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CORRELATIONS OF SHIFT WORK 2-2-2(2) ROTATION ON SLEEP QUALITY AND FATIGUE OF NURSES IBNU SINA GRESIK GENERAL HOSPITAL

HUBUNGAN SHIFT KERJA ROTASI 2-2-2(2) TERHADAP KUALITAS TIDUR DAN KELELAHAN PERAWAT RSUD IBNU SINA GRESIK

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A B S T R A C T

Background: *Working as a nurse in a hospital required to work with a shift system. Working with the shift system (morning, afternoon, and night) can affect the circadian rhythm, which has the potential to cause sleep disturbances and fatigue.* ***Purpose:*** *This research aims to analyze the influence of shift work rotation 2-2-2(2) on sleep quality and fatigue in nurses with shift work systems in inpatient rooms at General Hospital Ibnu Sina Gresik.* ***Method:*** *This research was an observational analytics study with a cross-sectional design. The total sample was 80 nurses in an inpatient care unit with a shift work system chosen through purposive sampling techniques. The Subjective Self-Rating Test (SSRT) issued by the Industrial Fatigue Research Committee (IFRC) questionnaire was used for the measurement of fatigue, and the Pittsburgh Sleep Quality Index questionnaire (PSQI) was used for the assessment of sleep quality. Univariate and bivariate analyses were done with a Chi-square statistical test.* ***Result:*** *The study showed that most respondents had good sleep quality (87.5%), and most had low tiredness (71.2%). The Chi-square test results obtained a p-value of 0.224 > 0.05 and a p-value of 0.108 > 0.05, meaning there were no correlations between shift work and sleep quality and fatigue.* ***Conclusion:*** *Shift work had no relationship with sleep quality and fatigue. Appropriate shift work arrangements can contribute to reducing the negative impact of shift work.*

A B S T R A K

Latar belakang: Pekerjaan sebagai perawat di rumah sakit dituntut bekerja dengan sistim shift. Bekerja dengan sistim shift yakni pagi, siang, dan malam dapat mempengaruhi siklus sirkardian yang berpotensi menyebabkan gangguan tidur dan menimbulkan kelelahan. **Tujuan:** Penelitian ini untuk menganalisa pengaruh shift kerja rotasi 2-2-2(2) terhadap kualitas tidur dan kelelahan perawat dengan sistem kerja shift di ruang rawat inap RSUD Ibnu Sina Gresik. **Metode:** Penelitian ini adalah observasional analitik dengan desain *cross-sectional*, jumlah sampel sebanyak 80 perawat di ruang rawat inap dengan sistim kerja shift melalui teknik *purposive* sampling. Pengukuran kelelahan menggunakan kuesioner *Subjective Self Rating Test* (SSRT) yang dikeluarkan oleh *Industrial Fatigue Research Committee* (IFRC) dan penilaian kualitas tidur menggunakan kuesioner *Pittsburgh Sleep Quality Index* (PSQI). Dilakukan analisis univariat dan bivariat dengan uji statistik *chi-square*. **Hasil:** Hasil penelitian menunjukan mayoritas kualitas tidur responden baik (87,5%) dan mayoritas kelelahan responden adalah rendah (71,2%). Hasil uji *Chi-square* didapatkan nilai *p-value* 0,224 > 0,05 dan *p-value* 0,108 > 0,05 artinya tidak ada hubungan shift kerja dengan kualitas tidur dan kelelahan. **Kesimpulan:** Sistim shift kerja tidak berhubungan dengan kualitas tidur dan kelelahan. Melalui pengaturan shift kerja yang sesuai dapat berkontribusi mengurangi dampak negatif akibat shift kerja.

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INTRODUCTION

Shift work is a method of managing working time where workers replace each other at work, allowing companies to operate for up to 24 hours (ILO, 2023) by dividing working time into parts in 24 hours as demands and need to maximize production (Murwidi, 2018; Yudha Nagara *et al*., 2019). Hospitals have used this system to organize work to provide health services and patient care for 24 (Rhamdani and Wartono, 2019), one of which is used for working time arrangements for nurse professionals (Murwidi, 2018). Shift work has been associated with circadian rhythm disturbances (Benzo *et al*., 2022), sleep disorders (Gifkins *et al*., 2020; Burch *et al*., 2019; Härmä *et al*., 2018), which can negatively impact performance, safety, and health (Benzo *et al*., 2022; Gander *et al*., 2020) both physical and mental (Ki *et al*., 2020). Some authors identify shift work disorder syndrome as encompassing several symptoms, including changes in sleep/wake circadian rhythms, insomnia, excessive daytime sleepiness, fatigue, gastrointestinal disturbances, and an increased risk of cardiovascular disease (Ferri *et al*., 2016; Jeong *et al*., 2019).

Shift work requires the reorganization of wake up and sleep times. This can cause disruption of circadian rhythms, which impacts internal synchronization and causes psychological and physiological disorders (Krimadies and Maulina, 2023). Many research reports on nurses with shift work explain that research on hospital nurses in the U.S. related to fatigue, shows that the length of shifts, shift rotations, and time of day can worsen nurse fatigue levels (Benzo *et al*., 2022). The American Academy of Sleep Medicine defines shift work disorder as excessive sleepiness or insomnia associated with shift work (Zhang *et al*., 2016). It is estimated that approximately 2 - 5% of the working population of the United States has this disorder (Almeida and Malheiro, 2016). Almost 60% of shift workers complain of sleep disturbances (sleeplessness and insomnia). Night shift workers feel more fatigue than day shift workers, and workers with changing work shifts tend to complain of chronic fatigue compared to workers with a fixed shift schedule (Yudha Nagara *et al*., 2019).

Fatigue is a protective mechanism of the body to avoid further damage, so recovery occurs after rest (Hutabarat, 2021). Physical fatigue which occurs due to physical work (Nurmufidah and Rumita, 2021). Several reports explained that fatigue is one of the main causes of work accidents caused by human factors. Data from ILO for 2011-2014 states that as many as 2 million workers each year die due to work accidents (Nuraini and Ramdhan, 2021), and of the 58.115 samples studied, it was found that 18.828 (32.8%) of accidents were due to fatigue factors (Sihombing *et al*., 2021). Social security administrator for employment data in 2014 states, that on the island of Java, there were 98.000 cases of work accidents, with 2.400 people dying, 40% of which were caused by fatigue (Narpati *et al*., 2019).

Ibnu Sina Gresik General Hospital is a hospital that implements a shift work system for nurses. Based on the results of interviews conducted with the head of the Nursing Division about shift work arrangements for inpatient nurses at this hospital, the working hours nurses consist of morning shifts, afternoon shifts, and night shifts. The shift work model (shift length and shift rotation) currently used is (metropolitan rota) 2-2-2-(2) (Fatona *et al*., 2015), meaning the morning shift is two days, the afternoon shift is two days, and the night shift is two days, with two days off after night shift. The policy of implementing this model was uniformly applied to all inpatient rooms and has been running for approximately one and a half years. However, until now, there has never been a direct evaluation of the impact of implementing the system. Based on this and some of the problems caused by shift work, researchers are interested in finding out how the description of the impact of the application of the current shift work system on the sleep quality and fatigue of inpatient nurses at RSUD Ibnu Sina Gresik and analyzing related factors.

MATERIAL AND METHOD

This research was an observational analytics study, approached with a cross-sectional design. The population of this study was nurses in the inpatient rooms of Ibnu Sina Gresik Hospital, East Java-Indonesia including Cempaka, Dahlia, Edelweiss, Gardena, Ixia, and Wijaya Kusuma rooms. Sampling by purposive sampling on respondents who met the inclusion criteria, namely nurses working with a shift work system. Working period >1 year and exclusion criteria for menstruating nurses, so the number of samples obtained was 80.

Data collection using questionnaires for work fatigue assessment using the *Subjective Self Rating Test* (SSRT) method (Pujiastuti *et al*., 2021) issued by the *Industrial Fatigue Research Committee* (IFRC) of the Japanese Association of Industrial Health (Muhamad Ramdan, 2019). Respondents scored their answers on a *Likert* scale with answer choices consisting of: (1) Never, (2) Sometimes, (3) Often, (4) Very often. The total score is obtained by adding up all scores per item, the lowest score is 30, and the highest is 120. The fatigue level is then categorized into (1) A low fatigue score of 30 – 52, (2) Moderate fatigue score of 53 – 75, (3) High fatigue score 76 – 98, and (4) Very high fatigue score 99 – 120. Sleep quality assessment using the *Pittsburgh Sleep Quality Index* (PSQI) questionnaire (Buysee *et al*., 2016; Liu *et al*., 2021), which consists of 18 questions and produced 7 component values on sleep quality. The score of each component ranges of 0 to 3.

Each component is summed to assess the total score. Good sleep quality score if the total score ≤5. While worse sleep quality score if the total score is >5 (Fachlefi and Rambe, 2021; Ho *et al*., 2023). The data

were analyzed univariately and bivariately with a *Chi-square* statistical test with a confidence level of 95% (0.05). This research was conducted from April to May 2023. It has fulfilled the ethical review of the Ethics Committee of Ibnu Sina Gresik Hospital with certificate No. 071/027/437.76/2023.

RESULT

Based on Table 1, it is known that the majority of respondents are female (68.8%), the majority of respondents are 25 – 30 years old (43.8%), the majority of respondents are married (87.5%), the majority of respondents have a working period of 6 – 10 years (46.2%), the majority of respondents have a break while working about 1 – 2 hours (63.8%), and the majority of respondent's distance between home and workplace is 15 – 30 km (37.5%).

Based on Table 2, it is known that the majority of respondents (37.5%) worked the night shift. The majority of respondents had good sleep quality (76.2%), and the majority of respondent's fatigue was low (71.2%).

Based on Table 3, it is known that respondents on the morning shift have good sleep quality (25.0%) and (3.8%) poor sleep quality. On the afternoon shift, they have good sleep quality of (26.2%) and (7.5%) poor sleep quality. On the night shift, they have good sleep quality of (25.0%) and (12.5%) poor sleep quality. The results of the *Chi-square* statistical test obtained a *p-value* of 0.222 > 0.05, meaning there is no significant effect of shift work on sleep quality.

Based on Table 4, it is known that the respondents working on the morning shift experienced moderate fatigue (8.8%) and low fatigue (20.0%). On the afternoon shift, they experienced moderate fatigue (5.0%) and low fatigue (28.7%). On the night shift, they experienced moderate fatigue (15.0%) and low fatigue (22.5%). The results of the *Chi-square* statistical test obtained a *p-value* of 0.108 > 0.05, meaning there is no effect of shift work on fatigue.

Table 1. Characteristics of inpatient nurses at RSUD Ibnu Sina Gresik

Characteristics of respondents	Total (n = 80)	Percentage (%)
Gender		
Male	25	31.2
Female	55	68.8
Age		
25 – 30 years	35	43.8
31 – 35 years	21	26.2
36 – 40 years	21	26.2
>40 years	3	3.8
Marital status		
Unmarried	10	12.5
Married	70	87.5
Working period		
1 – 5 years	21	26.3
6 – 10 years	37	46.3
11 – 15 years	17	21.2
>15 years	5	6.2
Work rest time		
<1 hours	20	25.0
1 - 2 hours	51	63.8
>2 hours	9	11.2
Distance between home and workplace		
15 km	28	35.0
15 – 30 km	30	37.5
31 – 50 km	10	12.5
>50 km	12	15.0

Table 2. Variable of shifts work, sleep quality, fatigue of inpatient nurses at RSUD Ibnu Sina Gresik

Variables of respondents	Total (n = 80)	Percentage (%)
Shift work		
Morning	23	28.8
Afternoon	27	33.7
Night	30	37.5
Sleep quality		
Good	61	76.2
Bad / poor	19	23.8
Fatigue		
Low	57	71.2
Moderate	23	28.8
High	0	0

Table 3. Analysis of the effect of shift work on sleep quality

Variable	Shift work			Total (%)	*p-value*
	Morning	Afternoon	Night		
	n (%)	n (%)	n (%)		
Sleep quality					
Good	20 (25.0)	21 (26.2)	20 (25.0)	61 (76.2)	0.222*
Bad/poor	3 (3.8)	6 (7.5)	10 (12.5)	19 (23.8)	

Source: * *Chi-square* statistical, a confidence level 0.05

Table 4. Analysis of the effect of shift work on fatigue

Variable	Shift work			Total (%)	*p-value*
	Morning	Afternoon	Night		
	n (%)	n (%)	n (%)		
Fatigue					
Low	16 (20.0)	23 (28.7)	18 (22.5)	57 (71.2)	0.108*
Keep	7 (8.8)	4 (5.0)	12 (15.0)	23 (28.8)	

Source: * *Chi-square* statistical, a confidence level 0.05

DISCUSSION

This study used 80 data, the results of characteristics in Table 1 shows that the majority of respondents are female (68.8%). The majority of respondents aged are 25 – 30 years (43.8%). The majority of respondents are married (87.5%). The majority of respondents have a working period of 6 – 10 years (46.3%). The majority of respondents have a break while working about 1 – 2 hours (63.8%), and the majority distance between home and workplace of respondents is 15 – 30 km (37.5%).

Furthermore, the variables of respondents in Table 2 shows that the majority of respondents (37.5%) worked the night shift, the majority of respondents had good sleep quality (76.2%), and the majority of respondents fatigue was low (71.2%). No respondents are experiencing severe fatigue. This is also in line with the results of the *Chi-square* statistical test related to rest time in Table 1, which obtained a *p-value* of 0.044 < 0.05, which means work rest time is related to fatigue. This result was in line with Narpati's research (2019) that states rest time is related to work fatigue.

Table 3 shows the results of the *Chi-square* statistical test have *p-value* of 0.222 > 0.05 there is no effect of shift work on sleep quality. This study also shows that most respondent's sleep quality was good (76.2%) in all three types of shift work. According to the researcher, this may be due to the shift pattern being applied quite well and being able to be adapted by respondents, namely the direction of rotation forward (clockwise). The rotation is fast, not long, and there is also an opportunity for sufficient rest time in each shift work, namely (75%) respondents have a rest period of between 1 and 2 hours more per shift work. This can be used to take breaks to eat, worship, or sleep for a while at work, especially on the night shift, if conditions allow, based

on information from respondents. This is in line with the statement of Gifkins *et al*. (2020) that fatigue can appear after any work activity but can recover after adequate rest (Sesrianty and Marni, 2021). However, Table 3 illustrates that respondents with night shifts experience worse sleep (12.5%) than morning or afternoon shifts. This shows that workers with night shifts have a greater tendency to experience sleep disorders.

The results show that performance and sleepiness remained stable in most day shift workers, while performance decreased and sleepiness increased in night shift workers (Benzo *et al*., 2022). That is also in line with the results of research at Advent Manado Hospital, night shift nurses tended to experience more significant fatigue (31.0%) than morning shift nurses (21.8%), and day shift nurses (25.3%) (Siregar and Wenehenubun, 2019). Workers on the night shift should be able to replace their lost hours of sleep before returning to work. There should be a break of at least 11 hours between shifts to prepare for work on the next shift. Because the time available for recovery sleep between shifts is an essential factor that affects performance during the next shift (Ganesan *et al*., 2019).

The *Chi-square* statistical test results, a *p-value* of 0.108 > 0.05. Table 4 shows no effect of shift work on fatigue. The results of this study are in line with research conducted in 2021 by Nursehan Br Ginting and Evelin Malinti that *p-value* of 0.683 > 0.05), there is no significant relationship between shift work and work fatigue (Sesrianty and Marni, 2021). Also in line with Krimadies and Maulina's research (2023) at X Batam Hospital in 2022 shows the results of the *Chi-square* test have a *p-value* of 0.470 > 0.05, which means there is no significant relationship between shift work and work fatigue (Krimadies and Maulina, 2023). Also, in line with the research of Sunarno *et al*. (2018) on 150 security personnel at the University of Indonesia, there is no significant relationship between shift work and fatigue, with the results of a statistical test *p-value* of 0.395 > 0.05.

The results of interviews with the head of the Nursing Division explained that the working hours for each shift of nurses were different. The morning shift had seven working hours from 07.00 to 14.00, the afternoon shift had six working hours from 14.00 to 20.00, and the night shift had 11 working hours from 20.00 to 07.00. This aligns with the description of different fatigue levels for each shift work, as shown in Table 4 of the 23 people (28.8%), who experienced moderate fatigue, the afternoon shift with the shortest working hours experienced the least moderate fatigue at four people(5%), and the night shift with the most extended working hours experienced the most moderate fatigue at 12 peoples (15%).

Suma'mur (1992) states that work fatigue on the night shift is relatively greater than on other shifts (Jannah and Tualeka, 2022). The shift work model used in this hospital is 2-2-2(2) (metropolitan rota). According to Effendi *et al*. (2021) and Roberts (2016), this rotation pattern rotates quickly on each shift, which can shorten worker adaptation from the night to the morning shift schedule. This rotation pattern uses four teams divided into three shifts, each team is rotated through a sequence of shifts: morning two days, afternoon two days, night two days, and two days off after the night shift during an 8 day cycle (Effendi *et al*., 2021; Roberts, 2016). This rotation pattern also has a break of more than 11 hours between subsequent shifts that can be used for rest time, as many European countries apply this rule, requiring a minimum of 11 hours of work rest between two shifts work (Ferri *et al*., 2016).

According to the researchers, the 2-2-2(2) (metropolitan rota) shift pattern is good because the rotation is regular, the rotation is clockwise and not long, and the night shift is consecutive for a maximum of 2 days so that nurses are not too long in the night shift rotation. They have two consecutive days off after the end night shift rotation to take rest, which can help them avoid fatigue before moving to the next shift rotation. Sufficient rest time during each shift rotation can prevent sleep disorders and fatigue. This is in line with the results of this study shown in Table 2. The majority of respondent's fatigue is low (71.2%) and moderate fatigue (28.8%), and no respondents are experiencing severe fatigue. This is also in line with the results of the *Chi-square* statistical test related to rest time in Table 1, which obtained a *p-value* of 0.044 < 0.05, which means work rest time is related to fatigue. This result also aligns with the research of Narpati *et al*. (2019) stating that rest time is related to work fatigue.

Gifkins *et al*. (2020) and Min *et al*. (2019) identified shift work arrangements (shift length, shift rotation, and number of night shifts) as working conditions that cause fatigue, and counterclockwise shift rotation is an essential factor in fatigue (Kida and Takemura, 2022). Setting the direction of shift work rotation forward (clockwise) is one of the strategies to reduce interference with circadian rhythms. This is a good shift work arrangement compared to the direction of rotation backward (counterclockwise). The results of Shiffer's research stated that nurses with forward work rotation (40%) experienced poor sleep quality less often than those with backward shift rotation (80%) (Afifah *et al*., 2021). Research by Härmä *et al*. (2018) in Helsinki and Uusima hospitals in Finland with a sample size of 2.781 showed that the proportion of night shifts of more than two consecutive days (>2 and >4) significantly affected fatigue during work (OR 1.13, 95% CI 1.05 – 1.22) and difficulty falling asleep (OR 1.16, 95% CI 1.08 – 1.25), with conclusion of the results saying a shift system that rotates forward quickly can reduce fatigue.

Noviyanti and Supriyadi (2020) explained that shift distribution and delegation of appropriate tasks and responsibilities can help reduce fatigue for nurses (Noviyanti and Supriyadi, 2020). In addition, the preparation of shift work schedule must also be in

line with the provisions of Law the Republic Indonesia Number 13 of 2003 concerning manpower and Law Number 11 of 2020 concerning job creation by considering the following: 1) Working time, including 7 – 8 hours a day and 40 hours a week, 2) Rest time, rest between working hours at least half an hour after working for four hours continuously, and the rest time does not include working hours, weekly rest between 1 and 2 days a week, 3) Changeover time with a forward rotation pattern (clockwise), 4) The duration of the shift work is a maximum of 8 hours a day, and if you add working hours, it can be done for a maximum of 4 hours in 1 day and 18 hours a week (Fadila, 2021).

CONCLUSION

Based on the study's results, there was no relationship between shift work with sleep quality and fatigue. Appropriate shift work arrangements can contribute to reducing the negative impact of shift work. In determining shift work, work institutes should consider factors including shift type, start and end time length, shift direction, and rest time.

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