FACTORS RELATED TO COMPUTER VISION SYNDROME (CVS) COMPLAINTS IN PROGRAMMERS DURING THE COVID-19 PANDEMIC

FAKTOR YANG BERHUBUNGAN DENGAN KELUHAN COMPUTER VISION SYNDROME (CVS) PADA PROGRAMMER DI MASA PANDEMI COVID-19

Original Research Article
Penelitian

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A B S T R A C T

Background: Computer Vision Syndrome (CVS) symptoms can result from improper computer use. The manifestation of symptoms may encompass ocular strain, cephalalgia, ocular pain, xerophthalmia, diplopia, and visual blurring, influencing occupational efficiency. **Purpose:** To analyze factors related to CVS complaints among programmers at an IT consulting company in Jakarta. **Method:** A cross-sectional quantitative descriptive research involving 60 participants was conducted. The research examined the relationship between CVS complaints among programmers and several independent variables, including individual characteristics such as gender, age, visual aids, rest time, duration of computer use, work period, and workstation factors such as viewing distance from the screen to the horizontal eye line. The Spearman rank correlation test was utilized for data analysis. **Result:** Specifically, gender (sig.= 0.000), visual aids (sig.= 0.003), and the position of the top screen with the horizontal line of the eye (sig.= 0.029) were significantly related to CVS complaints. Age (sig.= 0.608), length of rest (sig.=0.055), duration of computer use (sig.= 0.138), work period (sig.= 0.717), and screen viewing distance (sig.= 0.058) did not show a significant relationship with CVS complaints. **Conclusion:** There is a relationship between gender, visual aids, and the position of the top of the screen with the horizontal line of the eye with CVS complaints. There is no relationship between age, length of rest, duration of computer use, working time, and screen viewing distance. Companies are expected to provide education regarding the correct use of computers, regular eye health checks, and enforce a 20-20-20 rule (20 minutes of rest, looking at objects 20 feet away for 20 seconds).

A B S T R A K

Latar belakang: Penggunaan komputer yang tidak benar dapat menimbulkan keluhan *Computer Vision Syndrome* (CVS). Gejala dapat berupa mata lelah, sakit kepala, ketidaknyamanan visual, mata kering, penglihatan ganda, penglihatan kabur, serta berakibat pada produktivitas kerja. **Tujuan:** Untuk menganalisis faktor yang berhubungan dengan keluhan CVS pada programmer di salah satu Perusahaan Konsultan IT di Jakarta. **Metode:** Penelitian deskriptif kuantitatif menggunakan metode *cross-sectional* dengan sampel 60 orang. Variabel terikat keluhan CVS programmer. Variabel bebas karakteristik individu seperti jenis kelamin, usia, alat bantu penglihatan, waktu istirahat, durasi penggunaan komputer, masa kerja, serta faktor stasiun kerja seperti jarak pandang dari layar ke garis horizontal mata. Analisis data menggunakan uji korelasi *Spearman rank*. **Hasil:** Jenis kelamin (sig. = 0,000), alat bantu penglihatan (sig. = 0,003), kedudukan bagian atas layar dengan garis horizontal mata (sig. = 0,029) berhubungan secara signifikan dengan keluhan CVS. Usia (sig. = 0,608), lama istirahat (sig. = 0,055), durasi penggunaan komputer (sig. = 0,138), masa kerja (sig. = 0,717), jarak pandang layar (sig. = 0,058) tidak berhubungan secara signifikan dengan keluhan CVS. **Kesimpulan:** Terdapat hubungan antara jenis kelamin, alat bantu penglihatan, kedudukan bagian atas layar dengan garis horizontal mata dengan keluhan CVS. Tidak terdapat hubungan antara usia, lama istirahat, durasi penggunaan komputer, masa kerja, jarak pandang layar. Perusahaan diharapkan memberikan edukasi penggunaan komputer yang benar, pemeriksaan kesehatan mata secara berkala, dan memberlakukan budaya 20-20-20 (20 menit beristirahat, melihat benda yang berjarak 20 kaki selama 20 detik).

INTRODUCTION

Computers are now essential for completing tasks or jobs at work or home. The use of computers in Southeast Asia increased from 1.4 billion units in 2010 to 1.6 billion units in 2013 (Lee *et al.*, 2013). In 2017, according to a survey conducted by the Ministry of Communication and Information Technology, 7.97% of Indonesians owned personal computers and 13.70% used computers. In another instance, laptop ownership in Indonesia was more significant than computer ownership, which stood at 21.36%. This survey also revealed that 81.36% of computer users used it for work when not connected to the internet, and 52.81% used it for work when connected to the internet (Ministry of Communication and Informatics, 2017a; Ministry of Communication and Informatics, 2017b). According to a survey by the *Association of Indonesian Internet Service Providers* (APJII), the number of internet users in 2017 increased by 54.68% or 143.26 million persons, with 49.52% falling between the ages of 19 and 34 (APJII, 2016).

The inseparable integration of computers into daily life may adversely affect their users. These health effects can be induced by prolonged use, the type of computer utilized, or the environment in which the user works. The adverse health effects of computer use can reduce worker productivity, and *Computer Vision Syndrome* (CVS) is one of these effects. According to the *American Optometric Association* (AOA), CVS is a combination of close work-related ocular issues that an individual experiences during or concerning computer use (Nopriadi *et al.*, 2019). Several studies conducted in America found that CVS was believed to be associated with continuous monitor use. Data from Eye Care Technology shows that 60 million people suffer from visual impairment due to the use of monitors. The impacts that can CVS can cause include decreased vision ability, decreased work productivity, loss of working hours, and reduced job satisfaction (Zulaiha *et al.*, 2018).

In addition to causing visual pain, *Computer Vision Syndrome* (CVS) substantially impacts productivity of individuals affected by it. The manifestation of CVS is exemplified by various symptoms, such as ocular strain, cephalalgia, ocular discomfort, dryness of the eyes, diplopia, and visual blurring after computer usage (Bali *et al.*, 2014). Valentina's (2018) study shows a correlation between the amount of time individuals spend in front of a computer and the occurrence of CVS. Additional relevant aspects include using corrective lenses, interocular distance, and the ocular angle relative to the computer monitor. Based on the findings of Darmaliputra and Dharma's (2019) study, it can be inferred that prolonged computer usage exceeding four hours, insufficient breaks of less than fifteen minutes, and the use of spectacles are factors that contribute to an increased likelihood of developing CVS in women.

This Jakarta based IT consulting firm specializes in providing professional IT services through consulting to both individuals and businesses. The company comprises five departments: (1) Business development, (2) Professional services, (3) Sales, (4) Finance and accounting, (5) Human resources. The professional services department consists of IT specialists or programmers, as these departments rely on computers the most to perform their duties. A preliminary survey of 10 respondents revealed that four had more than three CVS complaints, five had two CVS complaints, and one had only one. The reported complaints included eye pain, itchy eyes, sore eyes, headache, red eyes, watery eyes, dry eyes, double vision, blurred vision, neck pain, and back pain.

Based on an initial survey conducted with 10 respondents, all 10 people (100%) used computers, with 7 respondents (70%) experiencing eye complaints when using computers, and 3 people (30%) not experiencing this. The duration of computer use for 6 people (60%) was 2 hours, and for 4 people (40%), it was 3 hours (Isnaniar *et al.*, 2021). According to the company's regulations on working hours, employees take a one hour lunch break (12.00 – 13.00).

In this IT consulting firm, research has yet to be conducted on the correlation between employee CVS complaints and individual characteristics and computer factors. This research examines the relationship between the duration of computer use and workstation related CVS complaints among IT consultants based in Jakarta. This research aims to provide additional information and insight to related businesses so that they can formulate or design policies regarding CVS complaints and implement appropriate prevention efforts to safeguard their employees.

MATERIAL AND METHOD

This research received ethical approval with reference number 207/HRECC.FODM/IV/2021 from the ethical committee in Universitas Airlangga. This research employed a descriptive observational approach with a cross-sectional design, where the research object and variables were not manipulated. The primary aim was to address and provide a detailed description of the problem formulation. The research was carried out in Jakarta from September 2020 to June 2021. The research population encompassed the entirety of the subjects under investigation in the research. The sample for this research consisted of 143 personnel from the professional service department, with 60 individuals selected from this department. The independent variables examined in this research included individual characteristics and workstations, while the dependent variable was CVS complaints. The research involved measuring all variables through the administration of a questionnaire.

According to the *National Institute for Occupational Safety and Health* (NIOSH) in the United States that approximately 90% of people who spend 3 hours or more a day at the computer can develop CVS (Anggrainy *et al.*, 2020). Several studies indicate that individuals working more than 2 - 3 hours a day with a computer are at risk of developing CVS (Rathore, 2017). CVS symptoms associated with the use of digital devices include neck pain/shoulders (35%), headaches (27.2%), tension in the eyes (32.4%), blurred vision (27.9%), and dry eyes (27.2%). Preventative actions to reduce the risk of exposure to CVS include taking breaks, rest should be taken for 10 - 15 minutes after working continuously in front of the computer for 1 - 2 hours (Alexandria, 2019).

Each univariate/descriptive variable obtained was organized as a frequency distribution table. A bivariate/analytic analysis was performed using the contingency coefficient to assess the degree of association between the independent variables, specifically individual characteristics and computer utilization factors, and the dependent variable, CVS complaints. The *Spearman rank* test was employed with a significance level of 0.05.

RESULT

Distribution of individual characteristics among programmers at IT consultant company X in Jakarta

Based on the findings of the research, the frequency distribution of programmers at IT Consultant Company X in Jakarta according to their characteristics is shown in Table 1. The age distribution of respondents is presented in Table 1 as 'mostly 17 - 25 years old', with 41 individuals (68.3%). Based on this age range, most respondents fell into the category of young adults. Seventy percent of the respondents were male, comprising 42 individuals.

Visual aids were used by 30 respondents (50%), while the remaining 30 respondents (50%) did not use visual aids. Most respondents, 37 (61.7%), reported having a leisure period of less than 15 minutes every 2 hours of computer work. A significant portion, 57 individuals (95%), used computers for more than 8 hours daily for work-related purposes. The majority of respondents, 40 individuals (66.7%), had worked with computers for over 5 years.

Distribution of programmer workstations at IT consultant firm X in Jakarta

Based on the results of the analysis, the frequency distribution of workstations for programmers at IT consultant company X in Jakarta is presented in Table 2. Table 2 reveals that most respondents had a screen viewing distance between 50 cm and 100 cm, with 35 people (58.3%) and 54 people (90%) having the top of the screen aligned with or below the horizontal line of the eye, respectively.

Distribution of CVS complaints among programmers at IT consultant company X in Jakarta

Programmers' CVS complaints at IT consultant firm X in Jakarta are shown in Table 3. Table 3 demonstrates that most respondents, 35 (58.3%), did not experience CVS complaints.

Distribution by the type of CVS complaints among programmers at IT consultant company X in Jakarta

The present research presents the distribution of symptoms associated with CVS complaints among programmers employed at IT consulting company X in Jakarta in Table 4. Table 4 shows that the most prevalent type of CVS complaint experienced by respondents is eye fatigue, with as many as 50 people (83.3%).

Table 1. Individual characteristics of programmers at Jakarta's IT consulting company X

Individual characteristics		Number (N)	Percentage (%)
Age	17 – 25 years	41	68.3
	26 – 35 years	18	30.0
	36 – 45 years	1	1.7
Gender	Male	42	70.0
	Female	18	30.0
Vision aid distribution	Using vision aids	30	50.0
	Not using a visual aid	30	50.0
Duration of break	< 15 minutes every 2 hours	37	61.7
	≥ 15 minutes every 2 hours	23	38.8
Duration of computer use	≤ 8 hours	3	5.0
	> 8 hours	57	95.0
Working period	< 5 years	20	33.3
	≥ 5 years	40	66.7

Table 2. Workstations for programmers at IT consultant company X in Jakarta

Workstation		Total (N)	Percentage (%)
Screen viewing distance	< 50 cm and > 100 cm	25	41.7
	50 – 100 cm	35	58.3
Position of the top of the screen	Parallel or lower	54	90.0
	Higher	6	10.0

Table 3. Programmers' *Computer Vision Syndrome* (CVS) complaints at IT consultant company X in Jakarta

CVS complaints	Total (N)	Percentage (%)
CVS complaints present	25	41.7
No CVS complaints	35	58.3

Table 4. Types of *Computer Vision Syndrome* (CVS) complaints among programmers at IT consulting company X in Jakarta

Type of CVS complaints	Frequency (people)			
	Yes	%	No	%
Tired eyes	50	83.3	10	16.7
Headache	24	40.0	36	60.0
Dizziness	9	15.0	51	85.0
Dry eyes	15	25.0	45	75.0
Blurred vision	13	21.7	47	78.3
Double vision	7	11.7	53	88.3
Neck pain	20	33.3	40	66.7
Shoulder pain	21	35.0	39	65.0
Back pain	27	45.0	33	55.0

Table 5. Relationship between individual characteristics and workstations with *Computer Vision Syndrome* (CVS) complaints in programmers at IT consulting company X in Jakarta

	Variable	Sig.	*c-value*	Conclusion
Individual characteristics	Age	0.608	0.068	No relationship
	Gender	0.000	0.480	There is a relationship
	Vision aids	0.003	0.372	There is a relationship
	Duration of break	0.055	-0.249	No relationship
	Duration of computer use	0.138	-0.194	No relationship
	Period of employment	0.717	-0.048	No relationship
Workstation	Screen viewing distance	0.058	-0.246	No relationship
	Workstation	0.029	0.282	There is a relationship

The relationship between individual characteristics and workstations with CVS complaints in programmers during the COVID-19 pandemic

According to the research's findings, the relationship between individual characteristics and workstations with *Computer Vision Syndrome* (CVS) complaints reported by programmers at IT consulting company X in Jakarta is shown in Table 5. Table 5 demonstrates that the gender variable generates a sig. value of 0.000, which is less significant than α= 0.05. The variable "vision aid" yields a sig. value of 0.003,

also less than α = 0.05, and the position of the top of the screen determines a value of sig. of 0.029, smaller than α = 0.05. The result implies a relationship between gender, visual aids, and the position at the top of the screen with complaints of CVS among programmers at IT consulting company X in Jakarta. However, the age, duration of rest, tenure of computer use, working period, and screen visibility variables yield a sig. value greater than α= 0.05, indicating no correlation of those variables with complaints of CVS among programmers at IT consulting company X in Jakarta.

DISCUSSION

The *American Optometric Association* (AOA) defines *Computer Vision Syndrome* (CVS) as an eye and compound vision problem related to near vision that a person continuously experiences while using a computer or other display device for a long time (AOA, 2016). Multiple reasons can give rise to distinct symptoms. Bali *et al.* (2014) posit that the syndrome in question is influenced by various elements, which may be multifactorial. These factors encompass the presence of light emitted by computer monitors, difficulties or impairments in visual adaptation, and the duration of computer usage. The statistical analysis reveals a moderate and significant link between gender and the reported complaints of CVS among the participants.

Many studies state that the incidence of CVS in women is higher than in men, although it is not significantly different. Physiologically, the tear film layer in women tends to thin more quickly as they age. Thinning of the tear film causes the eyes to feel dry, which is also one of the symptoms of CVS. Other physiological differences are decreased tear secretion, body size or mass differences, and hormonal function (Muchtar and Sahara, 2016). Women tend to be meticulous in their job, characterized by continuous focus on the computer screen. This behavior has the potential to induce stress.

According to prior research, the findings of this research suggest that female participants exhibit a higher propensity for developing CVS compared to their male counterparts (Darmaliputra and Dharmadi, 2019). Furthermore, the present research is substantiated by the study conducted by Setyowati *et al.* (2021), which reveals that female participants exhibit a significantly higher susceptibility to CVS compared to their male counterparts, with a staggering odds ratio of 3.242. The statistical analysis findings indicated a limited link between the utilization of visual aids and complaints related to CVS. This research also reports that the aids utilized by the respondents were glasses. Workers who rely on visual aids, such as eyeglasses, may encounter erroneous correction if they fail to use glasses specifically suited to their refractive errors. The prolonged use of a computer might result in eye fatigue, and improper correction of eye refraction may also contribute to ocular fatigue. According to the results of the 2015 American Eye-Q survey on technology and eye health, it was reported that the average worker in the United States works using a computer for 7 hours a day in the office and at home, with 58% of adults experiencing eye strain or vision problems as a direct result of using display devices. The survey also found that 59% of those surveyed answered that desktop computers and laptops were the tools that bothered them the most, with mobile phones at 26% (in second position), followed by tablets at 8% (AOA, 2016).

The present investigation is grounded in the research conducted by Maeda *et al.* (2020), which identified a noteworthy association between the use of computer eyewear and the prevalence of CVS among personnel working in electronic stores located in the Glodok Retail Area. Furthermore, the research findings indicate those wearing eyeglasses are more vurnerable to experiencing symptoms of CVS. An additional research also reported that out of the 89 participants, a significant proportion of 74 individuals (83.1%) identified as being at high risk of requiring spectacles reported experiencing CVS. The statistical analyses conducted in this research demonstrate a tenuous link between the vertical position of the screen's top and the horizontal line of the eye among individuals experiencing CVS symptoms.

According to Darmawan and Wahyuningsih's study in 2021, more employees who looked at a computer monitor at a distance of less than 50 cm experienced CVS compared to employees who looked at a computer monitor at a distance of 50 cm or more. The average employee's viewing distance to the monitor is 48.3 cm, which does not match the minimum viewing distance recommended for a computer monitor, which is 50 – 60 cm. The size of the letters on the computer monitor is small, and the workstation design is not very wide, causing them to see the computer monitor from less than 50 cm away. Sometimes, when entering data in the form of large numbers, employees, without realizing it, move their eyes closer to the computer monitor instead of using the zoom-in/out technique to avoid errors in entering data (Darmawan and Wahyuningsih, 2021). A visual distance 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 (Gowrisankaran and Sheedy, 2015). The physiological explanation is that close distances cause excess accommodation, resulting in overwork of the ciliary muscles of the eye, which manifests as eye tension and headaches (Akinbinu and Mashalla, 2014).

The present research aligns with the study conducted by Valentina (2018), which establishes a notable association between the angle of visual perception during computer usage and the prevalence of CVS. The statistical analyses conducted in the research also demonstrated a noteworthy correlation, indicating a five-fold increase in the risk of cardiovascular disease. In a study conducted by Asnifatima *et al.* (2017), a noteworthy association was discovered between increased visual angles and the occurrence of CVS complaints among internet cafe operators in the Bojonggede District of the Regency.

This research's statistical tests revealed no correlation between age, duration of break, duration of computer use, tenure, screen visibility, and CVS complaints. Similar studies conducted by Astuti *et al*. (2020), Sugarindra and Allamsyah (2017), Hasanah (2017), and Pratiwi et al. (2020) support the findings of this research. The absence of a correlation between age and CVS complaints could be due to the fact that most respondents, namely 41 (68.3%), were between the ages of 17 and 25. Additionally, most respondents with CVS complaints were in the age range of 17 to 25. The result is also in line with Darmawan and Wahyuningsih's research in 2021, which shows that there is no relationship between age and subjective complaints of CVS in Semarang City Diskominfo employees. The absence of a relationship between age and CVS subjective complaints shows that age does not affect CVS subjective complaints. The incidence of CVS is higher in respondents under 40 years (56.9%). This is because the number of computer-using employees at Diskominfo Semarang city is greater than those under 40 years, and working in front of a computer requires more work. Accuracy is more imposed on young employees (Darmawan and Wahyuningsih, 2021).

According to study by Hasanah (2017), the duration of work does not affect the incidence of CVS symptoms because the respondents do not stare at the computer screen continuously during the 8 hours of work. There is no correlation between the length of time respondents worked with a computer and their complaints of CVS, which could be caused by employees with more extended working periods proportional to their work experience. Therefore, workers with extended working hours would be more cautious and attentive to ergonomics. There is no correlation between screen visibility and CVS complaints since respondents solely provided estimates when the questionnaire data were collected. Thus, respondents may be subject to bias when completing the visibility questionnaire.

CONCLUSION

Based on individual characteristics, 68.3% of respondents' ages were between 17 and 25. Seventy percent of the participants in the research were male. Equal percentages of respondents utilized visual aids and did not use visual aids. 61.7% of respondents took a break of less than 15 minutes every 2 hours. Ninety five percent of respondents used a computer for more than 8 hours daily. Based on the workstation, 58.3% of respondents worked within a 50 - 100 cm screen viewing distance. Ninety percent of the time, the position of the screen's top was most dominant when it was parallel to or below the horizontal line

of the eye. 41.7% of respondents experienced CVS complaints. Most respondents experienced ocular fatigue after completing their work on a computer. There is a moderately robust correlation between gender and CVS complaints with CVS complaints, there is a faint correlation between visual aids and the position of the top of the screen concerning the horizontal line of the eye. There is no correlation between CVS complaints and age, length of pause, duration of computer use, length of service, or screen visibility.

Companies are required to provide training on the proper use of computers. Regular eye examinations are also required. In addition, it is recommended that each individual implements the 20-20-20 rule when using a computer (taking a 20-second break every 20 minutes and looking at an object 20 feet away).

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