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RISK FACTORS COMPUTER VISION SYNDROME IN COMPUTER ENGINEERING STUDENTS, SYIAH UNIVERSITY OF KUALA

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Abstract. Computer Vision Syndrome (CVS) is a collection of symptoms related to computer use prolonged. This can occur from various factors consisting of individual factors, computer factors and environmental factors. Computer engineering students are a group of students who use computers in doing assignments and other activities in daily life. The purpose of this study was to determine the risk factors for CVS events in students of the Computer Engineering Study Program, Syiah Kuala University. This research is an observational analytic survey with a cross sectional. The sample used consisted of 164 students from the 2017-2019 class who were taken by the stratified random sampling method. Collecting data through self-assessment using a questionnaire. Statistical test using Chi square test for bivariate and to find out which risk factor is the most influential, multivariate analysis is used, namely logistic regression analysis. The results showed that 63.4% of Computer Engineering Students at Syiah Kuala University experienced CVS. The factors that were significantly associated with the incidence of CVS were gender (p=0.03), duration of computer use (p=0.01) and eye distance to the monitor (p=0.001).

Keywords: risk factors; computer vision syndrome .

INTRODUCTION

Modern technological advances have revolutionized the world and provided benefits to society because modern technological devices provide the information sources they need and are more easily accessible. This indicates that someone will spend more time staring at electronic devices than visual displays (Noreen et al., 2016); (Kumar et al., 2021). The development of the era of using computers, notebooks, tablets, smartphones and digital devices has become a routine of daily life. Even people use it for official work to playing video games (Altalhi et al., 2020). The use of technology in education makes a real transformation in learning methods, including information and resources for learning (Abudawood et al., 2020); (Jahan et al., 2019). There are many benefits of using digital media to do various things. But behind the benefits, there are side effects due to the use of digital media, especially eye complaints (Widyantara & Puspasari, 2019). This dependence on computers can cause a very collective eye problem namely Computer Vision Syndrome.

The American Optometric Association (AOA) defines Computer Vision Syndrome (CVS) as "*a complex problem of the eye and vision associated with prolonged computers*". The symptoms of CVS occur when there is a need to increase the visual demand and even to exceed the visual abilities of the person. Although most of the symptoms of CVS are temporary and there is no permanent visual impairment, some people can experience visual difficulties after work which can reduce productivity (Sharmila et al., 2019). Symptoms can be divided into ocular, visual and musculoskeletal disorders. The first group consisted of tired eyes, burning and dry eyes. Then the second group consisted of blurred and double vision. And the last group was associated with neck and shoulder pain (Bartoszek et al., 2019).

The prevalence CVS varies in different places. The prevalence of CVS symptoms among computer users in the world ranges from 25-93%. One study states that CVS is seen in 70% to 75% of computer users. Previous research stated that of the 70 million workers who use digital, they spend an average of 7-9 hours per day and almost 90% of these workers suffer from CVS (Munshi et al., 2017).

Students can easily find information and books online so as to reduce the use of paper-based materials. In addition, some tasks also require staring at a computer screen for hours every day (Arif & Alam, 2015). Various symptoms are often seen in students due to the paradigm shift to internet studies (Asnifatima et al., 2017). This is in line with research conducted by Shantakumari et al which showed that 70% of students in Saudi Arabia experienced CVS disorders due to computer use. Another study conducted by Helmi on medical students at Malahayati University which showed that 73.9% of respondents experienced CVS (Mersha et al., 2020). Students majoring in Computer Engineering are one group of students who use computers longer than other students in doing assignments or carrying out other functions.

Awareness and understanding of CVS risk factors is very important for computer

users to know what factors can lead to CVS complaints. From the description above, the authors are interested in conducting research on "*Risk Factors for the Incidence of Computer Vision Syndrome in Computer Engineering Students at Syiah Kuala University*"

METHODS

The type of this research is observational analytic with cross sectional design. The sample used was Syiah Kuala University Computer Engineering students from the 2017-2019 class who were taken by the stratified random sampling method. The research tools and instruments used are questionnaires that have been tested for validity and reliability in previous studies and have been adapted in Indonesian. The questionnaire used is a CVS questionnaire that has been designed by Segui, Cabrero-Garcia & Crespo et al which consists of 16 CVS symptoms in the journal "*A Reliable and Valid Questionnaire Was Developed to Measure Computer Vision Syndrome at The Workplace*".

The data collection method was carried out by an online survey using a questionnaire through a google form that had been prepared after obtaining approval (permission) from the respondents as research subjects. Data collection was carried out on July 28 - August 8, 2020. The statistical test in this study used the chi square in a bivariate manner to see the relationship between each variable studied in this study. Then proceed with multivariate analysis to determine which risk factors are the most influential using logistic regression analysis.

RESULTS AND DISCUSSION

This study obtained a sample of 164 students from the 2017-2019 class of Computer Engineering at Syiah Kuala University. The characteristics of the research subjects who were sampled in this study were grouped by gender, age, class and CVS diagnosis, which are presented in Table 1 below.

Table 1. General Characteristics

No.	Characteristics		n	%
1.	Gender	Female	60	36.6%
		Male	104	63.4%
2.	Class of	2017	29	17.7%
		2018	60	36.6%
		2019	75	45.7%
3.	Age	18	24	14, 6%
		19	66	40.2%
		20	55	33.5%
		21	17	10.4%
		22	1	0.6%
		23	1	0.6%
4.	CVS	Yes	104	63.4%
		No	60	36.6%

Information: n = total number of frequencies, %= percentage

Respondent characteristics based on Table 1 above show that the majority of respondents are men, as many as 104 people (63.4%).respondents consisted of 29 students (17.7%) from the 2017 class, 60 students (36.6%) from the 2018 class and 75 students (45.7%) from the 2019 class

The age of the respondents ranged from 18 years to 23 years. The age of the most respondents in this study was 19 years as many as 66 students (40.2%). The number of respondents who experienced CVS was more than respondents who did not experience CVS, namely 104 students (63.4%).

Table 2. Frequency of CVS Risk Factors

No.	Characteristics		n	%
1.	Duration of Computer Use	<2 hours	51	31.1
		2-4 hours	79	48.2
		>4 hours	34	20.7
2.	Rest After Using Computer	<5 minutes	127	77.4
		>5 minutes	37	22, 6
3.	Wearing Glasses When Using a Computer	Yes	28	17.1
		No	136	82.9
4.	Wearing Contact Lenses When Using a Computer	Yes	9	5.5
		No	155	94.5
5.	Eye-to-Monitor Distance	cm	86	52.4
		5050 cm	78	47.6

Based on table 2 above, it was found that respondents who used the most computers with a duration of 2-4 hours were 79 respondents (48.2%). The number of students who took a break after using a computer <5 minutes was more than those who took a break >5 minutes after using a computer, namely 127 students (77.4%).

The results of respondents who use glasses when using a computer are 28 respondents (17.1%) while respondents who use contact lenses while using a computer are 9 respondents (5.5%). While the number of students with the use of eye-to-monitor distance <50 cm was more than students with eye-to-monitor use of >50 cm, namely 86 respondents (52.4%).

Table 3. Relationship between Sex and CVS

Sex	CVS				N	%	p
	Yes		No				
	n	%	n	%			
Male	59	56.7	45	43.3	104	63.4	0.03

Female	45	75	15	25	60	36.6

The results of statistical tests on the sex variable obtained a p value of 0.03. This value is less than the value of (p<α). So it can be concluded that there is a relationship between gender and the incidence of CVS in Computer Engineering Students at Syiah Kuala University. The results of this study are in line with research conducted by Eva Mari Arttime et al in Spain which stated that women contributed more to the incidence of CVS. There are several reasons that cause women to experience more *computer vision syndrome* than men, namely women are considered to be more thorough in doing tasks so that they require higher concentration than men. Previous research that supports that women have a higher risk than men is physiologically that there are differences in hormones that play a role in the regulation of the eye surface and adnexal tissue (Mantelli et al., 2016).

Table 4. Relation of Duration of Computer Use with CVS

Duration Use Computer	CVS				N	%	*p*
	Yes		**No**				
	n	**%**	**N**	**%**			
<2 hours	28	54.9	23	45.1	51	31.1	
2-4 hours	47	59.5	32	40, 5	79	48.2	0.01
>4 hours	29	85.3	5	14.7	34	20.7	

Based on Table 4, it was found that CVS symptoms were more common in respondents with a duration of computer use >4 hours. It can be seen that of the 34 students who used computers with a duration of >4 hours who experienced CVS, there were 29 students (85.3%). Statistical results obtained p value of 0.01. This value is less than the value of (p<α). So it can be concluded that there is a relationship between the duration of computer use and the incidence of CVS in Computer Engineering Students at Syiah Kuala University.

This is in line with the research conducted by Muchtar on students of the Faculty of Medicine, Malahayati University which also stated that there was a significant relationship between the duration of computer use and the incidence of computer vision syndrome. Longer duration of computer use tends to lead to longer complaints even after computer use (Manzoor et al., 2012).

Table 5. Relationship After Using Computer with CVS of Rest

Long Rest After Using	CVS				N	%	*p*
	Yes		**No**				
	n	**%**	**n**	**%**			
<5 minutes	81	63,8	46	34.8	127	77.4	0,837
>5 minutes	23	62 ,2	14	37,8	37	22,6	

Based on Table 5 it was found that the statistical results obtained a p value of 0,778 (p>α). So it can be concluded that there is no relationship between the length of rest after using a computer and the incidence of CVS in Computer Engineering Students at Syiah Kuala.

In this study, there was no significant relationship between the length of rest after computer use and the incidence of *computer vision syndrome*. This can occur when the *recall bias* from the respondents when the study was conducted. The results

of this study are different from the research conducted by Andi on internet cafe operators in Bogor Regency which stated that there was a relationship between the length of rest after using the computer.[11] According to a previous study, it was stated that the length of rest after using the computer was one of the risk factors for the incidence of CVS. Longer and more frequent breaks between computer use can increase comfort and can relax the eye's accommodation system.[11]

Table 6. Correlation between the use of glasses when using computers and CVS

glasses	CVS				N	%	p
	Yes		No				
	n	%	n	%			
Yes	22	78.6	6	21.4	28	17.1	0.107
No	82	60.3	54	39.7	136	82 ,9	

Based on Table 6, it was found that the statistical results obtained a p value of 0.107 (p>α). So it can be concluded that there is no relationship between the use of glasses when using a computer with the incidence of CVS in Computer Engineering Students at Syiah Kuala University.

The results of the analysis in this study concluded that there was no significant relationship between the use of glasses and the incidence of *computer vision syndrome*. In this study, it can be seen that both students who use or do not use glasses

mostly experience CVS complaints. This could be due to the inappropriate reporting of the respondent's visual acuity because the ophthalmic examination was not carried out when this research was conducted. The results of this study are in line with research conducted by Kanchan on Computer Engineering students at Pokhara University in Nepal. However, in another study, there was a difference conducted by Edema et al which stated that there was a significant relationship between the use of glasses and the incidence of *computer vision syndrome*.[13]

Table 7. Relationship between the use of contact lenses when using computers and CVS

contact lenses	CVS				N	%	p
	Yes		No				
	n	%	n	%			
Yes	7	77.8	2	22.2	9	5.5	0.357
No	97	62.6	58	37.4	155	94, 5	

Based on Table 7, it was found that the statistical results obtained a p value of 0.357 (p>α). So it can be concluded that

there is no relationship between the use of contact lenses when using a computer with the incidence of CVS in Computer

Engineering Students at Syiah Kuala University.

In this study, it was found that there was no significant effect between the use of contact lenses when using a computer on the incidence of CVS. This happens because respondents who use contact lenses during computer use perform proper eye care by using eye drops regularly. The results of this study are different from research conducted by Tauste which states that the chance of CVS is higher in contact lens wearers than those who do not use contact lenses.[14]

Table 8. Relationship between Eye Distance to Monitor When Using Computer with CVS

| Eye Distance to Monitor | CVS | | | | N | % | p |
| | Yes | | No | | | | |
	N	%	N	%			
< 50 cm	63	73.3	23	26.7	86	52.4	0.01
50 cm	41	52.6	37	47.4	78	47.6	

Based on Table 8, it was found that the statistical results obtained a p-value of 0.01 (p<α). So it can be concluded that there is a relationship between the distance from the eye to the monitor when using a computer with the incidence of Computer Vision Syndrome in Computer Engineering Students at Syiah Kuala University.

In this study, there is a relationship between monitor distance and the incidence of *computer vision syndrome*. This is in line with previous studies. Studies conducted by Yunitia on employees of PT Telkom Indonesia in Makassar more CVS symptoms that arise in individuals with eye distance to monitor <50 cm. Shorter viewing distances can increase asthenopia and affect focusing and accommodation of the eye (Mersha et al., 2020).

Table 9. Analysis With Logistic Regression

Variable	Exp(B)	95% CI	Sig
Gender	2.056	1.129-4.916	0.022
Duration of Use	2.018	1.221-3.334	0.06
Monitor Distance	0.412	0.209-0.815	0.011

According to the results of multivariate logistic regression analysis, it can be seen that the variable that has a greater influence on the incidence of computer vision syndrome is the duration of computer use with a value of 0.06. Duration of computer use has 2 times the risk of experiencing *computer vision syndrome.* Using a computer for a long time will make the ciliary muscle contract continuously, thereby reducing the accommodation power of the eye.[1] Prolonged computer use or more than 4 hours will increase the risk of up to 24 times the incidence of CVS (Ulpah et al., 2017).

CONCLUSIONS

Based on the results of this study, it can be concluded that 1) As many as 63.4% of Syiah Kuala University Computer

Engineering students experienced symptoms of computer vision syndrome. 2) The factors that cause CVS in this study are: a) Gender has a relationship with the incidence of computer vision syndrome (p-value 0.03) at Syiah Kuala University Computer Engineering Students. b) Duration of computer use has a relationship with the incidence of computer vision syndrome (p-value 0.01) at Syiah Kuala University Computer Engineering Students. c) Eye distance to the monitor has a relationship with the incidence of computer vision syndrome (p-value 0.001) in Computer Engineering Students at Syiah Kuala University. 3) There is no relationship between the length of rest after using a computer with the incidence of computer vision syndrome in Computer Engineering Students at Syiah Kuala University. 4) There is no relationship between the use of glasses when using a computer with the incidence of computer vision syndrome in Computer Engineering Students at Syiah Kuala University. 5) There is no relationship between the use of glasses when using a computer with the incidence of computer vision syndrome in Computer Engineering Students at Syiah Kuala University. 6) Duration of computer use is the most influential variable on the incidence of computer vision syndrome in Computer Engineering Students at Syiah Kuala University.

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