



## **The Relationship Between Shift Work Patterns and Cognitive Function Disorders in Health Workers at Hospital X, West Java, Indonesia**

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### **A B S T R A C T**

**Introduction:** Jobs with shift work patterns, especially irregular ones, can disrupt circadian rhythms and sleep quality, which then impacts cognitive function. Despite its importance, research on cognitive domain vulnerabilities related to shift work patterns is still limited. Sleep quality and cognitive function are critical in the context of hospital health services, where decisions and actions must be taken quickly and precisely to support patient safety. **Methods:** This research is a cross-sectional observational analytical study to determine the relationship between shift work patterns and impaired cognitive function. To measure sleep quality, the Pittsburgh Sleep Quality Index Indonesian (PSQI-Ina) is used, while cognitive function and cognitive domains were measured using Oxford Cognitive Screen (OCS) Indonesian (OCS-Ina), a cognitive instrument for stroke patients, which has been validated. The minimum sample size in this study was 72 samples. Correlation, principal component analysis, demographic analysis, and regression were used to characterize the relationship between PSQI-Ina, OCS-Ina, and other research variables. **Results:** A total of 83 health workers met the inclusion criteria and were included in the research. The results showed that 16 respondents (19.3%) experienced impaired cognitive function in the Attention domain and 2 respondents (2.4%) experienced impairment in 2 cognitive domains (Attention and Number Management). The results of statistical analysis showed a significant relationship with health workers who had part-time jobs having a 12.8-fold risk (OR 12.8; 95% CI 1.7-91;  $p = 0.011$ ) of experiencing cognitive impairment. Then health workers who experience poor sleep quality (with a PSQI value  $>5$ ) have a 40.3 times greater risk (OR 40.3; 95% CI 2.2-708.1;  $p = 0.011$ ) of experiencing cognitive impairment. Likewise, health workers with irregular shift work patterns have a 5.4 times risk of experiencing cognitive impairment (OR 5.4; 95% CI 0.1-26.6;  $p = 0.036$ ). **Conclusion:** There is a relationship between shift work patterns and impaired cognitive function in the workplace. Hospitals should prioritize ergonomic shift work schedules, emphasizing speed and clockwise rotation, to support the well-being of their healthcare workers.

### **1. Introduction**

Shift work patterns, especially irregular ones, have become an inseparable part of various industries, including health services. In hospitals, doctors, nurses, and other medical staff often have to work

rotating shifts, including nights and weekends. This work pattern, although important, can have consequences for individual health and performance, one of which is through disruption of circadian rhythms, sleep quality, and cognitive function.

Circadian rhythms are the body's internal clocks that regulate various physiological functions, including sleep and wakefulness. Irregular shift work patterns can disrupt this circadian rhythm, as individuals are forced to work and sleep at times different from their body's natural rhythm. Individuals may find it difficult to fall asleep or stay awake at desired times and may experience fragmented and restless sleep. Lack of sleep and disruption of circadian rhythms can lead to chronic fatigue, which can impact an individual's performance and health. Circadian rhythm disorders are associated with an increased risk of various health problems, such as obesity, diabetes, and cardiovascular disease.<sup>1-3</sup>

Lack of sleep and disruption of circadian rhythms can also negatively impact cognitive function. Individuals may find it difficult to focus and concentrate on tasks and may be more easily distracted. Individuals may have difficulty remembering information and learning new things. Lack of sleep can affect an individual's ability to think clearly and make informed decisions. Although research has been conducted on the impact of irregular shift work patterns on circadian rhythms, sleep quality, and cognitive function, research on the vulnerability of cognitive domains related to shift work patterns is still limited. This is important to learn, especially in the context of health services in hospitals, where decisions and actions must be taken quickly and precisely to support patient safety.<sup>4-6</sup> This study aims to determine the relationship between shift work patterns and impaired cognitive function in health workers.

## **2. Methods**

This study used an observational analytical design with a cross-sectional approach. This design was chosen to determine the relationship between shift work patterns and impaired cognitive function in individuals who work with this pattern. The population of this study is all individuals who work on a shift work pattern. The research sample was taken using a purposive sampling technique, namely by selecting individuals who met the inclusion and exclusion criteria. The inclusion criteria are aged 18-

65 years, working in a shift work pattern for at least 1 year, and willing to be a research respondent. Meanwhile, the exclusion criteria are having a neurological or psychological disorder, taking drugs that can affect cognitive function, and being pregnant or breastfeeding.

The minimum sample size in this study was calculated using the Slovin formula, assuming a confidence level of 95%, a margin of error of 5%, and a prevalence of cognitive dysfunction in shift workers of 50%. The calculation results show that the minimum sample size is 72 people. The research instrument used in this study was a demographic questionnaire to collect information about age, gender, education, employment, and length of work in shift patterns. Pittsburgh Sleep Quality Index in Indonesian (PSQI-Ina): to measure respondents' sleep quality. PSQI-Ina is a valid and reliable instrument for measuring sleep quality in adults. Oxford Cognitive Screen (OCS) Indonesian (OCS-Ina): to measure the cognitive function and cognitive domains of respondents. The OCS-Ina is a valid and reliable instrument for measuring cognitive function in stroke patients and can be used to measure cognitive function in the general population.

The research procedures carried out were as follows: Respondents were explained about the purpose of the research and asked to sign an informed consent agreement. Respondents filled out the demographic questionnaire, PSQI-Ina, and OCS-Ina. The data obtained is collected and analyzed. The data analysis carried out in this research is descriptive analysis, which describes the characteristics of respondents and the results of the PSQI-Ina and OCS-Ina measurements. Correlation test: to determine the relationship between PSQI-Ina and OCS-Ina. Principal component analysis: to reduce the variables measured in the OCS-Ina into several cognitive domains. Regression analysis: to determine the effect of demographic variables and sleep quality on cognitive function. This research was conducted by following the principles of research ethics, including respecting the rights of respondents, ensuring the confidentiality of respondent data, and obtaining informed consent from respondents.

### 3. Results and Discussion

Table 1 shows the shift work pattern carried out by the health workers at the Hospital). The majority of health workers do not smoke (89.2%) and do not experience complaints of insomnia (80.7%). The average body mass index (BMI) of workers is 26.4 kg/m<sup>2</sup>, which is the mild obesity category according to

the Indonesian Ministry of Health's body mass index threshold criteria (Asian criteria). The sample BMI varies (coefficient of variance = 17.8%), with the lowest BMI being 18.3 kg/m<sup>2</sup> and the highest up to 49.3 kg/m<sup>2</sup>. Meanwhile, the average working period for this research sample was 3.02 (±1.50) years, with the longest working period being 6 years.

Table 1. Characteristics of respondents.

Variable	n	(%)	Mean ± SD	Median (min-max)
<b>Gender</b>				
Male	28	33,7		
Female	55	66,3		
<b>Age (years)</b>			30,8(±4,571)	30 (22-43)
<b>Education</b>				
Non-Bachelor Primary school/Junior high school/Senior high school/Vocational high school/Associate degree/Bachelor of applied science	45	54,3		
Bachelor (Bachelor/Masters/Profession/Specialist)	38	45,7		
<b>Marital status</b>				
Single	25	30,1		
Married	56	67,5		
Widow/widower	2	3,40		
<b>Shift work pattern</b>				
Regular	44	53,0		
Irregular	39	47,0		
<b>Smoking habit</b>				
Non-smoker	74	89,2		
Smoker	9	10,8		
<b>Having children under five</b>				
No	43	51,0		
Yes	41	49,0		
<b>Insomnia</b>				
No insomnia	67	80,7		
Insomnia	16	19,3		
<b>Side job</b>				
No	72	86,7		
Yes	11	13,3		
<b>Body mass index (kg/m<sup>2</sup>)</b>			26,4 ±4,6	25,1 (18,3-49,3)
<b>Work period (years)</b>			3,02 ±1,5	3 (1-6)

Table 2 shows that most of the cognitive domains obtained normal results (100%) except for the domains of number management and attention and executive function. The cognitive domains of attention and executive function, especially in assessing object asymmetry, had the highest level of interference, namely 19.3%. Cumulatively, 19.3% of participants had cognitive impairment based on the Oxford

Cognitive Screen Indonesian version (OCS-Ina) examination, while the other 80.7% were declared to have no impairment in any cognitive domain. 2.4% who had errors in the number management domain (number writing task) also made errors in the cognitive domains of attention and executive function (object asymmetry judgment task).

Table 2. Results of cognitive function measurements.

<b>Cognitive domain</b>	<b>Frequency (%)</b>
Attention	16 (19,3%)
Memory	0
Language	0
Visuospatial	0
Number management	2 (2,4%)
Multitasking	0

Health workers who have risky side jobs have a 12.8 times higher risk of experiencing cognitive impairment. Health workers who experience poor sleep quality have a 40.3 times higher risk of

experiencing cognitive impairment. Health workers with irregular shift work patterns have a 5.4 times higher risk of experiencing cognitive impairment (Table 3).

Table 3. Results of statistical analysis of risk factors for cognitive disorders in health workers.

<b>Risk factors</b>	<b>Odds ratio (OR)</b>	<b>Confidential interval 95% (CI)</b>	<b>p-value</b>
Having a risky side job	12,8	1,7-91	0,011
Poor sleep quality (PSQI >5)	40,3	2,2-708,1	0,011
Irregular shift work pattern	5,4	1,8-26,6	0,036

This research shows that health workers who have risky side jobs have a 12.8 times higher risk of experiencing cognitive impairment. These findings have several important implications, both scientific and practical. Scientifically, these findings are in line with previous research showing that stress and lack of sleep can increase the risk of cognitive disorders. Health workers who have side jobs are at risk of experiencing higher stress and lack of sleep compared to health workers who do not have side jobs. Chronic stress can cause various neurological changes that can interfere with cognitive function. Excessive cortisol can damage brain cells in the hippocampus, an area important for memory and learning. Chronic inflammation can damage brain cells and disrupt communication between neurons. Stress can cause insomnia and other sleep disorders, which can lead to fatigue and difficulty concentrating. Lack of sleep can also cause various neurological changes that can interfere with cognitive function. Lack of sleep can inhibit neurogenesis, which is the process of forming new cells in the brain. Lack of sleep can disrupt neuroplasticity, namely the brain's ability to change and adapt. Lack of sleep can cause difficulty focusing, remembering information, and making decisions. Risky side jobs can cause stress and sleep deprivation through various mechanisms. Health workers with

second jobs may have excessive workloads, which can lead to stress and burnout. Risky side jobs may have high demands, which can cause stress and anxiety. A risky side job might disrupt your sleep schedule, which can lead to sleep deprivation and fatigue.<sup>7-11</sup>

Research shows that health workers who experience poor sleep quality have a 40.3 times higher risk of experiencing cognitive impairment. This can be explained through several biological and physiological mechanisms. Lack of sleep, which is one of the main components of poor sleep quality, has been scientifically proven to cause cognitive impairment. Sleep plays an important role in various brain functions. Sleep helps the brain to store and consolidate information learned during the day. Lack of sleep can interfere with this process, causing difficulties in remembering and learning. Sleep helps the brain to stay focused and alert. Lack of sleep can cause difficulty concentrating, being easily distracted, and making mistakes. Sleep helps the brain to process information quickly and efficiently. Lack of sleep can slow down the speed of information processing. Sleep helps the brain to make the right decisions. Lack of sleep can lead to impulsivity and difficulty making informed decisions. Lack of sleep can cause various physiological changes in the brain that can interfere with cognitive function. Lack of sleep can cause

changes in neurotransmitter levels in the brain, such as dopamine, serotonin, and norepinephrine. This neurotransmitter is important for a variety of cognitive functions, including memory, attention, and mood. Lack of sleep can increase inflammation in the brain. Chronic inflammation can damage brain cells and disrupt cognitive function. Lack of sleep can increase oxidative stress in the brain. Oxidative stress can damage brain cells and interfere with cognitive function. Lack of sleep can increase the apoptosis of brain cells. This can cause brain damage and decreased cognitive function. Poor sleep quality can cause various cognitive disorders in health workers. This can be explained through several biological and physiological mechanisms. It is important for healthcare workers to prioritize adequate, high-quality sleep to maintain brain health and cognitive function.<sup>12-15</sup>

This research shows that health workers with irregular shift work patterns have a 5.4 times greater risk of experiencing cognitive impairment compared to health workers who do not have irregular shift work patterns. Irregular shift work patterns can disrupt the body's circadian rhythm, which is the body's internal clock that regulates various physiological functions, including sleep, hormones, and metabolism. Circadian rhythm disturbances can cause various health problems. Health workers with irregular shift work patterns often experience a lack of sleep, which can cause fatigue, weakness, and difficulty concentrating. Circadian rhythm disturbances can interfere with the production of important hormones, such as melatonin, cortisol, and testosterone. This can affect mood, energy, and cognitive function. Circadian rhythm disturbances can increase inflammation in the body, which can damage brain cells and increase the risk of dementia. Irregular shift work patterns can increase oxidative stress, which is a process that can damage body cells. Oxidative stress can increase the risk of various health problems. Oxidative stress can speed up the aging process and increase the risk of neurodegenerative diseases, such as Alzheimer's and Parkinson's. Oxidative stress can damage DNA, which can increase the risk of cancer and other diseases. Oxidative stress can damage brain cells and interfere

with cognitive function. Irregular shift work patterns can disrupt the body's metabolism, which can increase the risk of diabetes, obesity, and cardiovascular disease. This metabolic disorder can also affect cognitive function. Health workers with irregular shift work patterns often have limited time to exercise. Lack of physical activity can increase the risk of various health problems. Lack of physical activity can increase the risk of heart disease, stroke, and high blood pressure. Lack of physical activity can lead to weight gain and obesity. Lack of physical activity can affect blood flow to the brain and impair cognitive function. Irregular shift work patterns can increase the risk of cognitive impairment through various biological mechanisms. This is important to consider when setting work schedules for health workers.<sup>16-18</sup>

#### 4. Conclusion

This study revealed cognitive impairment in the number management domain (2.4%) and the attention and executive function domain (19.3%), while other domains remained within normal limits. Factors associated with impaired cognitive function included poor sleep quality (PSQI>5), side jobs, and irregular shift work patterns, all showing statistically significant associations. Therefore, this research can help health workers and policymakers recognize irregular shift work patterns as a risk factor for cognitive impairment and implement prevention and intervention strategies.

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