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RESEARCH ARTICLES

Work Shifts Affect Blood Pressure in Employees In Tegal Sari Mandala II Village

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Abstract: Work shifts are a work system that is widely applied in various work sectors to increase productivity. However, the implementation of this system can hurt workers' health, especially in terms of blood pressure. Based on data from Tegal Sari Mandala II Village, Medan City, it was found that there was an increase in the prevalence of hypertension in workers who worked shifts compared to workers who had fixed working hours. Hypertension in shift workers can be caused by circadian rhythm disruptions, increased cortisol levels, irregular sleep patterns, and higher stress levels. This study aims to determine the effect of work shifts on blood pressure in employees in Tegal Sari Mandala II Village. This study uses an analytical design with a cross-sectional method. The sample consisted of 100 randomly selected employees. Data was collected through blood pressure measurements using a digital sphygmomanometer. Data analysis was carried out using *the Chi-Square test* with univariate and bivariate methods to measure the relationship between work shifts and hypertension. The results showed a significant relationship between work shifts and hypertension incidence (p=0.001). Shift workers are more prone to hypertension than *non-shift workers*, with the prevalence of grade 2 hypertension being 14 employees in the shift group. Shift workers have a higher risk of hypertension than non-shift workers. Therefore, structured occupational health interventions, good sleep patterns, and education about stress management are needed to reduce the risk of hypertension in shift workers.

Keywords: Work shifts, hypertension, blood pressure, circadian rhythms.

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INTRODUCTION

Hypertension occurs when systolic blood pressure is greater than or equal to 140 mmHg and/or blood pressure diastolic is greater than or equal to 90 mmHg. Hypertension is the number 3 cause of death after stroke and tuberculosis, which accounts for 6.7% of the population of all ages in Indonesia.[1]

The World Health Organisation (WHO) 2023 estimates that the number of adults with hypertension has almost doubled globally over the past three decades, from 650 million in 1990 to 1.3 billion adults in 2019. The health effects of increased high blood pressure lead to 10.8 million deaths and 235 million years of life lost or lived with disability. Globally, 1 in 3 adults suffer from hypertension, with the prevalence of men slightly higher than women under the age group of 50.[3]

Formal sector workers are workers who have employment relationships that are bound by laws and regulations, as well as labour laws, taxes, income, social protection or certain rights to certain job guarantees. Meanwhile, informal workers are those who work outside the formal sector, without formal employment contracts, social security or legal protection. As well as being responsible for individuals, as well as working capital comes from their own costs. Economic activities in the informal sector are not regulated and not recognised by the government.[4]

Shift work is derived from the foreign language "*shift*", which means a work system that implements alternating work patterns or working hours. Different working hours are set up, often including morning, noon, evening, and night. Many industries in the formal sector require work shifts to carry out 24-hour operations or meet high demand for services outside of normal working hours. For example, hospitals, factories, transportation, security, and customer service. Shift work provides benefits for its workers, including being able to do other activities in the morning and afternoon, such as taking care of family or doing studies. However, *shift* work can also increase the risk of health problems for workers, as essentially our body's internal clocks are designed to be active during the day and sleep at night. Changes in sleep hours disrupt the body's metabolism, such to obesity, diabetes, and hypertension. Complications from hypertension lead to heart failure, coronary heart disease, and stroke.[5]

In recent years, companies have started using shift work systems to increase productivity and efficiency. However, this shift work system also hurts workers' health, especially on blood pressure. Shift work can cause fatigue and affect changes in workers' blood pressure.[6] Changes in activity schedules from day to night in *shift* workers can cause chaos in circadian patterns, resulting in the disruption of various body functions. Therefore, companies should pay attention to the health of shift workers and take steps to mitigate those risks. In several previous studies, it has been found that the work shift

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system hurts workers' health, especially on blood pressure.[7]

Hypertension control is important to prevent lifelong complications and acute cardiovascular disorders. Hypertension is known to be the leading cause of premature death due to cardiovascular disease. Based on several health centres in Medan City, the Mandala Health Centre occupies the highest position for hypertension patients, which is 4,483 people.[2] The data shows the high prevalence of hypertension in the city of Medan and the findings of this study are expected to provide a basis for better interventions in supporting workers' health, increasing company awareness about the importance of maintaining blood pressure stability and regulating a work *shift* system that is balanced with workers' health, so that appropriate preventive measures can be taken.

This study aims to determine the effect of work shifts on blood pressure in employees in Tegal Sari Mandala II Village.

METHOD

The type of research used is unpaired categorical comparative analysis, using the cross-sectional method is included in the analytical survey research method, which is a study to study the dynamics between the effect of work *shifts* on blood pressure. Observation or data collection at once (point in time approach). The sample in this study is workers who have working time using *shifts* in Tegal Sari Mandala II sub-district, Medan Denai District. With an early adult age range of 20 – 40 years. The research sample was obtained using *the Slovin* method, with a total of 100 respondents. The data used is primary data collected through blood pressure measurement. Data analysis was carried out using *the Chi-Square test.*

RESULT

UNIVARIATE TEST

Table 1. Distribution of Subject Characteristics

Information	Characteristics	Work Shifts	Non-Shift Work
		N	N
Age	20 - 25 y.o	10	18
	26 – 30 y.o	10	12
	31 - 35 y.o	10	8
	36 - 40 y.o	10	22
Gender	Man	19	34
	Woman	21	26
History of HT	HT (+)	29	27
	HT (-)	11	33
Occupation	Teller Bank	0	3
	Teacher	0	4
	Administrative Staff	3	2
	Notary	0	2
	Driver	3	4
	Lecturer	0	4
	Online Motorcycle Taxi	0	4
	Restaurant Employees	0	2
	Builder	0	3
	Civil Servant	0	10
	Security	16	0
	Helper	0	3
	Shopkeeper	0	1
	Office Guard	2	0

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Hospital Cleaning Service	2	0
Gardener	0	1
Honorary Village	0	2
Lawyer	0	1
Street Sweeper	0	2
Motocyclle Sales	0	2
Minimarket Cashier	0	3
Minimarket Scurity	2	0
Hospital Nurse	3	0
Gas Station Employees	4	0
Factory Staff	2	0
Minimarket Guard	0	1
Cleaning Service	3	0
Printing	0	2
Cafe Employees	0	4

Based on UNIVARIATE TEST

. The data shows the distribution of respondent characteristics based on shift and non-shift work status, including age, gender, history of hypertension, and type of occupation. On the age variable, the largest distribution in the non-shift group was 36–40 years old (22 respondents), while the shift group had an even distribution across all age groups, with 10 respondents each. The age group of 36–40 years remains a representation of the productive age, which, according to WHO (2023) is beginning to experience an increase in metabolic risk, As we age, the elasticity of blood vessels begins to decrease, so blood vessels become stiffer and difficult to adjust blood pressure, increasing the risk of hypertension.

Table 2. Distribution of Work Shifts

Work Shifts	Frequency (n)	Percentage (%)
Work Shifts	40	40.0
Non-Shift Work	60	60.0
Total	**100**	**100.0**

Based on Table 2. **Distribution of Work Shifts**. As presented above, the majority of respondents work in a non-shift system (60%), while 40%) respondents work in a shift system. Work shifts generally consist of morning, afternoon, and night shifts, each of which has a working duration of 8-12 hours per shift.

Table 1. Blood Pressure Distribution

Blood pressure		Work Shifts	Non-Shift Work
Normal		5	22
Increase		6	20
Grade hypertension	1	15	10
Grade Hypertension	2	14	8
Total		**40**	**60**

Based on Table 1 results obtained from the respondents' blood pressure distribution showed variations that reflected significant differences between shift and non-shift work groups. Of the total 100 respondents, only 27% had blood pressure in the normal category, with the dominance coming from the non-shift group (22%) compared to the shift group (5%). This suggests that respondents with

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non-shift work patterns tend to have better blood pressure.

BIVARIATE TEST

Table 4. Chi Square Test Relationship of Work Shift with Blood Pressure

It can be seen from the results of the research in Table 4. Chi **Square Test Relationship of Work Shift with Blood Pressure** There was a statistically significant relationship between work status (shift and non-shift) and respondents' blood pressure, indicated by the value p = 0.001 (p < 0.05). This shows that working hours—whether shift or non-shift—are meaningfully correlated with the blood pressure condition of respondents.

The distribution of blood pressure showed a striking difference between the two groups. In the shift work group, only 12.5% of respondents (5 out of 40) had normal blood pressure. The rest showed an increase in blood pressure, with 15% (6 respondents) in the pre-hypertension category, 37.5% (15 respondents) suffering from Grade 1 Hypertension, and 35% (14 respondents) in the Grade 2 Hypertension category. Overall, 72.5% of shift respondents experienced clinical hypertension.

Meanwhile, in the non-shift group, the proportion of respondents with normal blood pressure was much higher, at 36.7% (22 out of 60). Increased blood pressure occurred at 33.3% (20 respondents), while Grade 1 and Grade 2 hypertension were recorded at 16.7% (10 respondents) and 13.3% (8 respondents), respectively, so that the total prevalence of hypertension in this group was 30%.

DISCUSSION

Characteristics of Research Subjects

The work shift group is evenly distributed in the age range of 20-40 years; each age group has 10 people. Meanwhile, in non-shift work, the majority are 36-40 years old (22 people), indicating that non-shift workers tend to be older. Age has a significant effect on the incidence of hypertension. As we age, there are natural changes in the cardiovascular system, such as endothelial dysfunction, decreased elasticity, thickening and tightening of blood vessels, and hormonal changes contribute to an increased risk of hypertension in old age.[8]

Working hours	Blood pressure				*P Value*
	Normal	Increase	Hypertension Grade 1	Hypertension Grade 2	
Work Shifts	5	6	15	14	0,001
Non-Shift Work	22	20	10	8	
Total	27	26	25	22	

The gender distribution in work shifts was relatively balanced between males (19) and females (21). In non-shift work, men are more dominant (34) than women (26). This difference can affect the risk of hypertension, considering that men tend to have a higher prevalence of hypertension than women of productive age.[9]

The majority of work shift respondents have a history of hypertension (29 people). This is due to several things,

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ranging from genetic factors, a messy lifestyle and a sleep pattern that has been disrupted for several years. This indicates that shift workers are more at risk of hypertension, likely due to circadian rhythm disturbances and erratic work patterns.[10]

Occupations with high levels of stress of professions such as healthcare workers, industrial workers, and security guards, have high levels of work stress due to time pressure, huge responsibilities, and high physical risks. These differences in types of work are related to different work patterns, which have the potential to affect health and blood pressure.[11]

The Relationship of Work Shift to Blood Pressure

The findings of this study revealed a significant relationship between the shift work system and an increase in blood pressure in employees in Tegal Sari Mandala II Village, Medan p=0.001(p < 0.05). Based on the distribution analysis, the prevalence of hypertension in all respondents reached 47%, with a much higher proportion in the shift worker group (72.5%) than in non-shift workers (30%). Notably, Grade 2 hypertension was found in 35% of shift group respondents, twice as high as that of the non-shift group (13.3%).

These findings indicate that the shift work system has great potential to be a risk factor for hypertension. Shift work can cause hypertension through complex and interrelated pathophysiological mechanisms. One of the main mechanisms is the desynchronization of circadian rhythms, which occurs as a result of changes in work patterns and irregular sleep hours.

As a result, the desynchronization of circadian rhythms in shift workers has an impact on *hypothalamic-pituitary-adrenal* (HPA) axis disorders, which are characterized by an increase in cortisol levels of up to 28% and a decrease in melatonin production by 34%. This condition causes vasoconstriction of blood vessels through overstimulation of α1-adrenergic receptors and increased sodium reabsorption in the distal renal tubules, thereby increasing peripheral vascular resistance and overall blood pressure. [12,13]

Prolonged activation of the sympathetic system can lead to an increase in blood pressure through the vasoconstriction mechanism of blood vessels, increased heart rate, and disorders of blood pressure regulation in general. In addition, sleep deprivation and chronic fatigue that are common in shift workers also weigh on the workload of the heart and cardiovascular system.[14]

Work shift disruption is one of the factors that can disrupt the body's circadian rhythm, which is the biological system that regulates the 24-hour sleep and wake cycle. This rhythm is controlled by the suprachiasmaticus nucleus (SCN) in the hypothalamus and is strongly influenced by light exposure and regular rest periods. In shift workers, working nights or having a rotating work schedule, there is a desynchronization between the internal

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circadian rhythm and externally imposed work time. This causes imbalances in hormonal regulation, including decreased melatonin levels and increased cortisol. As a result, individuals experience sleep disorders (insomnia), which then impacts the central nervous system.[15,16]

In line with several existing mechanisms, when filling out questionnaires and interviews took place, several respondents felt symptoms felt by shift workers including headaches, excessive fatigue, sleep disorders such as insomnia and poor sleep, accompanied by chronic fatigue, as well as concentration disturbances during activities and feelings of anxiety or irritability. These symptoms are a manifestation of the body's response to unstable blood pressure and prolonged physiological stress. This condition causes an increase in the activity of the sympathetic nervous system, which leads to high blood pressure even at night.

Based on previous research conducted by Ivana Laily & Rohim Tualeka (2023), Research on hospital nurses with 3 shifts, nurses at Hospital X work in a work shift system where nurses must work morning, afternoon, and night rotations with more than 8 hours of work. Nurses at Hospital X who work night shifts have less rest time, irregular sleep patterns, and heavier workloads when performed at night, making them more prone to increased blood pressure. As a result, night shifts were associated with blood pressure in the pre-hypertensive category, although the correlation of work shifts was weak (r = 0.259). Nurse respondents who worked on night shifts experienced more hypertensive blood pressure than on other work shifts, namely 4 people. The results of the Spearman correlation test stated a significance value of p=0.000 (p>0.05), which means that there is a significant relationship [17]

In addition to physiological factors, social and behavioural aspects also contribute to hypertension in shift workers. An increase in systolic blood pressure of 8.2 mmHg has been associated with several risk factors, such as sleep disorders that cause a decrease in sleep duration of about 1.5-2 hours per day, an unhealthy diet with excess salt intake, and a decrease in physical activity of up to 35%[54]. Another factor that plays a role is an increase in perceptual stress of up to 40%, which can worsen the condition of hypertension in this group. Demographic differences also affect the risk of hypertension, where workers aged 36-40 years are more prone to hypertension than the 20-25 year age group. This is due to a decrease in physiological adaptation capacity to changes in circadian rhythms with age[55]. In addition, sex differences showed a 35% higher risk in women than in men, which may be due to hormonal interactions with the blood pressure regulatory system[19]

From the results of research that has been carried out in line with several previous studies, the regulation of the work shift system has been proven to have a bad impact on blood pressure. Although this is accompanied by other factors, both from

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the environment and lifestyle, that contribute to blood pressure. The high prevalence of hypertension among shift respondents underscores the importance of attention to occupational health, especially in the implementation of stress management policies, healthy sleep patterns, and routine health monitoring for workers with a rotating work system.

The increase in the number of hypertensive patients is expected to cause a great burden on the health system due to hypertension-related complications such as heart disease, stroke, and kidney failure. The increase in hypertension from 2023 to 2025 is not only a matter of quantity, but also the quality of hypertension cases that now attack young people and are rarely recognised. A combination of unhealthy lifestyles, stress, obesity, and limited awareness of dangers is the main cause. [20]

Research Limitations: This study has several research limitations. First, this study is cross-sectional in nature, which only describes the relationship between variables at a single point in time and does not show a causal relationship. Second, this study is less specific because it does not look at changes over time to see long-term effects. Third, in this study, the sample obtained is still unbalanced between the two due to the limited time available, as non-shift workers, such as offices, have a busy schedule.

CONCLUSION

Based on the results of research conducted in Tegal Sari Mandala II Village, it can be concluded that:

1. There is a significant relationship between the shift work system and the incidence of hypertension in workers. This is proven by the Chi-Square statistical test with a value of p=0.001, which shows that the relationship is statistically significant ($p < 0.05$).
2. In the group of employees who worked with the shift system, it showed an increase in blood pressure. Overall, a total of 72.5% of shift respondents experienced clinical hypertension.
3. In the group of employees who worked without a shift system (non-shift), the number of respondents with normal blood pressure was higher than in the shift group. Overall, a total of 30% experienced hypertension.
4. The duration of working hours and work shift patterns have a significant influence on the increase in blood pressure. Working hours per shift >8 hours are considered to have an effect on blood pressure increases.
5. The prevalence of hypertension in all respondents was **47%** (47 out of 100 people), indicating that almost half of the workers had clinically high blood pressure.

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