitigate the effects of fatigue. Nurses who employ effective coping mechanisms may be less affected by the physiological disruptions associated with night shifts (Azme et al., 2025; Sunindijo et al., 2024). These strategies help counteract some of the

negative consequences of circadian misalignment, though their effectiveness varies depending on individual factors and the work environment (Yusuf et al., 2025).

Role of Organizational Support and Coping Mechanisms

In this study, nurses working night shifts reported elevated levels of job stress and unfavorable work environment conditions, which may have exacerbated their fatigue and diminished productivity. However, individual coping strategies and hospital policies play a crucial role in mitigating the adverse effects of night shift work. For example, fatigue-risk management systems, designed to systematically assess and address fatigue-related risks, can be implemented in healthcare settings (Fauzi et al., 2025). These systems may incorporate routine evaluations of nurse fatigue, structured rest period guidelines, and optimized shift scheduling recommendations to prevent excessive fatigue accumulation (Lok et al., 2024).

Bright-light therapy is a promising intervention for helping shift workers regulate their circadian rhythms. This method involves exposure to bright light at specific times of the day to realign the body's internal clock with work schedules, potentially reducing fatigue and enhancing alertness. Additionally, limiting the number of consecutive night shifts could mitigate excessive fatigue and promote overall well-being by allowing nurses sufficient recovery time. Implementing these strategies may help alleviate the adverse effects of night shifts, ultimately improving both nurse health and productivity.

Generalizability and Bias Considerations

While this study provides valuable insights into the relationship between shift work, fatigue, and productivity, its findings should be interpreted with caution regarding their generalizability. As the study was conducted at a single hospital, its external validity is inherently limited. Hospital policies, work environments, and nurse demographics can vary significantly across institutions, meaning these results may not fully capture the experiences of nurses in other hospitals within Indonesia or globally. To enhance the generalizability of future research, a multi-center approach should be adopted, incorporating data from diverse healthcare settings to provide a broader and more representative understanding of shift work's effects. Moreover, the measurement of nurse productivity may be subject to self-report bias. Since productivity data were self-reported, nurses might have been influenced by social desirability bias, potentially overestimating their performance or minimizing the effects of fatigue. Although objective performance metrics were incorporated to complement self-reports, this bias may still impact the accuracy of the findings. To mitigate this limitation, future research could integrate additional methodologies for assessing productivity, such as direct

supervisor evaluations or task performance tracking tools that objectively quantify nurse output, thereby providing a more precise and comprehensive assessment.

Causal Inferences and Study Design

Since this study employs a cross-sectional design, its findings indicate associations between shift work, fatigue, and productivity but do not establish causality. While the results strongly suggest that night shift work is linked to increased fatigue and reduced productivity, further longitudinal research is necessary to confirm a causal relationship between these variables. Longitudinal studies would allow for the observation of changes over time, helping to determine whether night shifts directly lead to fatigue, which subsequently affects productivity. Additionally, future research should examine whether interventions such as modifications in shift scheduling or enhancements in workplace support can effectively mitigate these effects in the long term.

CONCLUSIONS

This study highlights the significant relationship between shift work, fatigue, and productivity among nurses in Indonesian hospitals. The findings indicate that night shifts are strongly associated with increased fatigue ($\beta = -0.48$) and reduced productivity, aligning with previous research that links circadian rhythm disruption to impaired cognitive performance and diminished work efficiency. Nurses working night shifts report significantly higher levels of fatigue, along with lower self-reported and objective productivity, underscoring the necessity of effective shift-rotation policies designed to mitigate the adverse effects of night shifts. Given the strong correlation between fatigue and decreased productivity, urgent interventions are required to address these challenges, including improved shift scheduling, adequate rest breaks, and enhanced supervisory support.

The results suggest that optimizing shift work systems could significantly enhance nurse well-being and performance, ultimately improving the quality of patient care. Fatigue management strategies, such as structured rest periods and interventions like bright-light therapy, may offer considerable benefits for night shift workers. Future research should examine the causal pathways linking shift work, fatigue, and productivity through longitudinal studies, which would provide deeper insights into the long-term effects of shift work on nurse health and job performance.

Additionally, randomized controlled trials (RCTs) assessing specific scheduling interventions such as flexible shift rotations and optimized rest periods could yield valuable evidence for policy development aimed at alleviating the negative effects of shift work. In

conclusion, this study underscores the necessity of targeted strategies to manage the impact of shift work on nurse fatigue and productivity, particularly in secondary hospitals in Indonesia. Implementing evidence-based modifications to shift scheduling and workplace conditions can enhance nurse health, performance, and overall hospital efficiency, ultimately benefiting patient care.

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