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The effect of computer use, visibility to the monitor and lighting intensity on work performance through Computer Vision Syndrome (CVS) to employees of PT. PLN UIP3B Sulawesi

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Abstract

Increased and prolonged computer use can indeed lead to various health problems, including Computer Vision Syndrome (CVS). CVS is a syndrome that arises from constant exposure to computer screens or other electronic devices. Common symptoms of CVS include eye strain, blurred vision, headaches, eye dryness, and neck and shoulder strain. This study aims to determine the effect of computer use, viewing distance to the monitor and lighting intensity on employee performance through Computer Vision Syndrome (CVS). The quantitative with a cross-sectional study design was conducted in this research. The research was conducted on 108 workers using simple random sampling techniques. Variables were measured using the questionnaire, measuring tape and lux meter. Data were analyzed through univariate using SPSS, bivariate and multivariate approaches using AMOS program using path analysis. The study found that there was an effect of computer use duration on computer vision syndrome (p= 0.002), the effect of visibility on computer vision syndrome (p= 0.002), the effect of computer vision syndrome on employee performance (p= 0.033). whereas, there was no effect of lighting intensity on computer vision syndrome (p= 0.965), duration of computer uses on employee performance (p= 0.672), visibility on employee performance (p= 0.458) and lighting intensity on employee performance (p= 0.379). These findings of this study support employees by educating them about the elements that can cause a decrease in performance resulting in computer vision syndrome.

Keywords: Computer vision syndrome (CVS), Duration of computer use, Visibility to the monitor, Lighting intensity.

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1. Introduction

According to the American Optometric Association (AOA), CVS is a collection of symptoms that occur in the eyes caused by prolonged use of computers, tablets, cell phones or other electronic devices. The symptoms that arise divided into four categories, namely asthenopia symptoms (eye fatigue, eye strain, eye pain, dry eyes, and headache), symptoms related to the ocular surface (watery eyes, red eyes and due to contact lens use), visual symptoms (blurred vision, double vision, and difficulty focusing vision), and extraocular symptoms (shoulder pain, neck pain, back pain and headache) [1].

Many factors influence the incidence of CVS, including the duration of computer use, eye distance to the computer screen, screen height and inclination, computer screen light intensity settings and the surrounding environment, type of computer, as well as the use of glasses, contact lenses, and antiglare covers [2]. Research by Azkadina (2012) 60 respondents of hospital employees in Semarang showed that the biggest risk factors affecting the incidence of CVS were age, gender, length of work in front of the computer, and length of rest after computer use [3]. The number of internet usage can increase, driven by the new public habits that are done virtually. Starting from virtual learning to meetings.

This virtual habit is one of the drivers of the acceleration of internet usage. The growth of computer ownership and internet access ownership in households reached 20.05% for computer ownership and 66.22% for internet access ownership in households. Internet usage has also increased during the 2014-2018 period, as indicated by the increasing percentage of the population accessing the internet in 2014 of around 17.14% to 39.90% in 2018 [4]. A recent study on the prevalence and risk factors of computer vision syndrome by Ranasinghe involved a sample of 2210 computer workers across Sri Lanka. The highest risk factors for CVS based on the study were female workers, longer duration of daily computer use, previous eye disease, and not using VDT filters on computer screens [5]. Performance is the result achieved by someone according to the standards that apply to a particular job. Performance can also be interpreted as an appearance in terms of quality and quantity achieved by an employee in carrying out his duties according to the responsibilities given to him [6]. Maximum performance needs to be supported by a safe, healthy and comfortable work environment with one of the influential factors being lighting intensity. Insufficient lighting intensity can cause visual disturbances and eyestrain, while excessive lighting intensity can cause glare, reflection, shadows and eye fatigue. The results of Insani and Wunaini's research, showed that as many as 30 (62.5%) of 48 people experienced CVS events due to poor lighting intensity [7]. Based on the background description, the authors are interested in conducting a study entitled "The Effect of Computer Use, Lighting Intensity and View Distance to the Monitor on Employee Performance Through Computer Vision Syndrome (CVS) in Employees of PT PLN (Persero) UIP3B Sulawesi".

2. Materials and methods

This study uses analytic observational research with a cross-sectional approach. This research will be conducted in November 2023 at PT PLN Unit Induk Penyaluran dan Pusat Pengatur Beban (UIP3B) Sulawesi with 149 respondents selected using proportional random sampling technique. The variables in this study are the duration of computer use, visibility to the monitor and lighting intensity as the dependent variable, employee performance as the independent variable and computer vision syndrome (CVS) as the intervening variable. The duration of computer use is measured using a cvs symptom questionnaire with 2 categories, namely risky and less risky, visibility to the monitor is measured using a measuring tape with 2 categories, namely ideal and not ideal, lighting intensity is measured using a Lux meter with 2 categories, namely meeting standards and not meeting standards, employee performance is measured by a performance questionnaire with 2 categories, namely experiencing a decrease in performance (If the score ≥ 60%) and not experiencing a decrease in performance (If the score < 60%), computer vision syndrome is measured using a questionnaire with 2 categories, namely positive CVS and negative CVS. Data processing was carried out using SPSS and AMOS applications to identify path analysis through direct and indirect effects through intermediate variables. The results of the study are presented in the form of tables and reports. This study has received approval from the health research ethics commission (KEPK) Faculty of Public Health, Hasanuddin University on 31 October 2023 with protocol number: 231023062249 and letter number: 5866/UN4.14.1/TP.01.02/2023.

3. Results and Discussions

Based on Table 1, for the gender of respondents, it is known that the majority are male, as many as 77 people (71.3%). The age of respondents has an average of 35 years, where the majority of respondents are less than or equal to 35 years old, namely 71 people (65.7%) and some others are over 35 years old, namely 38 people (35.2%). The respondent's tenure has an average tenure of 13 years, where the majority of respondents have a tenure of less than or equal to 13 years, namely 70 people (64.8%) and for the division, the majority of respondents came from the KKU division, namely 41 people (38.0%). Based on Table 2, the largest direct effect of independent variables on the intervening variable (computer vision syndrome) is the effect of the duration of computer use, which is 0.483. For the largest effect of independent variables on the dependent variable (employee performance) is the effect of the duration of computer use which is -0.117. The value of the direct effect of the duration of computer use on employee performance is negative, which means that when computer use increases, it directly results in a decrease in employee performance. Likewise, the indirect effect of visibility and lighting intensity on employee performance is negative. Based on Table 3, the magnitude of the indirect effect of each independent variable on employee performance. The magnitude of the indirect effect of lighting intensity on employee performance through computer vision syndrome is 0.001, which means the effect is positive, so we can know that if the lighting intensity increases, it indirectly results in increased employee performance. The amount of indirect effect for visibility on employee performance through computer vision syndrome is -0.021, which means the effect is negative, so we can know that if visibility increases, it indirectly results in decreased employee performance. For the duration of computer use, it is known that the indirect effect is -0.093, which means that the indirect effect on employee performance through computer vision syndrome is negative or if the duration of computer uses increases, employee performance will indirectly decrease.

3.1. The Effect of duration of computer use on employee performance through Computer Vision Syndrome (CVS)

The duration of computer use is the length of time required for respondents to work in front of a computer without being interrupted by other activities in a day. Employees who use computers for more than 4 hours continuously can trigger CVS complaints because the eyes are forced to continue to focus on work on the computer. Based on observations in the field, some workers work more than the normal working hours (overtime) so that the duration of work becomes longer according to the work and demands of each field. Employees who use computers for more than 4 hours continuously can trigger CVS complaints because the eyes are forced to continue to focus on work on the computer. if the duration of computer uses increases, employee performance will indirectly decrease [8]. Based on the hypothesis test, the duration of computer use has no effect on employee performance through Computer Vision Syndrome (CVS) (p-value = 0.672> 0.05).

This indicates that there is no mediating role of

Computer Vision Syndrome (CVS) in the relationship between the duration of computer use and employee performance. Employee performance is an action taken by employees in carrying out the work given by the company. Every company always expects its employees to have achievements, because having outstanding employees will make an optimal contribution to the company. In addition, by having outstanding employees the company can improve the performance of its company. In other words, the continuity of a company is determined by the performance of its employees [9]. Using a computer for a very long time will cause physiological disorders because the computer monitor emits wave radiation. The physiological disturbance can be in the form of eye fatigue that arises with symptoms of headache, unclear vision, watery eyes, eye pain, foreign body sensation in the eye, photophobia, and double vision. Eye fatigue can occur because the vision function is used continuously so that it will result in a decrease in vision endurance. Research conducted by Nopriadi (2019), employees who use computers> 4 hours a day, have a 9 times higher risk of developing eye fatigue than employees who use computers < 4 hours a day [10]. For the direct relationship between the duration of computer use on computer vision syndrome, it is stated that it has a singular effect (p-value = 0.002 <0.05), where the magnitude of the effect is 0.483, which means that the direct effect is positive. We can conclude that when the duration of computer uses increases, the resulting computer vision syndrome will also increase, and vice versa. The results of this study are in line with research conducted by Darmawan (2021). The results of the analysis of the relationship between vision distance and CVS subjective complaints using the Fisher Exact Test obtained a value of p = 0.012 (p <0.05) so that it can be interpreted that there is a relationship between vision distance and CVS subjective complaints [11]. Similarly, the results of research by Maeda et al (2020) obtained a p-value of 0.000 which means that there is a significant relationship between the duration of computer use and CVS [12].

3.2. The Effect of visibility to the monitor on employee performance through Computer Vision Syndrome (CVS)

Visibility that is too close to the monitor while working can increase the eye's accommodation system. Increased ocular convergence requirements when reading on a computer is associated with higher internal ocular symptoms [13]. Based on the hypothesis test, the relationship between visibility to employee performance through Computer Vision Syndrome (CVS) is stated to have no significant effect (p-value = 0.458 > 0.05). This indicates that there is no mediating role of Computer Vision Syndrome (CVS) in the relationship between visibility to the monitor and employee performance. Visibility that is too close to the monitor while working can increase the eye's accommodation system. The increased need for ocular convergence when reading on a computer is associated with higher internal ocular symptoms. The physiological explanation is that close proximity causes excess accommodation which results in overwork of the ciliary muscles of the eye manifested as eye strain and headaches [14]. In research conducted on employees of PT PLN UIP3B Sulawesi, it was found that visibility on computer vision syndrome was stated to have a singular effect (p-value = 0.002 <0.05), where the magnitude of the effect was 0.108, which means a positive direct effect. The results of this study indicate that the closer the distance between the monitor and the respondent, the higher the risk of Computer Vision Syndrome (CVS) and the farther the distance between the monitor and the respondent, the less risk of Computer Vision Syndrome (CVS). Therefore, the visibility of the monitor can affect the quality of work of the respondents. The results of research conducted by Salote et al, (2020) on computer workers at RSO Prof. Dr. Soeharso, the average visibility to the computer monitor was 53.24 cm. the results of the analysis stated that only 5.4% of workers who had poor visibility complained of sore eyes, blurred vision, and headaches. This visibility is included in the normal range, good computer visibility is between 50-100 cm [15].

3.3. The Effect of lighting intensity on employee performance through Computer Vision Syndrome (CVS)

Poorly designed lighting intensity will cause eyestrain while working. Eye strain and discomfort are caused by unequal luminance between the background and the computer screen. Illumination that does not meet the standard causes poor vision and eye strain. But excessive lighting intensity causes glare, reflections, excessive shadows, visibility, and eyestrain [16]. Based on the findings of hypothesis testing, the relationship between lighting intensity and employee performance through Computer Vision Syndrome (CVS) is stated to have no significant effect (p-value = 0.397 > 0.05). This indicates that there is no mediating role of Computer Vision Syndrome (CVS) in the relationship between lighting intensity and employee performance. Good lighting promotes occupational health and allows workers to work more safely and comfortably, while providing a better sense of scenery and a refreshing environment. Insufficient lighting causes workers' eyes to tire quickly because the eyes will try to see by opening wide. This eye fatigue will also lead to mental fatigue and furthermore can cause damage to the eyes [17]. In this study, results of the effect of lighting intensity on computer vision syndrome (CVS) obtained a p-value = 0.965> 0.05. So, it can be interpreted that lighting intensity has no singular effect on computer vision syndrome (CVS). Humans as perfect beings are still not free from shortcomings, in the sense that all their abilities are still influenced by several factors, which come from themselves or influences from outside. One of the factors that comes from outside that affects human abilities is the work environment, namely all conditions found around the workplace such as temperature, air humidity, circulation, lighting, noise and others which in this case will significantly affect the results of human work. Basically, the use of computers in the work environment aims to increase work effectiveness. However, increasing the frequency of computer use has an impact on increasing the incidence of CVS which will continue to occur and is vulnerable to office employees in the workplace [18]. Lighting is an important aspect of the physical environment for occupational safety. Several studies have shown that proper lighting, adapted to the job, results in maximum production and minimal inefficiency, and thus indirectly helps reduce the occurrence of accidents [19]. Therefore, adequate lighting is needed to reduce the occurrence of eye fatigue complaints.

Table 1: Characteristics of Respondents.

Characteristics of Respondents		Frequency	
		n	%
Gender	Male	77	71.3
	Female	31	28.7
Age	≤ 35 years	71	65.7
	>35 years	37	34.3
Working Period	≤ 13 years	70	64.8
	> 13 years	38	35.2
Division	Biro	16	14.8
	KKU	41	38.0
	Opsis	17	15.7
	Ren	15	13.9
	Trans	19	17.6

Table 2: Results of Path Analysis on employees of PT PLN UIP3B Sulawesi.

	Lighting Intensity	Visibility	Duration of Computer Use	Computer Vision Syndrome	Work Performance
Computer Vision Syndrome	-0.001	0.108	0.483	0	0
Work Performance	-0.009	-0.014	-0.111	-0.192	0

*p-value < 0.05: there is a significant effect.

Table 3: Standardized Indirect Effect.

	Lighting Intensity	Visibility	Duration of Computer Use	Computer Vision Syndrome	Work Performance
CVS	0	0	0	0	0
Work Performance	0.001	-0.021	-0.093	0	0

*p-value < 0.05: there is a significant effect.

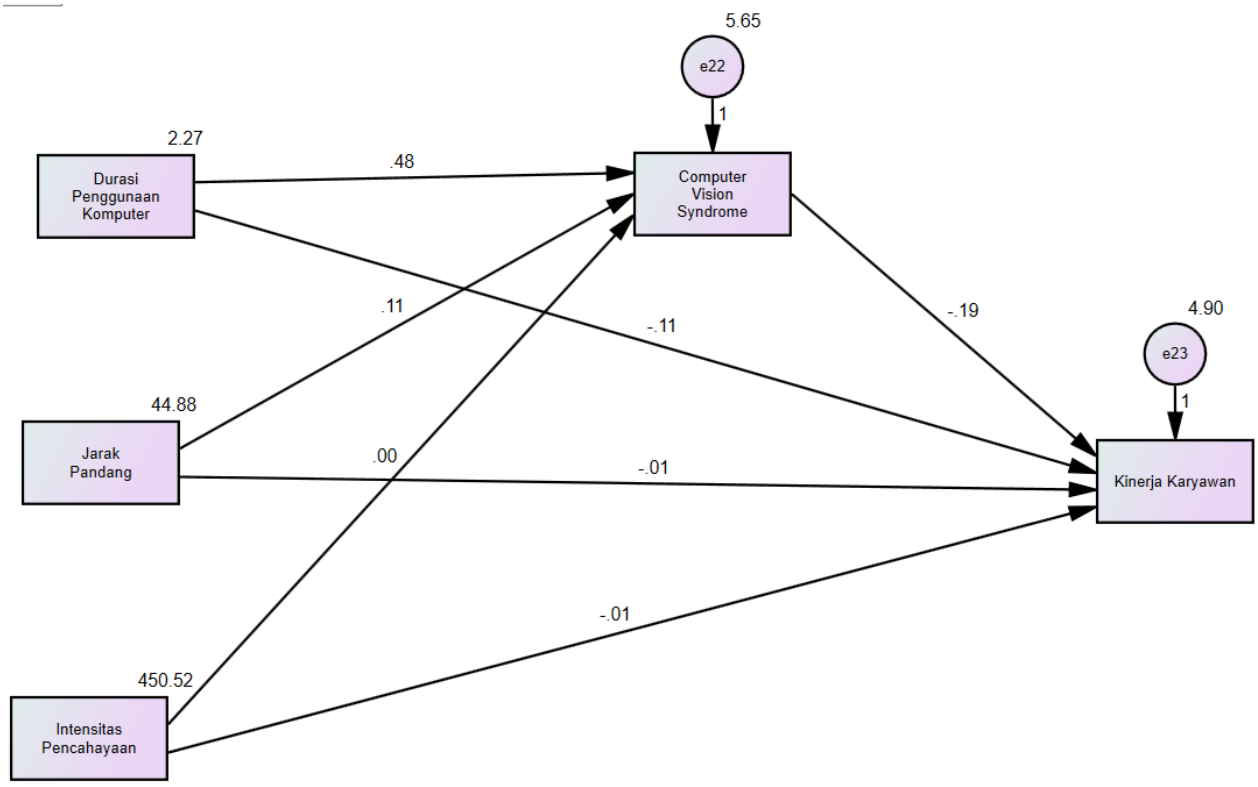

Figure 1: Path Analysis Construction.

When someone works in front of a computer with lighting less than 300 lux, he has a risk of experiencing eye fatigue complaints by 10.7 times greater than a computer user worker with the same lighting or more than 300 lux [20]. Based on the results of research measuring the intensity of general lighting in the room of the Sulawesi UIP3B employee work unit as many as 17 work rooms, the results of general lighting in the work room in the opsis and planning divisions are still below the specified standards or still do not meet the requirements, the light intensity of the opsis work room is 280 lux (doesn't meet the standards) and the planning division work room is 295 lux (doesn't meet the standards).

4. Conclusions

The study found that there was a significant direct and indirect effect between the Duration of computer use, visibility to the monitor, lighting intensity and performance through computer vision syndrome. When the duration of computer use, visibility to the monitor and lighting intensity increase, the result of computer vision syndrome will also increase, and vice versa.

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