ORIGINAL ARTICLE

Musculoskeletal Disorders, Work Stress, and Fatigue of Workers as the Impact of Work from Home Activities during the Covid-19 Pandemic

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ABSTRACT

Introduction: This study aims to determine the relationship between musculoskeletal disorders, work stress and work fatigue in workers from home activities. **Methods:** This research conducted using cross sectional design. Population is all mother in Indonesia, and sample who participated in the study were 253 mother. Instrument research using Nordic Body Map questionnaire and data collection by online using a valid and reliable questionnaire. Pearson's Product Moment Correlation was use to analysis the correlation between variable. **Results:** Respondents aged ≤ 30 years (88.1%), mostly was female (72.3%), with a married marital status of 29.2%. Most of the education level is bachelor degree (45.1%) with the largest type of work being private employees as many as 147 people (58.1%). Work activities duration is mostly ≤ 8 hours per day (94.5%), the most used work tools are mobile phones (hand phone) as much as 80.6%. The favourite location chosen for activities is inside the house (42.3%). **Conclusion:** The results of the correlation test using Pearson's Product Moment Correlation showed that there was no relationship between musculoskeletal disorders and work stress. However, there was a relationship between musculoskeletal disorders and work fatigue. There was also a relationship between work stress and work fatigue. It is suggested that workers who work from home and using mobile devices to do their work in an ergonomic location (work station) to prevent musculoskeletal disorders and work fatigue.
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INTRODUCTION

In December 2019, the first case of mysterious pneumonia had reported in Wuhan, Hubei Province. The source of the transmission is still unknown, but the first case was linked to a fish market in Wuhan. From December 18 to December 29 2019, there were five patients who were treated with Acute Respiratory Distress Syndrome (ARDS)(1). From December 31, 2019 to January 3, 2020, this case increased rapidly, marked by the reported 44 cases. In less than a month, the disease has spread to other provinces in China, Thailand, Japan, and South Korea (2).

The existence of the COVID-19 pandemic has caused the Indonesian government to take action to carry out work activities at home, or what we often call Work from Home (WFH) activities. With the changing work rhythm, from direct activities in the office or at work, it was shifted to work at home activities. However, not all types of work can be done from home. Work that can be done at home online, including in the fields of education, services, and services that use online systems. Activities carried out by employees can cause musculoskeletal complaints, work fatigue and work-related stress if the causative factors are not immediately identified so that prevention can be done.

WFH or working from home is an alternative work pattern that is different from usual. Usually, under normal conditions, the work is carried out at the Workplace provided by the Employer. The workplace is usually an office or factory. Currently, the Workplace has to be shifted from the office/factory to the homes of each Worker. This Workplace Transfer of course needs

to be done carefully and carefully. Care must be taken, because not all jobs can be WFH. Caution is needed because WFH brings several consequences that have the potential to reduce worker protection. That is why there are several aspects that must be considered when the Employer implements WFH for its workers.

The easiest jobs to WFH are all jobs that use information and communication technology (ICT) devices. In principle, as long as ICT equipment and facilities are available, this work can be done anywhere, including at home. Another type of work that may be possible to do at home is the production of goods, but cannot be done in large quantities. The production of services in the form of direct services, seems impossible to WFH. The easiest examples are cleaning services and security services. Availability of equipment, materials, facilities and work tools. should be a concern. Usually workers come to the office/factory to work, without bringing or providing anything except themselves and their own energy. At the time of WFH, it is very likely that these facilities and infrastructure are not available so that it can be burdensome if the workers themselves have to provide and buy these work materials and equipment. So, as in the office/factory, it is the employer's responsibility to provide facilities, materials and work tools so that they can carry out work from home smoothly.

Fatigue is a common phenomenon that occurs in all workers in various types of work, and each type of work has its own characteristics of work fatigue with different dimensions (3). Work burnout is a type of stress experienced by many people who work in service jobs to others, such as health care, transportation, police, and education, work fatigue can cause work accidents (4). Job stress is a condition resulting from the subjective appreciation of individuals in the form of interactions between individuals and the work environment that can threaten and put pressure on psychological, physiological and individual behavior. Job stress caused by work environment and personal factors. Work environment factors can be in the form of physical conditions, office management and social relations in the work environment. Personal factors can be in the form of personality types, personal experiences, and family socioeconomic conditions (5).

The jeopardy of stress is also caused by work fatigue conditions which will reduce performance and increase the level of work errors. Basically, work fatigue will also greatly affect performance as a teacher educator and will have an impact on who is being taught, because teachers will feel lost concentration on teaching. As defined that fatigue is a common occurrence when a person works. Work fatigue can cause problems for organizations and companies because work fatigue can appear in the form of decreased performance commitment, loss of frustration, and decreased morale. Currently fatigue is a crucial problem in the world of work, because it often hampers employee performance, which is detrimental to the company. Work fatigue often appears in the world of work due to routine and high pressure in daily life. Overcoming work fatigue cannot be done at the individual level alone. This requires good cooperation between workers, companies and workers' families (6).

Musculoskeletal Disorders (MSDs) are complaints in the skeletal muscles that are felt by a person when the muscles receive repeated static loads for a long time (7). These disorders can cause complaints in the form of damage to the joints, ligaments and tendons. Musculoskeletal disorders are complaints that are felt to attack the muscles, nerves, tendons, ligaments, joints, cartilage and spinal nerves. Symptoms of the disease are caused by work that is carried out continuously and is chronic which is influenced by risk factors such as load, posture, frequency, and duration (8).

MSDs are complaints or disturbances that felt by a person ranging from mild complaints to feeling very sick in the musculoskeletal area, includes the joints, nerves, muscles and spine due to unnatural work. If the muscles are disturbed, then daily activities such as doing work caused muscle strength is one of the most important parts of the human body's organs so that the body can move. While the muscle strength itself will be determined by the number of actively wrinkled fibers in the human body in a certain period of time. In addition, excessive muscle contraction coupled with giving a load that is too heavy and in a sufficiently long duration can pose a risk for MSDs complaints. Studies related to MSDs complaints themselves have been carried out in various companies and industries. As research conducted on stone crusher workers in Leyangan Village, Semarang Central Java it is known that as many as 40% of respondents feel MSDs complaints in several parts of the body with a high level of risk. The lower back was felt by the most respondents, namely 76.7% of a total of 30 respondents (9).

Work from home make burnout complaints among employees. One of which is due to the workload that is more than before, because they have to take care of the household and children, especially for working parents, while at home, in addition to doing work activities, it is also coupled with activities for Supervise children who do learning activities at home (Study from home). Likewise, working hours or working time at home are longer than working hours when working in the office or at work.

With regulations to work at home for workers during the Covid-19 pandemic, workers must adapt to conditions at home. There are still many workers who do not have an adequate and non-ergonomic location or workplace, which can cause musculoskeletal problems. Workers use makeshift work tools and tools at home to work, unlike those used when they work in their offices or

workplaces. This can cause musculoskeletal complaints in workers who do work activities at home.

Based on this background, it is necessary to conduct research on musculoskeletal complaints, work fatigue and work-related stress in employees who work from home during the covid-19 pandemic. This study aims to identify musculoskeletal complaints, work fatigue and work stress experienced by employees who work at home during the COVID-19 pandemic. The purpose of the study was to determine the relationship between musculoskeletal disorders, work stress and fatigue in workers on work from home activities during the COVID-19 pandemic.

MATERIALS AND METHODS

This study uses a cross sectional approach, which is a study to study the dynamics of the correlation between risk factors and effects, by approaching, observing or collecting data all at once (point time approach). Data collection for each variable is only done once, regardless of the follow-up data.

The population of this study is workers who carry out activities at home during the COVID-19 pandemic. The total population is an infinite population, so to determine the number of samples carried out by accidental sampling over a period of 3 months, namely in August - October 2020 by online using google form.

Respondents' inclusion criteria were: 1) willing to be involved in research; 2) can communicate well online and 3) have the facility to fill out data in online questionnaires, 4) carry out activities during the covid-19 pandemic. There were 253 participants in this research filled out the instrument that given by online.

The instrument used to determine the presence or absence of MSDs in the respondents used the Nordic Body Map (NBM). The Nordic Body Map questionnaire is a form of ergonomics check list questionnaire. Another form of ergonomics checklist is the International Labor Organization (ILO) checklist. However, the Nordic Body Map questionnaire is the questionnaire that is most often used to find out workers' discomfort, and this questionnaire is most often used because it is standardized and neatly arranged (9). Data collection is done online using a questionnaire that has been created in the google form.

Subjective Self Rating Test from the Industrial Fatigue Research Committee (IFRC) Japan, is one of the questionnaires that can measure subjective fatigue levels. The questionnaire contains a list of 30 questions consisting of; 10 questions about the weakening of activities (questions 1 to 10), 10 questions about the weakening of motivation (questions 11 to 20) and 10 questions about the description of physical fatigue (questions 21 to 30). This instrument has been used in research conducted on workers in companies in Bekasi City (10).

The Perceived Stress Scale (PSS) was developed by Cohen (1988). This questionnaire consists of 10 statements. The researcher adapted it by translating it into Indonesian. In addition, modifications were made by turning it into a statement with an alternative response of "Never" to "Always". The reliability coefficient is 0.904 (11) (12).

Univariate analysis for each variable used a frequency distribution and for bivariate analysis using a cross table. The results of the normality test showed that all variables were normally distributed. The research hypothesis will be accepted if the p value is less than 5%. The statistical test used was Product Moment Correlation to determine the relationship between variables and linear regression to determine the relationship between work stress, musculoskeletal disorders and fatigue.

The research was carried out after receiving a letter of ethics from the Health Research Ethics Committee of the Immanuel College of Health Sciences, Bandung. Certificate of Ethics Eligibility, namely: Number No. 002/KEPK/STIKI/2020. The assignment to conduct research was issued by the Head of the College of Health Sciences Immanuel Bandung Number: 82/STIKI/WK1/LP2M/VI/2020.

RESULTS

Respondents who participated in the study were 253 people, with the following characteristics: age 30 years as many as 223 people (88.1%), the most gender were women (72.3%), with marital status married as much as 29.2%. Most of the education levels are undergraduate (45.1%) with the most types of work being private employees as many as 147 people (58.1%) (Table I).

The length of work activity is mostly 8 hours per day as many as 239 people (94.5%) with the work tools used when doing activities at home are mobile phones (mobile phones/HP) as much as 80.6%. The favorite location chosen for activities at home was not specifically stated. Most answered that activities were carried out at home (42.3%), in bed (18.6%) and in the living room as many as 42 people (16.6%).

Association between musculoskeletal disorders and work stress

Table II shows the relationship between musculoskeletal complaints and work stress. As many as 31 respondents who were included in the no-complaint category, it turned out that respondents who experienced stress in the moderate and normal categories had the same proportion, namely 38.7%, and only 3.1% experienced severe work stress. Respondents with musculoskeletal complaints as many as 222 people, it turns out that most

Table I: Characteristics of Respondents (n=253)

Variables	n = 253	%
Age (years)		
≤30 years	223	88.1
> 30 years	30	11.9
Gender		
Male	70	27.7
Female	183	72.3
Marital status		
Not married	179	70.8
Married	74	29.2
Level of education		
Senior high school	109	43.1
Diploma	17	6.7
Bachelor	114	45.1
Magister	13	5.1
Length of work activity (hour/day)		
≤ 8	239	94.5
> 8	14	5.5
Device used		
Hand phone	204	80.6
Laptop	47	18.6
Hand phone and Laptop	2	0.8
Work activity location		
Bed room	47	18.6
Living room	42	16.8
Workbench	56	22.1
Front yard	1	0.4
Inside house	107	42.3

of them are also included in the sedan category work stress and respondents with heavy work stress category are only 2.3%.

The results of statistical tests using the Product Moment Correlation Test from Pearson's obtained a p value of 0.067. The p value is greater than the value (5%), so that there is no relationship between musculoskeletal complaints and the incidence of work stress.

Association between musculoskeletal disorders and fatigue

Table III shows that there are 31 respondents in the category of no musculoskeletal complaints, in fact most (80.6%) are in the category of mild work fatigue and only 3.2% are included in the category of high fatigue. Respondents with musculoskeletal complaints were 222 people, in fact most of them were included in the mild category. The proportion of respondents with mild fatigue in the no-complaint category was greater than in the no-complaint category.

The results of statistical tests using the Product Moment Correlation test obtained a p value of 0.0001. The p value is smaller than the value (5%), so that the statistical test results can be rejected by H0 or H0 being rejected. There is a relationship between musculoskeletal complaints and the incidence of work fatigue. The Product Moment correlation coefficient is 0.398, which means that the relationship between musculoskeletal complaints is positive and the relationship is in the moderate category.

Table II: Association between Musculoskeletal Disorders and Work Stress

Musculoskeletal Disorders	Work Stress										*p*
	Normal		Light		Moderate		Heavy		Total		
	f	%	f	%	f	%	f	%	f	%	
No complaint	12	38.7	6	19.4	12	38.7	1	3.2	31	100	0.159
Complaints	61	27.5	53	23.9	103	46.4	5	2.3	222	100	

Table III: Association between Musculoskeletal Disorders and Fatigue

Musculoskeletal Disorders	Fatigue										*p*
	Normal		Light		Moderate		Heavy		Total		
	f	%	f	%	f	%	f	%	f	%	
No complaint	25	80.6	5	16.1	1	3.2	31	100.0	31	100	0.0001
Complaints	124	55.9	92	41.4	6	2.7	222	100.0	222	100	

Table IV: Association between Work Stress and Fatigue

Work Stress	Fatigue								*p*
	Light		Moderate		Heavy		Total		
	f	%	f	%	f	%	f	%	
Normal	51	69.9	22	30.1	0	0.0	73	100.0	0.0001
Light	42	71.2	17	28.8	0	0.0	59	100.0	
Moderate	56	48.7	56	48.7	3	2.6	115	100.0	
Heavy	0	0.0	2	33.3	4	66.7	6	100.0	

Association between work stress and fatigue

Table IV shows the relationship between job stress and job fatigue. Respondents in the normal category as many as 73 people, apparently none of them experienced severe fatigue, most of them were in a light tired condition (69.9%). Respondents with light work stress were 59 people, 71.2% were included in the mild fatigue category. Respondents with moderate work stress had the highest proportion compared to the others, namely 115 people, the trend was 48.7% each included in the mild and moderate categories and the respondents who experienced severe stress were 6 people, all of whom were in severe and moderate fatigue. (66.7%) and 33.3%.

The results of statistical tests using the Product Moment Correlation test obtained a p value of 0.0001. The p value is smaller than the value (5%), so that the statistical test results can be rejected by H0 or H0 being rejected. There is a relationship between musculoskeletal complaints and the incidence of work fatigue. The Product Moment correlation coefficient is 0.433, which means that the relationship between musculoskeletal complaints is positive and the relationship is in the moderate category.

Assosication between work stress, musculoskeletal disorders and fatigue

Table V shows the regression between work stress, musculoskeletal disorders and fatigue. It shows an F value of 60.348 significant at $p<0.05$. These results mean that regression model can be used to predict fatigue using work stress and musculoskeletal disorders. Fatigue increased by 0.44 when there was an increase of 1 unit of work stress and an increase in fatigue of 0.234 when there was an increase in musculoskeletal complaints by 1 unit. About 32,6% of variability in fatigue can be explained in this model.

Table V: Regression Coefficient Work Stress, Musculoskeletal Disorders and Fatigue

	B	β	T	R^2	Sig	F
(Constant)	14.545		4.235	0.326	0.000	60.348
Work Stress	0.752	0.410	7.880		0.000	
Musculoskeletal Disorders	0.445	0.373	7.163		0.000	

DISCUSSION

Research on the relationship between musculoskeletal complaints, work stress and work fatigue was carried out during the covid-19 pandemic. Online data collection with the sampling technique used is accidental sampling, obtained 253 respondents who participated in the study. Measurement of research variables through instruments distributed online, which was previously carried out directly, so there may be limitations in data collection.
Most of the respondents were under 30 years old and female. Data collection through the internet or online is more attractive to women and young people. Most of them are unmarried, possibly because they are younger and spend more time in front of their devices doing activities during the pandemic.

The education level of the most respondents is Bachelor or S1, so it can be concluded that the trend of online data collection is more reaching people with higher education. Given the many words in the instrument that do not understood by ordinary people. The length of work activity is mostly 8 hours per day, still in accordance with the rule that the length of work per day is not more than 8 hours. Most of the work tools used by respondents for online activities are cellphones, considering that cellphones are more flexible to carry anywhere compared to laptops. While the favorite locations were chosen for WFH activities at home, there were still some respondents who carried out activities outside or around the house.

Most of the respondents experienced musculoskeletal complaints. Measurement of musculoskeletal complaints using NBM, as well as previous research, namely musculoskeletal complaints in photocopiers (7). Some of the complaints felt by some respondents were included: upper neck, lower neck, right and left shoulders, back, upper right arm, waist, right wrist, right and left hand, and left and right legs. Complaints that are felt can be caused by activities using gadgets for a long time and continuously.

Most of the respondents had moderate stress levels and no very heavy stress. This stress level serves to increase work motivation, where when stress will direct the potential of individual resources at work, so that not all are classified as having a negative connotation. Different socio-cognitive factors, personality traits, individual conditions, and strategies for dealing with any stress that arises, where a person better understands and manages stress as he gets older and working period. Based on the concept of psychoneuroimmunology, stress affects the hypothalamus, affects the pituitary, then produces the adrenaline hormone ACTH will produce cortisol. Physical complaints are exacerbated due to a decreased immune system which is produced when cortisol is produced in high levels when stress is very high (13). MSDs symptoms among office workers in any body parts is also high (14). Research conducted in the Gelgel, Klungkung, Bali area revealed that fatigue and musculoskeletal complaints caused by the same variable, namely repetitive or monotonous work continuously. Monotonous activities can also cause work stress (15).

Most of the respondents experienced light work fatigue. Work fatigue experienced by respondents can be caused by the length of work and work positions that are not suitable. The use of work tools in this case the use of gadgets, namely cellphones and laptops is one of the factors that can cause work fatigue. Work fatigue is a

condition experienced by the workforce which can lead to a decrease in vitality and work productivity. Work fatigue referred to in this study is general fatigue experienced by workers, characterized by a slowdown in reaction time and feelings of fatigue. Fatigue is regulated centrally by the brain. In the central nervous system, there are activation (sympathetic) and inhibitory (parasympathetic) systems. The term fatigue usually denotes different conditions for each individual, but all of them lead to a loss of efficiency and a decrease in the body's work capacity of endurance (16).

The results showed that there was no relationship between musculoskeletal complaints and work stress. Statistical test using Product Moment Correlation obtained p value greater than 5%, so the conclusion from the hypothesis test is that there is no relationship between musculoskeletal complaints and work stress. This study is not in line with research conducted on complaints of back pain in midwives. The results showed that the incidence of back pain can cause work stress in midwives (17). However, several research showed that there was a relationship between work stress and musculoskeletal disorders. They found that there was a significant relationship between work stress and musculoskeletal complaints in the neck, shoulder, wrist and upper back (18). Research conducted on sewing workers at CV SAA Tawangsari Sukoharjo Central Java, Indonesia also proves that there is a relationship between work stress and musculoskeletal complaints. Research conducted at PLTU Cilegon states, West java, Indonesia that the cause of work stress is not due to musculoskeletal complaints, but is caused by the physical work environment in the workplace, namely: noise, lighting, workspace temperature and somatic factors (19). The greater the level of stress, the worse the physical health and the possibility of symptoms of psychological disorders appearing. The musculoskeletal system states when the body is stressed, the muscles become tense which is a reflex reaction to stress and the body's way of guarding against injury and illness. The musculoskeletal system states when the body is stressed, the muscles become tense which is a reflex reaction to stress and the body's way of guarding against injury and illness (20). The cause of stress come from the work environment from the workers themselves. (21). Some workers find it difficult to adjust home conditions to make it possible to work from home. Even some workers feel unfit to bring work home because family members feel neglected and inattentive, causing poor communication and relationships, which can cause work stress.

The results showed that there was a relationship between musculoskeletal complaints and the occurrence of work fatigue. The p value of the statistical hypothesis test results using the Product Moment Correlation is smaller than 5%, so it can be concluded that there is a significant relationship between musculoskeletal complaints and work fatigue in respondents. The value of the correlation coefficient of 0.159 means that the relationship between the two variables is included in the low category. A positive relationship indicates that the higher the complaint felt by the respondent, the higher the level of fatigue he feels.

This result is in line with Daneshmandi et al's research. They found that severity of discomfort/pain in musculoskeletal (neck, shoulders, lower back and thighs was correlated to total fatigue. They suggested to improve the working condition in order to reduce musculoskeletal problems and fatigue (22). This is also in line with research conducted on female employees who work at SPA Denpasar Bali. The results showed that the relationship between work fatigue and musculoskeletal complaints had a positive and low relationship. Musculoskeletal complaints are caused by inappropriate ergonomic positions and are carried out repeatedly by SPA employees. (13). Similarly, research conducted on long-distance night bus drivers PO. Restu Mulia, the results of the study concluded that musculoskeletal complaints in bus drivers were related to the occurrence of work fatigue (23). Most work from home was done in a sitting posture. This posture tends to be static so that it can pose a potential hazard to skeletal muscle health. Workers can experience various complaints of aches and pains in their skeletal muscles. This was as found in smoked fish workers, 87% of whom feel musculoskeletal complaints in the neck, back arms, waist and legs (24). The intervention on the work attitude of employees at PT Sucofindo Denpasar Branch was able to reduce work fatigue. Musculoskeletal complaints before and after the intervention changed towards improvement and there was a decrease in musculoskeletal complaints (25). Good work attitudes can reduce musculoskeletal disorders and work fatigue in employees. The higher the complaints of workers, the fatigue that occurs will also increase.

Musculoskeletal complaints that occur contribute to work fatigue. In activities at home, the work position and activities carried out may be due to non-ergonomic workplace. Activities carried out in bed or in the living room and yard are one of the factors in the occurrence of musculoskeletal complaints that can exacerbate work fatigue. The position of the desk where you work or do activities at home may not be an ergonomic place, so that when you work, it is easier to feel tired due to a poor working position. To reduce musculoskeletal complaint, regular sport can be done. Regular sports activities strengthen muscular power and endurance for work activity while enhancing muscle performance. The same physical activity may cause less muscular fatigue in people who do regular exercises (26).

The results showed that there was a significant relationship between work stress and work fatigue with a p value of less than 5% and a correlation coefficient of 0.433, which means that the relationship between

work stress and work fatigue is in the medium category. The higher the work stress, the more severe the work fatigue felt. Research conducted at a shoe factory shows that work stress is influenced by work posture and work fatigue, the more fatigue increases, the higher the work stress that occurs. Work fatigue can cause work stress and vice versa (27). Research on nurses at the Yogyakarta Islamic Hospital PDHI Yogyakarta City proves that there is a relationship between work stress and nurse work fatigue. Based on the results of the Chi Square analysis, it can be concluded that job stress has a significant relationship with work fatigue. The higher the level of stress felt by nurses, the more severe the fatigue felt. The research on Danish ferry ship employees showed that physical work stressors were positively associated with one of five fatigue subscales: lack of energy. High work stress on worker will trigger fatigue and even lack or loss of energy to complete the work (17).

Work fatigue can occur because employees experience work stress and stress occur due to work fatigue. In jobs related to services such as teachers, fatigue caused by stress that occurs due to an unsupportive work environment. Especially the organizational environment related to the workload, the relationship between teachers and students, fellow teachers, and teachers and their superiors. Teachers who experience work stress have a tendency to experience higher fatigue compared to teachers who do not experience work stress (21). Stress that occurs can be caused by working conditions that require adjustment. Before the pandemic, work and work activities were carried out in the workplace, while during the pandemic it had to be done at home. The actual work environment is different from the conditions of the work environment at home, this can cause stress to workers. However, if workers feel that work is more comfortable to do at home, it will not aggravate the occurrence of work fatigue.

The results of linear regression analysis showed that there was a joint relationship between work stress, musculoskeletal complaints and work fatigue. Therefore, it is necessary to prevent these three variables, so that they do not affect each other. By preventing the occurrence of one of these variables, it is hoped that the other variables will not occur.

CONCLUSION

Most of the respondents are 30 years old, the most gender is female, with married marital status. Most of the education levels are undergraduate with the most types of work being private employees. The length of work activity mostly 8 hours per day with the work tools used during activities at home. The favorite location chosen for activities is inside the house. Most of the respondents experienced musculoskeletal complaints, with most of the complaints felt in the upper neck, lower neck, right and left. There are relationship between work stress, musculoskeletal disorers and fatigue. Workers who carry out work activities at home during the pandemic must be aware and pay attention so that work fatigue, work stress and musculoskeletal complaints do not occur, because all three are proven to be related.

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