JHE 6 (2) (2021) 65-72

Journal of Health Education

http://journal.unnes.ac.id/sju/index.php/jhealthedu

Risk Factors for the Incidence of Computer Vision Syndrome (CVS) in Lecturers During the Online Learning Period

Dewi Sari Rochmayani✉, Oktaviani Cahyaningsih
Universitas Widya Husada Semarang, Indonesia

Article Info

Article History:
Submitted 19 June 2021
Accepted 30 August 2021
Published 30 September 2021

Keywords:
Computer Vision Syndrome, online learning, lecturer

DOI:
https://doi.org/10.15294/jhe.v6i2.47513

Abstract

Background: The online learning process during the Covid 19 pandemic has increased the incidence of Computer Vision Syndrome (CVS). The results of the study showed that there were 15% of lecturers at Widya Husada University Semarang experienced CVS. The purpose of the study was to analyze CVS risk factors among lecturers during the online learning period.
Methods: The study was conducted using a case-control design. The research sample was lecturers at Widya Husada University as many as 60 people consisting of 30 people each in the case and control groups. A questionnaire with google forms was used for data collection. The data analysis used was univariate, chi-square for bivariate analysis and multiple logistic regression for multivariate analysis.
Results: There are 5 variables that are significantly proven as risk factors for CVS, namely: 1) long working with computers (OR = 18.693; 95% CI = 1.487 – 234.955); 2) duration of computer use continuously (OR = 54,281; 95% CI = 2,523 – 1167,92); 3) length of rest after using the computer (OR = 31.060; 95% CI = 1.884 – 512.062); 4) distance from eyesight to monitor (OR = 34.640; 95% CI = 2.263 – 530.240); and 5) the position of the top of the monitor with respect to the horizontal eye level (OR = 17.555; 95% CI = 1.778 -173.296). Lecturers who have these 5 risk factors together will have a probability of experiencing CVS by 83%. Conclusion: Exposure to computer monitors experienced by lecturers during online learning will increase the risk of CVS events. There needs to be an effort to modify risk factors so that CVS events among lecturers during online learning can be prevented.

How to Cited

Rochmayani, D. S., Cahyaningsih, O. (2021). Risk Factors for the Incidence of Computer Vision Syndrome (CVS) in Lecturers During the Online Learning Period. *JHE (Journal of Health Education)*, 6(2), 65-72

✉ Correspondence Address:
Email : dewisari.smg@gmail.com

p-ISSN 2527-4252
e-ISSN 2528-2905

Introduction

The Covid 19 pandemic that has occurred since the end of 2019 until now has changed the order of campus life. Lecture activities that were previously held face-to-face have shifted to online meetings. The consequence of online lectures is to increase the frequency and duration of computer use. Exposure to computer screens with a higher frequency and duration is a risk factor for Computer Vision Syndrome (CVS) (Gowrisankaran & Sheedy, 2015).

Occupational safety and health administration (OSHA) defines computer vision syndrome (CVS) is complex eye and vision complaints experienced when using computers. According to the American Optometric Association, CVS is a close work-related compound eye problem that a person experiences when using a computer. No one can explain the exact cause of CVS because many factors play a role in the incidence of CVS including individual factors, environmental factors and computer factors (Blehm et al., 2005; Gowrisankaran & Sheedy, 2015; Mowatt et al., 2018; Munshi et al., 2017).

Increased frequency and duration of computer use causes complaints such as eye strain and fatigue, burning sensation, irritation, redness, blurred vision, dry eyes. In general, these complaints are symptoms of CVS (Fradisha, 2017; Noertjojo et al., 2006). Symptoms of CVS are grouped into four major groups. The first is called asthenopia, which is characterized by complaints of eye strain, tiredness, and soreness. Second, symptoms related to the surface of the eyeball, these symptoms are characterized by dry, watery eyes, irritation, problems using contact lenses. Third, symptoms of vision, characterized by blurred vision, slow changes in focus, double vision, presbyopia. The four extraoculars are complaints of neck pain, back pain, and shoulder pain (Nopriadi et al., 2019; Parihar et al., 2016; Ranasinghe et al., 2016).

The severity of the disease due to CVS is not fatal, but the incidence of CVS is related to the quality of life. The clinical manifestations of this syndrome in some individuals are often considered unimportant and unobtrusive (Lurati, 2018; Muchtar, Helmi. Sahara, 2016; Sari et al., 2018). This indifference to CVS results in delays and promptness in early treatment. The impact that can occur when this syndrome is not overcome is obstacles in daily activities, decreased work productivity, increased error rates in carrying out work, and ultimately can reduce service satisfaction (Al Tawil et al., 2020; Karuppiah et al., 2019; Shrestha et al., 2014).

Satisfaction of academic services for universities is one indicator of the progress of the institution. The COVID-19 pandemic situation which requires the implementation of online learning is not an excuse for a university to ignore the quality of academic services. Therefore, the risk of health problems in the academic community arising from learning activities must be minimized as much as possible. One of the academic communities included in the group at risk of experiencing CVS is the teaching staff/lecturers. The tri dharma task of higher education during the COVID-19 pandemic has increased the frequency and duration of computer use.

Preliminary studies conducted on lecturers in 2 study programs at Widya Husada University Semarang showed that all of them confirmed an increase in the frequency and duration of computer use during the online learning period. Furthermore, the preliminary study also showed 15% of lecturers experienced CVS symptoms.

In general, the risk factors for CVS have been studied by previous researchers. However, a study of CVS risk factors at an institution still needs to be done, especially if the prevalence of CVS is quite high. This encourages the importance of screening for CVS events and mapping the risk factors. These risk factors include age, gender, use of glasses, length of time working with a computer, duration of continuous computer use, length of rest after computer use, a distance of vision, the position of the top of the monitor to the horizontal height of the eye. The purpose of the study was to identify the determinants of CVS events among lecturers during the online learning period.

Methods

The study used a case-control design. The determination of the case group and control

group was carried out based on interviews/data collection with google forms. Questions about the CVS symptom set included the presence or absence of the following symptoms: tired and strained eyes, irritated dry eyes, blurred vision, headache, sore eyes, watery eyes, double vision, difficulty focusing vision (Sánchez-Brau et al., 2020). Study subjects who complained of at least three main CVS symptoms from the interview were included in the case group. Research subjects who did not complain of symptoms at all to complain of less than three main symptoms of CVS were included in the control group. This research was conducted from January – June 2021.

The target population in this study are lecturers who carry out online learning in the city of Semarang. While the affordable population is lecturers who carry out online learning at Widya Husada University Semarang. The research sample is all lecturers who carry out online learning taken by purposive sampling. The study involved a sample of 60 lecturers consisting of 30 case groups and 30 control groups.

The research inclusion criteria were: 1) have worked with computers for at least 6 months; and 2) working in front of the computer for at least 1 hour continuously in a day. There are 5 exclusion criteria, namely: 1) suffering from certain diseases, such as: immunosuppression, lupus, thyroid disease, rheumatoid arthritis, diabetes, hormonal disorders, Sjogren's syndrome, meibomian gland dysfunction, blepharitis, allergic conjunctivitis, blepharochalasis, trichiasis, eyelid disorders such as ectropion, entropion, and strabismus. 2) Are undergoing certain medications, such as: antihistamines, antihypertensives, antidepressants, anticholinergics, anti-anxiety, oral contraceptives, oral steroids, and aspirin. 3) Use contact lenses. 4) Using glasses with poor refractive correction which is characterized by the presence of blurred vision. 5) Not filling out the questionnaire completely.

The independent variables studied in this study were age, gender, use of glasses, length of time working with a computer, duration of continuous computer use, length of rest after computer use, a distance of vision, the position of the top of the monitor to the horizontal height of the eye.

The research instrument is a questionnaire that has been tested for validity and reliability first. Data analysis was done by univariate, bivariate and multivariate. Analytical analysis to determine the relationship between the independent variable and the dependent variable used the Chi-square test, to determine the value of the association of the magnitude of the risk, an odd ratio was used, and to determine which risk factor had the most influence, multivariate analysis was used, namely logistic regression analysis.

Result and Discussion

The study collected data from 60 lecturers as research subjects who met the inclusion and exclusion criteria. The research subjects consisted of 30 lecturers as the case group and 30 lecturers as the control group. Table 1 below presents the distribution of research subjects according to CVS symptoms:

Table 1. Distribution of research subjects according to CVS symptoms

Symptoms	**CVS**				**Jumlah**	**%**
	Case		**Control**			
	n	**%**	**n**	**%**		
Tired and tense eyes	30	100,0	19	63,3	49	81,7
Irritated dry eyes	11	36,7	2	6,7	13	21,7
Blurred vision	10	33,3	3	10,0	13	21,7
Headache	20	66,7	3	10,0	23	38,3
Eyes hurt	4	13,3	0	0	4	6,7
Watery eyes	14	46,7	3	10,0	17	28,3
Double vision	1	3,3	0	0	1	1,7
Difficult to focus vision	20	66,7	0	0	20	33,3

Table 1 shows that the symptoms most complained about by the research subjects were tired and tense eyes (81.7%), even all respondents (100%) from the case group complained about it. The symptom with the least complaint was a double vision (1.7%).

Bivariate analysis of the independent variables studied in this study showed several variables were proven to be risk factors for CVS events. The following table 2 shows the relationship of the independent variables with the incidence of CVS:

Table 2. Association of Independent Variables with CVS Incidence

Variables		CVS Incidence				OR (95% CI)	*p*
		Case		Control			
		n	%	n	%		
Age	≥ 40 years old	6	20,0	9	30,0	0,583 (0,178 – 1,913)	0,371
	< 40 years old	24	80,0	21	70,0		
	Total	30	100,0	30	100,0		
Gender	Female	7	23,3	10	33,3	0,609 (0,195 – 1,897)	0,390
	Male	23	76,7	20	66,7		
	Total	30	100,0	30	100,0		
Use of glasses	Ya	21	70,0	12	40,0	3,50 (1,201 – 10,196)	0,02
	Tidak	9	30,0	18	60,0		
	Total	30	100,0	30	100,0		
Length of time working with a computer	< 5 years	25	83,3	10	33,3	10,0 (2,941-34,008)	0,0001
	≥ 5 years	5	16,7	20	66,7		
	Total	30	100,0	30	100,0		
Duration of continuous computer use	≥ 4 hours	21	70,0	8	26,7	6,417 (2,084 – 19,755)	0,01
	< 4 hours	9	30,0	22	73,3		
	Total	30	100,0	30	100,0		
Length of rest after computer use	< 10 minutes	25	83,3	9	30,0	11.667 (3.384 – 40.220)	0,0001
	≥ 10 minutes	5	16,7	21	70,0		
	Total	30	100,0	30	100,0		
Distance of vision	< 50 cm	21	70,0	6	20,0	9.333 (2.847 – 30.602)	0,0001
	≥ 50 cm	9	30,0	24	80,0		
	Total	30	100,0	30	100,0		
Position the top of the monitor to the horizontal height of the eye.	Higher	23	76,7	7	23,3	10.796 (3.263-35.718)	0,0001
	Equal/lower	7	23,3	23	76,7		
	Total	30	100,0	30	100,0		

Table 2 shows that the variables of age and sex were not statistically significant with the incidence of CVS (p > 0.05). While the other 6 independent variables were significantly proven to be risk factors for CVS events (p < 0.05). Furthermore, the independent variables that have a p-value <0.25 from the results of the bivariate analysis are then included in the multivariate analysis model. Based on the p-value from table 2, there are 6 independent variables included in the multivariate analysis, namely: 1) the use of glasses, 2) the length of working with the computer, 3) the length of use of the computer, 4) the length of rest after using the computer, 5) the distance of vision. , and 6) position the top of the monitor at eye level.

The results of multivariate analysis with logistic regression showed that 5 independent variables in this study were included in the final model of multivariate analysis. The five variables are: 1) length of time working with a computer, 2) continuous use of the computer, 3) length of rest after using a computer, 4) distance from eyesight to monitor, and 5) position of the top of the monitor relative to the horizontal eye level. The following table 3 summarizes the estimated risk of each variable on the incidence of CVS:

Table 3. Results of multivariate analysis with logistic regression

Variables	Exp(B)	95% CI	*p-value*
Length of time working with a computer	18,693	1.487 – 234,955	0,023
Duration of continuous computer use	54,281	2.523 – 1167,92	0,011
Length of rest after computer use	31,060	1.884 – 512,062	0,.016
Distance of vision	34,640	2.263 – 530,240	0,011
Position the top of the monitor to the horizontal height of the eye.	17,555	1.778 -173,296	0,014

Table 3 shows that research subjects who have worked with computers > 5 years have an 18 times greater risk of developing CVS than subjects with less than 5 years of work. The results of this study strengthen the findings of previous studies which concluded that prolonged exposure to computer screens (> 5 years) is a risk factor for CVS. The duration of exposure to computer screens according to several studies is a predictor of asthenopia. Studies show that the incidence of asthenopia is higher in Video Display Terminal (VDT) users who work with computers for approximately 5 years (Nopriadi et al., 2019; Parihar et al., 2016; Randolph, 2017).

The duration of continuous computer use in this study was proven to be a risk factor for CVS events. The duration of continuous computer use is defined as the length of time allocated by research subjects to use the computer continuously without any other activity. Computer use 4 hours continuously is categorized as a limiting risk factor for CVS events. The results of the analysis as shown in table 3 show that research subjects who use computers continuously for 4 hours have a risk of experiencing CVS almost 54 times greater than research subjects who use computers < 4 hours.

Previous studies on CVS have shown that continuous exposure to computer screens > 4 hours can increase the risk of CVS. Karuppiah's research (2019) conducted on the subject of school students also showed the same thing. Students who use computers for 4-6 hours per day have a significantly higher risk of experiencing complaints of burning in the eyes, red eyes, and dry eyes compared to those who use computers for less than 4 hours (Dessie et al., 2018; Karuppiah et al., 2019; Permana; et al., 2015).

The length of rest after using the computer is a variable which in this study proved to be a risk factor for CVS. The length of rest after computer use is defined as the length of time off after the research subject has previously worked at the computer. Rest time < 10 minutes after using the computer is categorized as a risk factor for CVS. In this study, subjects who took a break after using a computer for less than 10 minutes had a risk of about 31 times greater for CVS than subjects with a rest period of > 10 minutes.

Several previous studies have also shown

that taking a break from exposure to computer screens > 10 minutes can reduce the risk of CVS complaints. The lack of frequency of rest time after working in front of a computer screen generally causes complaints of blurred vision. This shows that the length of rest after exposure to computer screens is very important for CVS prevention measures (Al Tawil et al., 2020; Nopriadi et al., 2019; Sari et al., 2018).

The variable distance of the eye to the monitor in this study was proven to be a risk factor for CVS events. The variable eye-to-monitor visibility was defined as the distance the study subject's eyes were to the center of the monitor while working with a computer. Distance is categorized as a risk factor if < 50 cm. In this study, subjects whose eyesight to monitor distance was <50 cm had almost 34 times greater risk of developing CVS than study subjects whose eyesight to monitor distance was >50 cm.

The results of this study strengthen the findings of previous studies which state that the distance from the VDT to the eye is a determinant of CVS incidence. Eye distance to the VDT that is too close will force the eye to work harder for the accommodation mechanism. This accommodation mechanism is needed so that the eye can focus the object of vision on the retina so that an image can be formed that falls right on the retina. The accommodation mechanism makes the object more visible. The habit of working using a computer with an eye distance of < 50 cm will cause excess accommodation. This will cause the ciliary muscle of the eye to work hard which manifests as eye fatigue and headaches (Blehm et al., 2005; Jaiswal et al., 2019; Parihar et al., 2016; Ranasinghe et al., 2016; Sánchez-Brau et al., 2020).

The variable position of the top of the monitor to the horizontal height of the eye in this study was proven to be a risk factor for CVS events. The variable position of the top of the monitor to the horizontal height of the eye is categorized as risky if the height of the monitor is 10 cm higher than the horizontal height of the eye. The results of multivariate analysis showed that subjects who when working using computers were accustomed to a monitor height > 10 cm above the horizontal eye level had about 17 times greater risk of developing CVS.

The results of this study on the horizontal height of the eye to the center of the monitor are in line with the results of previous studies. Eye-level is also related to the angle of view of the subject on the computer monitor. Research shows that visual complaints also occur in subjects who use a 30-50 degree viewing angle. The recommended position of the subject against the monitor is about 10-20 degrees below eye level (Fradisha, 2017; Ranasinghe et al., 2016; Sari et al., 2018).

The results of the logistic regression analysis in this study showed the Nagelkerke R Square value of 0.830. This means that if a person is exposed to 5 risk factors together, the chance of experiencing CVS is 83%. The five risk factors are: 1) long time working with a computer, 2) continuous use of the computer, 3) long rest after using the computer, 4) the distance from the eye to the monitor, and 5) the position of the top of the monitor concerning to the horizontal eye level.

The results of this study indicate that lecturers are one of the groups vulnerable to CVS. The COVID-19 pandemic which has encouraged the implementation of online learning has increased the risk of CVS events among lecturers. Prevention efforts that can be done are educating lecturers so that they can modify CVS risk factors. Modification of these risk factors, for example: 1) limiting the duration of continuous computer use to a maximum of 4 hours, 2) adjusting the length of rest after using the computer, 3) keeping the eye's eye distance to the monitor always > 50 cm, and 4) maintaining the position of the top of the monitor to the horizontal height of the eye is always > 10 cm. Some studies also recommend prevention efforts through the 20-20-20 method every hour. With this method, someone who works with a computer is advised that every 20 minutes look away from 20 feet or 6 meters for 20 seconds (Nopriadi et al., 2019).

Conclusion

During the online learning period, lecturers have been exposed to risk factors for CVS events. There are 5 risk factors for CVS

occurrence, namely 1) long time working with computers, 2) continuous use of computers, 3) long breaks after using computers, 4) distance from eye-sight to monitor, and 5) position of the top of the monitor to the horizontal height of eye. Lecturers who have these 5 risk factors together will have an 83% greater risk of experiencing CVS.

References

Al Tawil, L., Aldokhayel, S., Zeitouni, L., Qadoumi, T., Hussein, S., & Ahamed, S. S. (2020). Prevalence of self-reported computer vision syndrome symptoms and its associated factors among university students. *European Journal of Ophthalmology,* 30(1), 189–195. https://doi.org/10.1177/1120672118815110

Blehm, C., Vishnu, S., Khattak, A., Mitra, S., & Yee, R. W. (2005). Computer vision syndrome: A review. *Survey of Ophthalmology*, 50(3), 253–262. https://doi.org/10.1016/j.survophthal.2005.02.008

Dessie, A., Adane, F., Nega, A., Wami, S. D., & Chercos, D. H. (2018). Computer vision syndrome and associated factors among computer users in Debre Tabor town, Northwest Ethiopia. J*ournal of Environmental and Public Health*, 2018. https://doi.org/10.1155/2018/4107590

Fradisha. (2017). Hubungan Durasi Penggunaan Komputer dengan Computer Vision Syndrome pada Karyawan Bank Sinarmas Jakarta. *Nexus Kedokteran Komunitas,* 6(1), 50–61.

Gowrisankaran, S., & Sheedy, J. E. (2015). Computer vision syndrome: A review. *Work*, 52(2), 303–314. https://doi.org/10.3233/WOR-152162

Jaiswal, S., Asper, L., Long, J., Lee, A., Harrison, K., & Golebiowski, B. (2019). Ocular and visual discomfort associated with smartphones, tablets and computers: what we do and do not know. *Clinical and Experimental Optometry,* 102(5), 463–477. https://doi.org/10.1111/cxo.12851

Karuppiah, V., Wong, L., Tay, V., Kang, L., & Ge, X. (2019). School-based programme to address childhood myopia in Singapore. *Singapore Medical Journal,* November, 1–17. https://doi.org/10.11622/smedj.2019144

Lurati, A. R. (2018). Computer Vision Syndrome: Implications for the Occupational Health Nurse. *Workplace Health and Safety,* 66(2), 56–60. https://doi.org/10.1177/2165079917731790

Mowatt, L., Gordon, C., Santosh, A. B. R., & Jones, T. (2018). Computer vision syndrome and ergonomic practices among undergraduate university students. *International Journal of Clinical Practice,* 72(1). https://doi.org/10.1111/ijcp.13035

Muchtar, Helmi. Sahara, N. (2016). Hubungan Lama Penggunaan Laptop Dengan Timbulnya Keluhan Computer Vision Syndrome (Cvs) Pada Mahasiswa/I Fakultas Kedokteran Umum Universitas Malahayati. *Jurnal Medika Malahayati,* 3(4), 197–203.

Munshi, S., Varghese, A., & Dhar-Munshi, S. (2017). Computer vision syndrome—A common cause of unexplained visual symptoms in the modern era. *International Journal of Clinical Practice,* 71(7), 1–5. https://doi.org/10.1111/ijcp.12962

Noertjojo, K., Maberley, D., Bassett, K., & Courtright, P. (2006). Awareness of eye diseases and risk factors: Identifying needs for health education and promotion in Canada. *Canadian Journal of Ophthalmology,* 41(5), 617–623. https://doi.org/10.1016/S0008-4182(06)80035-9

Nopriadi, Pratiwi, Y., Leonita, E., & Tresnanengsih, E. (2019). Faktor yang Berhubungan dengan Kejadian Computer Vision Syndrome pada Karyawan Bank Factors Associated with the Incidence of Computer Vision Syndrome in. *Jurnal MKMI,* 15(2), 111–119.

Parihar, J. K. S., Jain, V. K., Chaturvedi, P., Kaushik, J., Jain, G., & Parihar, A. K. S. (2016). Computer and visual display terminals (VDT) vision syndrome (CVDTS). *Medical Journal Armed Forces India,* 72(3), 270–276. https://doi.org/10.1016/j.mjafi.2016.03.016

Permana;, M. A., Koesyanto, H., & Mardiana. (2015). Faktor Yang Berhubungan Dengan Keluhan Computer Vision Syndrome (Cvs) Pada Pekerja Rental Komputer Di. *Unnes Journal of Public Health.,* 4(3), 48–57. https://doi.org/10.15294/ujph.v4i3.6372

Ranasinghe, P., Wathurapatha, W. S., Perera, Y. S., Lamabadusuriya, D. A., Kulatunga, S., Jayawardana, N., & Katulanda, P. (2016). Computer vision syndrome among computer office workers in a developing country: An evaluation of prevalence and risk factors. *BMC Research Notes,* 9(1), 1–9. https://doi.org/10.1186/s13104-016-1962-1

Randolph, S. A. (2017). Computer Vision Syndrome. *Workplace Health and Safety*, 65(7), 328. https://doi.org/10.1177/2165079917712727

Sánchez-Brau, M., Domenech-Amigot, B., Brocal-Fernández, F., Quesada-Rico, J. A., & Seguí-Crespo, M. (2020). Prevalence of Computer Vision Syndrome and Its Relationship

with Ergonomic and Individual Factors in Presbyopic VDT Workers Using Progressive Addition Lenses. *International Journal of Environmental Research and Public Health,* 17(3), 1–18. https://doi.org/10.3390/ijerph17031003

Sari, F. T. A., Himayani, R., Kedokteran, F., Lampung, U., Kedokteran, M. F., & Lampung, U. (2018). Faktor Risiko Terjadinya Computer Vision Syndrome Risk Factors Occurrence of Computer Vision Syndrome. *Majority,* 7(28), 278–282.

Shrestha, M. K., Guo, C. W., Maharjan, N., Gurung, R., & Ruit, S. (2014). Health literacy of common ocular diseases in Nepal. *BMC Ophthalmology*, 14(1). https://doi.org/10.1186/1471-2415-14-2