



The Relationship Between Environmental Factors and Monitor Distance with Computer Vision Syndrome Complaints Among Employees of The East Java Provincial Health Office

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ARTICLE INFORMATION

Received: March 27, 2024

Revised: May 11, 2024

Available online: May 2024

KEYWORDS

Environmental factors, Computer Vision Syndrome, Monitor Distance

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A B S T R A C T

The East Java Provincial Health Office employs most office workers who frequently use digital devices like computers to support their work performance. This study is an analytical observational study utilizing a cross-sectional design. A sample of 41 respondents was obtained. The variables investigated include age, gender, room lighting, room temperature, and monitor distance, all about complaints of computer vision syndrome. The study found significant associations between complaints of computer vision syndrome and the following variables: room lighting ($p = 0.001$), room temperature ($p = 0.001$), and monitor distance ($p = 0.001$). There is a significant relationship between environmental factors, specifically room lighting and temperature, as well as monitor distance and the occurrence of computer vision syndrome among office workers.

INTRODUCTION

The utilization of electronic devices has proliferated and become an indispensable part of life. Both adults and children utilize computers and other electronic devices for professional and recreational purposes. With the emergence of the internet, the modern world has become addicted to screens rather than using traditional books. These devices are purported to make life easier but can pose dangers if misused. The prolonged use of computers and other digital electronic devices often induces a cluster of symptoms collectively known as Computer Vision Syndrome (CVS) (Al Tawil *et al.*, 2020). In facing the era of Industry 4.0, technology continues to develop, especially in digital devices. One prevalent form of technology used to facilitate various work-related tasks is computers. Presently, computers serve as tools for information dissemination, work or business operations, and communication, and can also serve as means for control and entertainment. Information technology, in the form of computers, is indispensable for most employees in the digital era due to the constant technological improvisations. In recent years, computers and digital screens have substantially increased in almost every aspect of our lives, such as in offices, colleges, universities, and homes, as their usage has enhanced easier access to information (Zalat *et al.*, 2022).

According to the National Institute for Occupational Safety and Health (NIOSH) of the United States, approximately 90% of individuals who spend three hours or more per day on a computer have the potential

to develop Computer Vision Syndrome. Darmawan and Wahyuningsih (2021) according to the American Eye-Q survey conducted in 2015 on technology and eye health, it was reported that, on average, employees in the United States who work using computers for seven hours per day, both in the office and at home, experienced eye strain or vision problems as a direct result of using display devices. The survey indicated that 58% of adults were affected. Based on data from the Indonesian Telecommunications Statistics, there has been an increase in computer ownership in households by approximately 0.56% per year as of 2019.

Computer Vision Syndrome combines eye and vision problems associated with computer use. The symptoms that arise are then divided into four categories, namely asthenopia symptoms (eye fatigue, eye strain, eye discomfort, dry eyes, and headaches), symptoms related to the ocular surface (watery eyes, irritated eyes, and consequences of contact lens use), visual symptoms (blurred vision, double vision, presbyopia, and difficulty focusing vision), and extraocular symptoms (shoulder pain, neck pain, and back pain) (Fikri *et al.*, 2022). Factors that can influence CVS, according to the Occupational Health and Safety Unit of Queensland University, are workstation factors (object size on the screen and screen display), work environment (monitor light, room lighting, air temperature), work design (document characteristics, work duration), and individual characteristics (medical history) (Afifah *et al.*, 2022).

For employees of the East Java Provincial Health Office, working hours for staff typically commence at 8:00 AM and conclude at 4:00 PM. Most office employees are constantly engaged with and utilize digital devices such as computers to support their work performance. Based on employee observations, eye fatigue is prevalent due to prolonged computer usage. The building housing the East Java Provincial Health Office is relatively old, thus necessitating environmental measurements to enhance employee productivity and address eye health issues. This is particularly crucial for secretarial roles, where individuals often use computers for more than 4 hours, stationed in various locations within the different departments of the East Java Provincial Health Office. Such circumstances may lead to eye fatigue when working in front of computers. Based on research Valentina *et al.* (2019), Nearly 60 million people globally experience symptoms of Computer Vision Syndrome. In research conducted at a Saudi Medical College, the prevalence of Computer Vision Syndrome among staff employees reached 81.2%, with the most frequently reported symptom being difficulty focusing when looking at nearby objects. Similarly, a study conducted in Sri Lanka with a sample size of 2210 employees as respondents yielded a CVS prevalence of 67.4%. The study also reported that gender, duration of computer work, pre-existing eye conditions, and ergonomic practices were all significantly associated with CVS (Ranasinghe *et al.*, 2018). In addition to Computer Vision Syndrome (CVS), musculoskeletal complaints are frequently reported due to computer use. Musculoskeletal complaints refer to the discomfort experienced by individuals in skeletal

muscle areas, ranging from very mild to severe pain (Putri & Mulyono, 2018). Complaints resulting from prolonged computer usage during work occur due to issues with equipment or facilities, workplace layout, working environment conditions, or a combination of these factors (Zenbaba *et al.*, 2021). The high risk of Computer Vision Syndrome (CVS) disturbances among employees who use computers in their daily work activities necessitates further action to identify the primary causes of these issues. Therefore, researchers are interested in investigating the relationship between environmental factors and monitoring distance with complaints of Computer Vision Syndrome among East Java Provincial Health Office employees.

METHOD

This research was conducted in December 2023 at the East Java Provincial Health Office. Due to the location of the study falling under field research, direct implementation of research activities in the workplace was necessary. The research design employed an analytical observational approach with a cross-sectional design. The population in this study comprised 69 employees, and the sample size, determined using the Lemeshow calculation notation, was 41 employees. Data collection instruments included questionnaires, observations, and environmental measurements such as lux meters and thermohygrometers. The data collection procedure using the questionnaire was validated it consisted of 16 questions (Seguí *et al.*, 2015). Data analysis was performed using the chi-square test, and the data scale for all variables was ordinal. This research was carried out after obtaining ethical clearance .

RESULT

Table 1. Description of Research Subject variables

No	Variable	Frequency	Percentage (%)
1	Age		
	< 40 Years	15	36,6
	> 40 Years	26	63,4
	Total	41	100,0
2	Sex		
	Male	21	51,2
	Female	20	48,8
	Total	41	100,0
3	Room Lighting		
	Fulfilled	25	61,0
	Not Fulfilled	16	39,0
	Total	41	100,0
4	Room Temperature		
	Fulfilled	29	70,7
	Not Fulfilled	12	29,3
	Total	41	100,0
5	Monitor Distance		
	Fulfilled	31	75,6
	Not Fulfilled	10	24,4
	Total	41	100,0

Table 2. Relationship between environmental factors and monitor distance with complaints of Computer Vision Syndrome

No	Variable	Computer Vision Syndrome						P-value
		No		Yes		Amount		
		n	%	n	%	n	%	
1	Age							
	< 40 Years	11	73,3	4	26,7	15	100,0	0,671
	> 40 Years	16	61,5	10	38,5	26	100,0	
2	Sex							
	Male	15	71,4	6	28,6	21	100,0	0,659
	Female	12	60,0	8	40,0	20	100,0	
3	Room Lighting							
	Fulfilled	22	88,0	3	12,0	25	100,0	0,001
	Not Fulfilled	5	31,3	11	68,8	16	100,0	
4	Room Temperature							
	Fulfilled	24	82,8	5	17,2	29	100,0	0,001
	Not Fulfilled	3	25,0	9	75,0	12	100,0	
5	Jarak monitor							
	Fulfilled	25	80,6	6	19,4	31	100,0	0,001
	Not Fulfilled	2	20,0	8	80,30	10	100,0	

Table 1 indicates that out of 41 East Java Provincial Health Office employees, the majority were aged > 40 years, comprising 26 respondents (63.4%). Most employees were male, accounting for 21 respondents (51.2%). Lighting in the work environment met more than 300 Lux for 25 respondents (61.0%), while room temperature ranged from 23°C to 26°C for 29 respondents (70.7%). Additionally, monitor distance fell within the range of 45cm – 60cm for 31 respondents (75.6%) among East Java Provincial Health Office employees.

Table 2, based on the Chi-Square test results, yielded a value of $p = 0.671$ for age, indicating that the age variable does not have a significant relationship with Computer Vision Syndrome complaints as the p -value is more significant than 0.05. Similarly, for the gender variable, the Chi-Square test yielded a result of $p = 0.659$, signifying that gender does not have a significant relationship with Computer Vision Syndrome complaints as is $p > 0,05$. The result for the environmental factor, lighting, obtained from the Chi-Square test yielded a result of $p = 0.001$. This indicates that the room lighting variable is significantly related to Computer Vision Syndrome complaints because the p -value is $< 0,05$. The correlation coefficient 0.584 indicates a moderately strong relationship between room lighting and Computer Vision Syndrome complaints. On the other hand, for room temperature, the Fisher's Exact Test yielded a result of $p = 0.001$, signifying that the room temperature variable has a significant relationship with Computer Vision Syndrome complaints because the p -value is $p < 0,05$.

The correlation coefficient 0.554 indicates a moderately strong relationship between temperature and Computer Vision Syndrome complaints. The Fisher's Exact Test yielded a result of $p = 0.001$ for the monitor distance variable, indicating that monitor distance has a significant relationship with Computer

Vision Syndrome complaints because the p-value is $p < 0,05$. The correlation coefficient 0.549 indicates a moderate relationship between monitor distance and Computer Vision Syndrome complaints.

DISCUSSION

1. The Relationship Between Room Illumination and Computer Vision Syndrome Complaints

Illumination measurement in the East Java Provincial Office was conducted at 3 points, which adheres to the standard stipulated in SNI 7062:2019. The standard specifies that for general lighting measurements in rooms larger than 100 square meters, measurements should be taken at 36 points, and the results should be averaged. Lux meters were utilized for these measurements. This illumination is classified as meeting the requirements of > 300 Lux by Minister of Manpower Regulation No. 5 of 2018.

Based on the research findings, it is evident that employees at the East Java Provincial Health Office have a high potential of experiencing Computer Vision Syndrome complaints, reaching 68.8%, due to inadequate illumination in the work environment. The results are consistent with those of (Nadia *et al.*, 2021). Who researched medical and health science students at the University of Jambi in 2020. Their findings revealed that illumination levels around the room were less than 300 lux, indicating a significant relationship between environmental lighting conditions and the occurrence of Computer Vision Syndrome. Based on the statistical test results from the research conducted on employees at the East Java Provincial Health Office regarding illumination and CVS complaints, the chi-square test yielded a p-value of $p = 0,001$, which signifies that the illumination variable has a significant relationship with Computer Vision Syndrome complaints due to the value $p < 0,05$. The correlation coefficient 0.584 indicates a moderately strong relationship between illumination and Computer Vision Syndrome complaints. The statistical test results suggest that the room illumination does not meet the standard, especially for tasks requiring specific precision, such as reading and typing in work activities. This is attributed to the incomplete implementation of lighting management, including room color design, arrangement of lamps and windows, and the use of lighting aids in each room.

The findings of this research are consistent with those of (Souisa *et al.*, 2019). Conducted at PT. Bank X in Ambon in 2019 indicated a relationship between illumination and eye fatigue, yielding a value of $p = 0,042$ ($p < 0,05$). This is supported by the study conducted by Yudha *et al.* (2023), which states a relationship between room lighting and the occurrence of CVS. Their findings also indicate that vision deteriorates when using a computer in glaring environments, thus reducing the eye's ability to focus on the monitor.

2. The Relationship Between Room Temperature and Computer Vision Syndrome Complaints

Temperature measurements in the East Java Provincial Office determine the room temperature, which should meet room occupants' health and comfort needs, referring to SNI 16-7061-2004. Relative temperature measurements in workspaces can be performed using a Thermo hygrometer. This temperature range is classified by Minister of Manpower Regulation No. 5 of 2018 to meet the health and comfort requirements for office room temperatures, ranging from 23°C to 26°C.

Based on the research results, it is found that employees at the East Java Provincial Health Office have a high potential of experiencing Computer Vision Syndrome complaints, reaching 75.0%, when the temperature does not meet the requirements of the work environment. These findings are consistent with Darmawan and Wahyuningsih (2021), stating that environmental factors contributing to decreased blink frequency include low room temperature conditions during work, thereby not meeting the requirements. Based on the statistical test results from the research conducted on employees at the East Java Provincial Health Office regarding temperature and CVS complaints, the chi-square test yielded a p-value of $p = 0,001$, which indicates that the temperature variable has a significant relationship with Computer Vision Syndrome complaints due to the value $p < 0,05$. A correlation coefficient 0.554 indicates a moderately strong relationship between temperature and Computer Vision Syndrome complaints. When employees at the East Java Provincial Health Office perform their tasks throughout the day, they are influenced by environmental conditions outside the building, such as high or inadequate air temperatures, leading to psychological stress and decreased concentration when using computers. This aligns with the Widia et al. (2021) during the research, it was stated that excessively high temperatures can lead to an increased risk of accidents and eye health disorders.

This is consistent with research by Roestijawati, who reported that 60% of employees working in rooms with temperatures below 24°C or above 26°C experienced dry eye syndrome. This is supported by a study conducted by Septiyanti *et al.* (2021), when researching Computer Vision Syndrome, with an odds ratio $OR = 6.124$ among medical students, the results indicate that temperature conditions are significantly associated with the occurrence of Computer Vision Syndrome.

3. The Relationship Between Monitor Distance and Computer Vision Syndrome Complaints

Monitor distance in the East Java Provincial Office is measured using a centimeter-scaled meter for each employee. According to the Occupational Safety and Health Association (OSHA), the optimal distance between the eyes and the computer monitor screen is 19-24 inches or 46-61 cm, with an ideal distance being around 20 inches or approximately 50.80 cm. According to the Minister of Manpower Regulation of the Republic of Indonesia No. 5 of 2018, the requirement is met if the distance between the operator and the monitor is between 45-60 cm.

The research findings revealed that East Java Provincial Health Office employees have a high potential of experiencing Computer Vision Syndrome complaints, reaching 80.6%, when the monitor distance does not meet the requirements. This is consistent with Ariyanto *et al.* (2022), during the research conducted on employees at Institution X in the General Administration Subsection, most respondents had eye-to-screen distances of less than 50 cm, thus not meeting the monitor distance requirements.

CONCLUSION

The conclusion of the above study indicates that environmental factors observed among employees at the East Java Provincial Health Office reveal significant associations with Computer Vision Syndrome complaints. Specifically, room lighting and indoor temperature were significantly correlated with Computer Vision Syndrome. Additionally, monitoring distance showed a significant association. The recommendation from this research regarding environmental factors, particularly lighting, is to improve the current room lighting design by replacing dim lighting with more comfortable colors. Improving airflow in the room can be achieved by using adequate ventilation or an adequate room cooling system. Furthermore, maintaining the distance between the monitor and the eyes should be emphasized through verbal and written communication.

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