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The Relationship between Workload and Occupational Fatigue among Nurses in the Operating Room Installation

Kurnia Rohmasa^{1*}

¹Widyagama Husada College of Health Sciences, Malang, Indonesia

Corresponding author: donyhermawan2380@gmail.com

ABSTRACT

Background: Operating-room nurses face continuous physical, mental, time-related, and responsibility demands that may predispose them to occupational fatigue, yet the extent to which workload relates to fatigue in this high-risk perioperative setting remains insufficiently documented at the local level. **Objective:** This study aimed to analyze the relationship between workload and occupational fatigue among nurses in the Operating Room Installation of Dr. Etik Asharto Hospital, Batu City. **Methods:** A quantitative correlational study with a cross-sectional design was conducted among 15 operating-room nurses selected through total sampling. Workload was measured using the NASA Task Load Index (NASA-TLX) and occupational fatigue was measured using the Fatigue Assessment Scale (FAS). Univariate analysis used descriptive statistics, and bivariate analysis used Spearman's rank correlation test. **Results:** Most nurses had a high workload (46.7%), followed by very high workload (40.0%) and moderately high workload (13.3%); no nurse reported low or moderate workload. The highest mean NASA-TLX dimension was frustration (73.53 ± 15.21). Most nurses experienced extreme fatigue (73.3%), while 26.7% experienced fatigue; none reported being free of fatigue. Spearman's rank correlation showed a strong, positive, and statistically significant relationship between workload and occupational fatigue ($r_s = 0.704$; $p = 0.003$; $n = 15$). **Conclusion:** Workload is strongly and significantly associated with occupational fatigue among operating-room nurses. Hospitals are encouraged to periodically evaluate workload distribution, shift patterns, staffing adequacy, and rest periods to reduce the risk of nurse fatigue.

Keywords: workload; occupational fatigue; nurses; operating room

Background

Hospitals are health institutions that provide basic, referral, and supporting health services to the community, with nurses serving as frontline providers of round-the-clock patient care encompassing assessment, intervention, monitoring, and education (1). Because nursing staff must respond continuously to patients' health problems, an imbalance between workload and the number of available nurses is a common source of excessive workload, which in turn may lead to occupational fatigue (2). Workload can be understood as the set of activities that a worker must complete within a given period, carried out systematically using specific analytical techniques appropriate to the worker's professional role.

According to World Health Organization data for 2020, the global nursing workforce reached 27.1 million, and nurses working in Indonesian hospitals numbered 219,264, representing 45.65% of the total health workforce; however, Indonesia's nurse-to-population ratio of only 87.65 per 100,000 remains far below the national target of 180 per 100,000 set for that year, reflecting a persistent shortfall in nursing personnel that can elevate workload (1). The International Labour Organization has reported that approximately two million workers die each year from occupational accidents linked to fatigue, and The Joint Commission reported in 2008 that fatigued nurses were over 300% more likely to make errors resulting in patient death (3).

A preliminary study conducted at Dr. Etik Asharto Hospital, Batu City in January 2026 found that the number of surgical procedures performed ranged from 314 to 449 per month between August and December 2025, averaging approximately 393 operations per month, carried out by only 15 operating-room nurses. This disproportion between surgical volume and nursing staff has produced complaints consistent with fatigue, including drowsiness, listlessness, reduced enthusiasm for work, poor concentration leading to forgetfulness, and dizziness; fatigue manifests differently across individuals but consistently reflects diminished work efficiency and reduced work capacity and physical endurance (4).

Previous studies have reported significant associations between workload and nurse fatigue. Mulfiyanti et al. found a significant relationship between workload and fatigue among hospital nurses (3); a subsequent study by Mulfiyanti reported that 43.1% of nurses experienced fatigue, with 61.5% reporting moderate workload (5); and Gumelar et al. found that 56.9% of nurses experienced heavy workload and 67.2% experienced high fatigue (2). A high nurse workload can compromise the quality of patient service and jeopardize patient safety.

The operating room is among the most complex service units in a hospital. Nurses assigned there must sustain high concentration throughout surgical procedures, work in a standing position for prolonged periods, handle sterile equipment, and remain ready for both elective and emergency operations, all of which impose greater physical and mental workload than in many other units and involve high cognitive demands that can affect surgical-team performance and patient safety (6). Interviews with the head of the operating-room installation and several operating-room nurses at Dr. Etik Asharto Hospital, Batu City confirmed that services are provided daily for both elective and emergency cases, that nurses must remain ready even when unscheduled cases arise, and that nurses sometimes work beyond normal hours when procedures run longer than planned or when a cito (emergency) operation must be handled immediately. Nurses reported frequently feeling tired after their shifts, particularly when several procedures were performed within a single shift or when operations were prolonged, describing leg, back, and shoulder pain as well as difficulty concentrating and drowsiness after completing their duties, despite the continuing requirement to provide care according to standard operating procedures.

Given the physical, mental, temporal, and responsibility-related demands of perioperative care and their potential link to rising fatigue, this study was undertaken to examine the relationship between workload and occupational fatigue among nurses in the Operating Room Installation of Dr. Etik Asharto Hospital, Batu City. The research problem addressed was whether a relationship exists between workload and occupational fatigue among these nurses, with the specific aims of identifying nurses' workload, describing their level of occupational fatigue, and analyzing the association between the two variables.

Methods

This study used a quantitative correlational design with a cross-sectional approach, in which workload as the independent variable and occupational fatigue as the dependent variable were measured concurrently. The study was conducted in the Operating Room Installation of Dr. Etik Asharto Hospital, Batu City, East Java, in July 2026.

The population comprised all 15 nurses assigned to the operating-room installation, consisting of 1 head nurse, 2 anesthesia nurses, 7 senior scrub/instrument nurses, and 5 junior scrub/instrument nurses. Because the population numbered fewer than 100, all members meeting the inclusion criteria were recruited using a non-probability total-sampling technique, yielding a final sample of 15 nurses. Inclusion criteria were being on duty in the operating-room installation and willingness to participate as evidenced by signed informed consent; nurses who were unwilling to participate or who withdrew consent were excluded.

Workload was measured using the National Aeronautics and Space Administration Task Load Index (NASA-TLX), which assesses six dimensions—mental demand, physical demand, temporal demand, own performance, effort, and frustration—yielding a total score from 0 to 100 categorized as low (0–9), moderate (10–29), moderately high (30–49), high (50–79), or very high (80–100) (7). Occupational fatigue was measured using the Fatigue Assessment Scale (FAS), a 10-item instrument rated on a 5-point Likert scale (with two items reverse-scored), yielding a total score from 10 to 50 categorized as no fatigue (10–21), fatigue (22–34), or extreme fatigue (≥ 35).

Data were processed through editing, coding, entry, cleaning, and tabulation, and were analyzed descriptively for the univariate analysis. The Shapiro-Wilk test showed that the NASA-TLX total score was normally distributed ($p = 0.305$), while the FAS total score was borderline for normality ($p = 0.050$); given the small sample size ($n = 15$) and the borderline FAS distribution, the bivariate relationship between workload and occupational fatigue was analyzed using Spearman's rank correlation test, with statistical significance set at $p < 0.05$ (8).

This study adhered to core research-ethics principles, including autonomy, justice, beneficence and non-maleficence, and privacy, anonymity, and confidentiality (9). All nurses were informed of the

study's purpose and procedures and provided written informed consent prior to data collection; respondent codes rather than personal identities were used throughout data processing and reporting to protect confidentiality.

Results

Table 1. Demographic characteristics of nurse respondents in the Operating Room Installation

Characteristic	f	%
Age		
Early adulthood (20–30 years)	3	20.0
Middle adulthood (31–40 years)	6	40.0
Late adulthood (41–50 years)	6	40.0
Sex		
Male	13	86.7
Female	2	13.3
Education		
No formal schooling	0	0.0
Elementary school	0	0.0
Junior high school	0	0.0
Senior high school	0	0.0
Higher education	15	100.0
Length of work		
1–3 years	3	20.0
4–6 years	6	40.0
7–10 years	3	20.0
>10 years	3	20.0

Fifteen operating-room nurses participated in this study. Most respondents were in middle adulthood (31–40 years) or late adulthood (41–50 years), each accounting for 40.0% of the sample; most were male (86.7%); all respondents (100.0%) had attained higher education; and most (40.0%) had 4–6 years of work experience, as summarized in Table 1.

Table 2. Distribution of workload and occupational fatigue levels among nurses in the Operating Room Installation

Variable	Category	f (%)
Workload	Low	0 (0.0)
	Moderate	0 (0.0)
	Moderately high	2 (13.3)
	High	7 (46.7)
	Very high	6 (40.0)
Occupational fatigue	No fatigue	0 (0.0)
	Fatigue	4 (26.7)
	Extreme fatigue	11 (73.3)

Regarding the study variables, most nurses had a high workload (n = 7; 46.7%), followed by very high workload (n = 6; 40.0%) and moderately high workload (n = 2; 13.3%); no nurse reported low or moderate workload. Most nurses experienced extreme occupational fatigue (n = 11; 73.3%), while the remainder experienced fatigue (n = 4; 26.7%); no nurse reported being free of fatigue, as shown in Table 2.

Table 3. Mean scores of the six NASA-TLX workload dimensions among nurses in the Operating Room Installation

NASA-TLX Dimension	Mean	SD	Minimum	Maximum
Mental Demand (MD)	69.87	17.37	39	93
Physical Demand (PD)	69.53	14.59	44	92
Temporal Demand (TD)	71.53	14.81	46	92
Own Performance (OP)	72.00	14.89	47	95
Effort (EF)	69.53	12.76	44	90
Frustration (FR)	73.53	15.21	45	96

Among the six NASA-TLX dimensions, the highest mean score was frustration (73.53 ± 15.21), followed by own performance (72.00 ± 14.89) and temporal demand (71.53 ± 14.81); mental demand averaged 69.87 ± 17.37 , while physical demand and effort each averaged 69.53, as shown in Table 3. The mean FAS physical-fatigue component score was 17.87 ± 2.85 and the mental-fatigue component score was 17.80 ± 3.45 , indicating a nearly balanced contribution of physical and mental fatigue to respondents' overall fatigue.

Table 4. Result of Spearman's rank correlation test between workload and occupational fatigue among nurses

Variables	r_s	Sig. (2-tailed)	N	Interpretation
Workload (NASA-TLX) with occupational fatigue (FAS)	0.704	0.003	15	Positive, strong, significant

The Shapiro-Wilk test indicated a normal distribution for the NASA-TLX total score ($p = 0.305$) and a borderline distribution for the FAS total score ($p = 0.050$). Spearman's rank correlation test showed a coefficient of $r_s = 0.704$ with $p = 0.003$ ($n = 15$), indicating a statistically significant, strong, and positive relationship between workload and occupational fatigue among operating-room nurses at Dr. Etik Asharto Hospital, Batu City (Table 4): higher workload scores were associated with higher occupational-fatigue scores.

Discussion

Most nurses in this study had a high (46.7%) to very high (40.0%) workload, with no nurse reporting low or moderate workload, indicating that operating-room nurses at Dr. Etik Asharto Hospital, Batu City generally face substantial work demands. Across the six NASA-TLX dimensions, frustration, own performance, and temporal demand had the highest mean scores, indicating that workload in this setting stems not only from physical demands but also from time pressure, performance expectations, effort, mental demand, and frustration experienced while working, consistent with the multidimensional structure of the NASA-TLX instrument (7). In the operating-room context, elevated frustration may reflect the psychological pressure of meeting service demands, temporal demand relates to time pressure, and own performance reflects the demand to sustain successful task execution; together, these dimensions are consistent with the concentration, precision, physical readiness, and coordination required during perioperative care.

Most respondents were in middle and late adulthood (each 40.0%) with 4–6 years of work experience (40.0%); although such experience may support work adaptation, the responsibility and complexity of operating-room duties can sustain a high workload regardless of tenure(10)(11). All respondents (100.0%) had attained higher education, which supports professional competence but is also accompanied by greater professional responsibility, so higher education does not exempt nurses from experiencing high workload.

These findings are consistent were found that 66% of inpatient-ward nurses at Malahayati Islamic Hospital in Medan had a heavy workload and a significant relationship between workload and fatigue ($p = 0.017$)(12), and additionally identified work duration and circadian rhythm as factors associated with

fatigue(13), reinforcing that nurse fatigue is closely tied to work demands and time-related work arrangements.

The high workload observed in this study likely reflects the continuous service demands of perioperative care, which require a combination of physical, mental, and emotional capacity; higher education and moderate tenure were not sufficient to offset the impact of these demands, since operating-room nurses must sustain concentration, precision, speed, and responsibility throughout patient care. Hospital management should therefore consider workload not only in terms of the number of patients, but also patient dependency level, case complexity, the volume of nursing procedures, documentation, non-nursing tasks, shift patterns, and staffing adequacy, so that workload can be managed within nurses' capacity while sustaining care quality and reducing the risk of fatigue.

Regarding occupational fatigue, most nurses (73.3%) experienced extreme fatigue and the remainder (26.7%) experienced fatigue, with none reporting an absence of fatigue. The FAS physical- and mental-fatigue component scores were nearly equal (17.87 ± 2.85 and 17.80 ± 3.45 , respectively), indicating that fatigue among respondents manifested in both physical and mental domains, consistent with the design of the FAS instrument to capture both dimensions of fatigue and their impact on motivation to function (14) (15). This pattern is consistent with Sumantri et al., who likewise research reported that most nurses experienced fatigue in relation to workload ($p = 0.017$)(12), and reported a similar association among inpatient-ward nurses(2).

The extreme fatigue observed in this study corresponds with the finding that all respondents fell into the moderately high to very high workload categories, suggesting that the elevated fatigue observed cannot be separated from the high work demands nurses face. Fatigue may also relate to a combination of age, tenure, work stress, and working conditions (16); while experience may support more structured task completion, tenure alone is not a protective factor against fatigue when work demands remain high and recovery time is limited (13)(10). Higher education, though supportive of professional competence, is accompanied by clinical responsibility, decision-making, documentation, and accountability that can sustain fatigue despite advanced qualifications(12). Because nurses play a direct role in patient care, extreme fatigue warrants attention, as it can reduce concentration and precision and potentially affect the quality of nursing care(17); fatigue should not be attributed to individual characteristics alone, since organizational factors such as staffing adequacy, task distribution, shift patterns, and rest opportunities also play a role, consistent with evidence linking shift work to nurse fatigue(18).

The Spearman's rank correlation test found a strong, positive, and statistically significant relationship between workload and occupational fatigue ($r_s = 0.704$; $p = 0.003$), indicating that as workload scores increase, fatigue scores tend to increase as well. Workload reflects the physical, mental, temporal, performance, effort, and frustration demands a worker must manage(7); for operating-room nurses, the requirement to maintain concentration, precision, and readiness for both elective and emergency surgery, prolonged standing, and responsibility for patient safety mean that physical and mental workload occur simultaneously(6), and when these demands persist without adequate recovery, fatigue can increase. Together reinforcing that workload is closely tied to nurse fatigue regardless of hospital unit, although the association appears particularly salient in the operating room given its high demand for concentration and precision during surgical procedures (2)(3)(5)(12)(1).

Because the cross-sectional design captures both variables at a single point in time, the significant relationship identified should be interpreted as an association rather than a causal relationship. Based on these findings, hospital management is encouraged to evaluate task distribution, staffing adequacy, shift scheduling, rest opportunities, and periodic fatigue monitoring to help safeguard nurses' condition while maintaining the quality and safety of operating-room services.

This study has several limitations. First, the sample was limited to 15 nurses from a single hospital, so the findings primarily describe conditions at the study location and period and have limited generalizability to broader populations. Second, the cross-sectional design measured workload and fatigue at a single time point, allowing an association to be identified but not a causal relationship to be established. Third, both instruments relied on self-report, which may be subject to differences in respondents' perception of their own workload and fatigue. Finally, other factors potentially related to fatigue such as shift patterns, sleep quality, health status, actual working hours, and the work environment were not analyzed as confounding variables and should be considered in future research.

Conclusions and Recommendations

Most nurses in the Operating Room Installation of Dr. Etik Asharto Hospital, Batu City had a high (46.7%) to very high (40.0%) workload, and most experienced extreme occupational fatigue (73.3%). Workload was found to have a statistically significant, strong, and positive relationship with occupational fatigue ($r_s = 0.704$; $p = 0.003$; $n = 15$), indicating that higher workload is associated with higher fatigue among operating-room nurses. Hospitals are encouraged to periodically evaluate and manage nurses' workload by considering patient numbers and condition, task distribution, shift systems, and rest periods to help reduce the risk of fatigue. Nurses are encouraged to manage their working and rest time, recognize signs of fatigue, and maintain their physical and mental condition in order to sustain optimal nursing care. Future research is recommended to use larger samples across multiple hospitals and to examine additional variables such as shift work, sleep quality, work stress, health status, and the work environment as potential confounders, ideally using multivariate analysis.

Ethical Consideration and Competing Interest

This study adhered to fundamental research-ethics principles, including autonomy, justice, beneficence and non-maleficence, and privacy, anonymity, and confidentiality. All participants were informed of the study's purpose and procedures prior to data collection, and written informed consent was obtained before questionnaire administration. Participant anonymity was maintained by using respondent codes rather than personal identities in data processing and reporting, and all data collected were used solely for research purposes. The authors declare that there is no conflict of interest related to this publication.

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Conflicts of Interest

The authors confirm that there are no conflicts of interest related to this study.

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