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by Vidi Posdo A. Simarmata, Marjasa D. Dicky Newton

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The Relationship between the Length of Time Using Laptops on the Incidence of Computer Vision Syndrome in Students of the Faculty of Medicine, Christian University of Indonesia

Vidi Posdo A. Simarmata[1], Marjasa D. Dicky Newton[2]

[1,2]Medical Faculty, Universitas Kristen Indonesia, Jakarta

Corresponding Author: Vidi Posdo A. Simarmata

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ABSTRACT

Continuous long term laptop use causes a health complaint called Computer Vision Syndrome (CVS). The syndrome is influenced by applying an ergonomic system that is not good for students to use the laptop. This study aims to identify and analyze the correlation between length of time laptop usage and CVS. The method of this study was a descriptive study with the cross-sectional method. The study was conducted among Medical Faculty of Indonesia Christian University Students Class 2013 from October-December 2016. The data was collected via a questionnaire. The total number of samples was 62 persons with the random sampling method. The statistic test is used as a chi-square. The results indicate a correlation between time duration with visual problems (p=0.0000). There was a correlation break time with visual problems (p=0.0000), ocular problems (p=0.083) and extra-ocular problems (p=0.092). Nevertheless, the duration and break times have no significant correlation with CVS. There was a correlation between adequacy of light and CVS (p<0.05). The result of the study concluded that there was a correlation between length of time laptop use and CVS.

Keywords: CVS, length of time, laptop usage, ocular problems

INTRODUCTION

Computers or laptops have become an inseparable part of today's daily life. It is because a computer or laptop can provide a range of benefits. Through computers, works can be completed easily, quickly, effectively and efficiently, and alsoincreases productivity. In the field of office affairs, where most of the works usecomputers, all institutions have developed the use of computers, includingeducational institutions and health institutions such as hospitals and health centres.

According to Mc Dougall and Jones, the role of computers in education is divided into three parts, namely tutors, tools and tutee. As a tutor, the computer plays the role of a teacher through a computer-assisted teaching approach [1; 2]. Using computers as learning tools is known as CBE (Computer Based Education). As a tool, the computer becomes a tool to facilitate the teaching and learning process. Computers are also used to process data in the learning process, such as processing student grade data, scheduling, and scholarships. As a Tutee, the computer acts as a tool to be taught and can conduct questions and answers or dialogue with a computer, commonly referred to as CAI (Computer Assist Instruction). In addition to providing various kinds of convenience, excessive computer usage can also cause adverse effects on health if exposed for a long time, such as Computer Vision Syndrome [3].

According to the results of a survey by the Central Statistics Agency (BPS) in collaboration with the Association of Indonesian Internet Service Providers (APJII), the growth rate of computer users in Indonesia until the end of 2015 reached 88.1 million people. Compared with Indonesia's population of 252.4 million, it can be said that computer users in this country reach 34.9%. This illustration increased quite a lot compared to 2013, which reached 28.6%. With this achievement, Indonesia is ranked 8th in the world. This data shows a significant increase in users and duration of computer use in Indonesia [4]. Based on data from the Research Institute Mark Plus Insight, those who use computers who spend more than three hours daily increased from 24.2 million in 2012 to 31.7 million people in 2013 [5].

The increasing use of computers has led to ocular complaints called Computer Vision Syndrome (CVS) by many people. The American Optometric Association (AOA) defines Computer Vision Syndrome as a complex eye disorder and vision problem associated with prolonged activities in front of a computer with a maximum limit of 4 hours of computer use per day [6]. Blehm et al. have divided CVS symptoms into four categories, namely 1) asthenopia such as eye strain, eye fatigue and eye pain, 2) ocular/ocular surface-related symptoms such as watery eyes, irritation and dry eyes, 3) visual symptoms such as blurred vision, sluggishness changes in focus, and double vision 4) extraocular/extraocular pain such as headache, neck pain, shoulder pain and back pain [7]. Using the computer for a long period of time can cause reduced accommodation power, loss of near-point convergence, and drift for near-sightedness. Extraocular symptoms can occur due to inappropriate working conditions and poor work habits. Vision-related problems occur most frequently in more than 70% of computer workers; it is estimated that nearly 60 million people globally suffer from CVS and that one million new cases occur each year.Symptoms of CVS are usually temporary and disappear after the user rests, although a minority of users may experience continuity of symptoms. If not treated properly, most of the symptoms of CVS will recur and also worsen in the future and also lowering productivity and reducing a person's quality of life [8].

UKI Medical Students have a series of tasks that must be done during their lectures. The task requires the use of laptop in its completion, such as typing and searching for information sources via the internet. This condition makes students have to interact frequently using laptops. If the use of laptops continuously is not done in the right way, it can cause symptoms of CVS, which can negatively impact health and can further reduce productivity in carrying out all activities during lectures so that it can have an impact on decreasing productivity student academic achievement. Based on this, researchers are interested in studying the duration of laptop use on the incidence of CVS in UKI Medical Faculty students.

Based on the background of the research above, the formulation of the research problem is "does the duration of laptop use affect the incidence of Computer Vision Syndrome in UKI Medical Faculty Students? This research aims to find out the relationship between the duration of laptop usage and the incidence of Computer Vision Syndrome in UKI Medical Faculty students.

LITERATURE REVIEW

Computer Vision Syndrome (CVS) is a condition that occurs in people who work on computer monitors. According to the American Optometric Association, the definition of Computer Vision Syndrome is stated as a complex eye and vision problem associated with activities that emphasize near vision concerning computer use [9]. Computer Vision Syndrome can be interpreted as a disturbance in the eyes due to someone using a computer for too long caused to poor lighting or too bright, which

affects the monitor screen so that over time it can damage eye health [10].

The causes of Computer Vision Syndrome are multifactorial. Many studies have found that the cause of Computer Vision Syndrome has not been found with certainty. Computer Vision Syndrome is caused by a decrease in the frequency of blinking when using a computer for a long time. Studies show that a decrease in blinking frequency (6-8 times per minute) causes dry eye complaints [11].Factors that can cause Computer Vision Syndrome are age, gender, use of glasses, use of contact lenses, length of time working with computers (individual/personal factors); computer spesification; duration of computer use, length of rest after computer use (work factor) [12; 13; 14; 15]; and environmental factors [16; 17].

The condition of a person experiencing one or more of the following eye symptoms as a result of computer operation is generally referred to as Computer Vision Syndrome (CVS). These symptoms are broadly divided into four categories, namely asthenopia, symptoms related to the ocular surface, visual symptoms, and extraocular symptoms [18; 19; 20].Complaints of dry eyes can occur due to increased evaporation of tears and reduced tear secretion. Caused by the need to be able to focus the eyes on the monitor. The concentration of vision is done by looking straight, and the interpalpebral fissure is wide open. It increases the eye's exposure to air and reduces the frequency of blinking. This situation is exacerbated by several factors, including using an air conditioner that will circulate dry air with a fast flow and room'slightings with a high level of illumination. So excessive contrast occurs between the monitor and the work environment, which will disrupt the accommodation function and result in eye discomfort. A computer monitor positioned higher than the horizontal level of the eye causes a larger surface area of the eye exposed to the environment.

Complaints of eye strain and eye fatigue are mainly caused by accommodation activities and excessive eye convergence when working in front of a computer. Excessive activity occurs because the eyes need adjustment to the distance between the eyes and the monitor and the letters and images characters on the computer [21]. Headaches in computer user workers are triggered by eye conditions (refractive errors) and inappropriate working conditions (glare, lack of lighting, and improper computer location). Pain in the neck and back can be caused by improper posture when working in front of a computer. This posture may derived from an attempt to adjust the monitor higher or lower than the horizontal eye level.

Work done with a computer is a job that requires the ability of both eyes to be able to focus vision at close range. Near vision requires the convergence of the two eyes coordinated by the brain so that the eye can maintain both images in equal places on the retina [22]. Convergence ability can decrease due to working continuously in front of the computer so that the two eyes are not in the same direction and fixed at different points. The brain that works to suppress or eliminate the image in one eye will experience fatigue over time, resulting in double vision.

Blurred vision occurs when the eye cannot precisely focus the object of vision on the retina, so a clear image is not formed. Work environment could also affect this complaint: a dirty monitor screen, poor viewing angles, glare of light reflections, or poor quality computer monitors [23]. Before diagnosing CVS, other eye diseases that have the same symptoms as CVS must be first ruled out. Complaints of Computer Vision Syndrome can be experienced by individuals who do not use computers. Therefore, the diagnosis of CVS is carried out on individual computer users. Confimation of the diagnosis of Computer Vision Syndrome consists of anamnesis, physical examination and examination of the work environment [24].

Dry eyes are more often the target of therapy in Computer Vision Syndrome. Artificial tear eye drops can reduce dry eye complaints in Computer Vision Syndrome. The symptoms of asthenopia can be reduced by resting the eye. Regular blinking is also recommended to aid in the tear film refilling. Reducing the work of the ciliary muscle can be helped by occasionally looking out of the window and looking up at the sky [25]. Anggrainy state that every 20 minutes, focus your eyes on an object 20 feet (6 meters) away for 20 seconds [26]. This order is known as the "20-20-20 rule". In addition to this, it may also be advisable to close eyes for 20 seconds, as often as possible or at least half an hour.

Prevention of CVS symptoms is recommended by several researchers, such as [27; 28]:

a. Computer monitors should be 50 cm to 100 cm from the eyes. The monitor is positioned in such a way, slightly tilted back 10° – 20° from the upright position. The top of the monitor is at or slightly lower than eye level.
b. The light source is placed in a plane perpendicular to the computer and should be adjusted to half the room's lighting. The room's lighting can also be made not too bright so that the light does not glares and the reflection is not visible on the monitor. The light source can come from low-intensity lamps, three lamps in the workspace, and the use of curtains on the windows. An antiglare filter can be used if glare problems come from reflected light. Another thing that can be done is to set the computer monitor at the brightness and contrast levels that are most comfortable for you.
c. The letters or characters on the computer are adjusted to a size large enough.
d. Computer workers are advised to blink more often.
e. It is necessary to take a short break after working with the computer. Previous studies suggest a break can be done for 10-15 minutes after working continuously in front of the computer for 1-2 hours. Today's most widely used rule is the 20/20/20 rule, which means that after 20 minutes of work, you should take your eyes off the monitor by looking at a distant object about 20 feet (6 meters) away for 20 seconds.
f. The National Institute of Occupational Safety and Health (NIOSH) advises computer workers to have regular eye exams when starting to work with computers and periodically once a year. Eye examinations are mainly carried out for workers who have previously been diagnosed with eye disease and use glasses or contact lenses because of the possibility that CVS symptoms are felt to be more severe.
g. Use of lubrication to reduce dry eye complaints.
h. The room temperature should be set at 24-27℃, and the humidity should be 40-70%. Setting up good air ventilation and keeping the room clean. The workspace should be made a non-smoking room.
i. Workers with a history of certain diseases that can affect their work should often consult a doctor.

RESEARCH METHOD

This type of research is an observational analytic study with a cross-sectional approach. The risk factor is a long time to use a laptop with the effect obtained in the form of Computer Vision Syndrome. The research was conducted from October-December 2016 at the UKI Faculty of Medicine. The population of this study consisted of the reachable population and the target population. The affordable population in this study were all 2013 UKI Medical Faculty students. The target population in this study were all UKI Medical Faculty students who used laptops every day. Sampling was done by the non-probability sampling method. Each subject in the population has an unequal opportunity to be selected as the research sample. This study used a purposive sampling method,

with the sample meeting the inclusion criteria. This study used a cross-sectional research design so that the number of samples was determined using the following formula:

$$n = \frac{Z^2_{1-\alpha/2} P(1-P) N}{d^2(N-1) + Z^2_{1-\alpha/2} P(1-P)}$$

$$n = \frac{(1{,}96)^2 x 0{,}88 x (1-0{,}88) x 258}{((0{,}1)^2 x (258-1)) + ((1{,}96)^2 x 0{,}88 x (1-0{,}88))}$$

$$n = \frac{212{,}87}{2{,}47 + 0{,}858}$$

$$n = 61{,}96$$

$$n \approx 62$$

Description:

N = number of samples,
P = prevalence (66.3%)19,
d = limit error (0.1),
Z = normal distribution value at a significance level of 0.05 = 1.96.

Thus, the number of samples is 62 UKI Medical Faculty students. Data were collected by distributing questionnaires that were first tested for reliability to determine the feasibility to be relied upon to achieve the research objectives. The reliability test in this study used Cronbach's alpha, where the questionnaire that was declared reliable was the one with > 0.6. To perform the reliability test, questionnaires were distributed to 20 respondents who were not intended for research. The reliability test was then conducted using the SPSS (Statistical Package of Social Science) computer application. After being declared reliable, the questionnaire was distributed to the actual respondents from October-December 2016 to the 2013 UKI Medical Faculty students. The questionnaire was provided in multiple-choice form, where the answers had been provided so that respondents just chose the already available answers. This study used univariate data analysis to determine the frequency of Computer Vision Syndrome (CVS) occurrence in UKI Medical Faculty students with descriptive statistical analysis. In addition, a bivariate analysis was also carried out, namely to determine the relationship between the length of time using a laptop and the incidence of CVS through the one-sample chi-square test and the Odds Ratio (OR) calculation was carried out. The analysis in this study was carried out using the SPSS 15.0 program assistance.

RESULT AND DISCUSSION

This research was conducted using primary data, obtained from distributing questionnaires to respondents who were students of the UKI Faculty of Medicine. After being selected randomly and through inclusion and exclusion criteria, 62 students were obtained. The analysis of this research includes descriptive analysis and statistical analysis. The descriptive analysis includes data characteristics of all respondents, and statistical analysis includes bivariate analysis. The analysis of this research was

carried out using the SPSS (Statistical package for social science) program.

Descriptive analysis was carried out on all respondents used as research samples. The first stage is to calculate the frequency of respondents based on gender, blood type, duration of laptop use per day, length of rest breaks, and adequacy of light when using a laptop through descriptive analysis. The second stage is by separating the frequency of respondents experiencing CVS through a pie chart to see the comparison.

Table 1. Characteristics of research respondents by age

Age	Frequency	%
20 years old	21	34%
21 years old	32	52%
22 years old	9	14%
Total	**62**	**100%**

Based on the table above, it can be seen that the number of samples in this study was 62 respondents. The results showed that the respondents aged 20 years were 21 people (34%), respondents aged 21 years were 32 people (52%), and respondents aged 22 years were nine people (14%).

Table 2. Characteristics of research respondents by gender

Sex	Frequency	%
Male	17	27%
Female	45	73%
Total	**62**	**100%**

Based on the table above, it can be seen that the number of samples in this study was 62 respondents. The results showed 17 male respondents (27%) and 45 female respondents (73%).

Table 3. Characteristics of research respondents based on blood type

Blood group	Frequency	%
O	48	77%
B	14	23%
Total	**62**	**100%**

Based on the table above, it can be seen that the number of samples in this study was 62 respondents. The results showed 48 respondents (77%) with blood type O and 14 respondents (23%).

Table 4. Distribution of CVS disturbances based on the duration of using a laptop per day

Duration of Using Laptop Per Day	Asthenopia Disorder		Ocular Surface Disorders		Visual Disturbance		Extraocular disorders	
	No	Yes	No	Yes	No	Yes	No	Yes
< 4 hours	14	20	28	6	29	5	9	25
≥4 hours	14	14	7	21	7	21	3	25
Total	**28**	**34**	**35**	**27**	**36**	**26**	**12**	**50**

Based on the table above, it can be seen that in 34 respondents who used the laptop for less than 4 hours, 20 respondents experienced asthenopia, and 14 respondents did not experience it. As many as six respondents experienced ocular surface disorders, and 28 respondents did not experience it; as many as five respondents experienced visual disturbances, and 29 respondents did not experience it; 25 respondents experienced extraocular disorders, and nine respondents did not.

Meanwhile, in 28 respondents who used laptops for more than 4 hours, 14 respondents experienced asthenopia, and 14 respondents did not experience it. Twenty-one respondents experienced ocular surface disorders, and only seven respondents did not; 21 respondents experienced visual disturbances, and only seven did not; 25 respondents experienced extraocular disorders, and only three respondents did not.

Table 5. Distribution of CVS Disorders Based on the Length of Rest

Resting Time	Asthenopia Disorder		Ocular Surface Disorders		Visual Disturbance		Extraocular disorders	
	No	Yes	No	Yes	No	Yes	No	Yes
≥15 minutes	14	19	28	5	29	4	9	24
< 15 minutes	14	15	7	22	7	22	3	26
Total	28	34	35	27	36	26	12	50

Based on the table above, it can be seen that in the category of respondents with a rest interval of more than 15 minutes, from 33 respondents, 14 respondents did not experience asthenopia, and 19 respondents did. Five respondents experienced ocular surface disorders, and 28 respondents did not; 4 respondents experienced visual disturbances, and 29 respondents did not, and 24 respondents had extraocular disorders while nine respondents did not. In the respondents with the category of long rest breaks of less than 15 minutes, 15 respondents experienced measuring surface disorders while 14 respondents did not; 22 respondents experienced ocular surface disorders while seven respondents did not; 22 respondents experienced visual disturbances while seven respondents did not; and 26 respondents experienced extraocular disorders while three respondents did not.

Table 6. Distribution of CVS Interference Based on Light Adequacy

Adequate Lighting	Asthenopia Disorder		Ocular Surface Disorders		Visual Disturbance		Extraocular disorders	
	No	Yes	No	Yes	No	Yes	No	Yes
Yes	25	20	35	10	36	9	12	33
No	3	14	0	17	0	17	0	17
Total	**28**	**34**	**35**	**27**	**36**	**26**	**12**	**50**

Based on the table above, it can be seen that the respondents in the category of using laptops with adequate lighting, out of 45 respondents, 20 respondents experienced asthenopia while 25 others did not. Ten respondents experienced ocular surface disorders while 35 respondents did not; 9 respondents experienced visual disturbances while 36 respondents did not; and 33 respondents experienced extraocular disorders while only 12 respondents did not. In the poor lighting category, of the 17 respondents, 14 respondents experienced symptoms of asthenopia while the other three did not; 17 respondents had ocular surface disorders; 17 respondents all experienced visual disturbances, and 17 respondents all experienced extraocular disorders.

Bivariate analysis is used to determine the relationship between one independent variable and one dependent variable. The analysis used in this study is a paired categorical comparative analysis, so the test used is chi-square.

Table 7. Bivariate Test

No	Characteristics	Asthenopia No		Asthenopia Yes		OR	P
		Number	%	Number	%	IK95%	
1	Using Duration						
	< 4 hours	14	50%	20	59%	1,075	0,487
	≥4 hours	14	50%	14	41%		

The data above shows the results of bivariate chi-square analysis regarding the relationship between the characteristic variables and the dependent variable, namely the incidence of asthenopia disorders. In this analysis, what is considered is the p-value, where the p-value <0.05 indicates a significant relationship between the independent and dependent variables. Based on the table above, there is no significant relationship between the variable duration of laptop use and the incidence of asthenopia disorders (p = 0.487). These results indicate p>0.05, so H0 is accepted, and Ha is rejected.

Table 8. Bivariate Test

No	Characteristics	Ocular surface No		Ocular surface Yes		OR	P
		Number	%	Number	%	IK95%	
1	Using Duration						
	< 4 hours	28	80%	6	21%	1,075	0,000
	≥4 hours	7	20%	21	79%		

The data above shows the results of bivariate chi-square analysis regarding the relationship between characteristic variables and the dependent variable the ocular surface. In this analysis, what is considered is the p-value, where the p-value <0.05 indicates a significant relationship between the independent and dependent variables. Based on the table above, there is a significant relationship between the variable duration of laptop use and the ocular surface (p = 0.000). These results indicate p <0.05, so H0 is rejected, and the alternative Ha is accepted.

Table 9. Bivariate Test

No	Characteristics	Visual Disturbance No		Visual Disturbance Yes		OR	P
		Number	%	Number	%	IK95%	
1	Using Duration						
	< 4 hours	29	81%	5	19%	1,075	0,000
	≥4 hours	7	19%	21	81%		

In the data above, the results of the bivariate chi-square analysis regarding the relationship between the characteristic variables and the dependent variable visual disturbance. In this analysis, what is considered is the p-value, where the p-value <0.05 indicates a significant relationship between the independent and dependent variables. Based on the table above, there is a significant relationship between laptop use and visuals (p = 0.000). These results indicate p <0.05, so H0 is rejected and Ha is accepted.

Table 10. Bivariate Test

No	Characteristics	Extra-ocular No		Extra-ocularYes		OR	P
		Number	%	Number	%	IK95%	
1	Using Duration						
	< 4 hours	9	75%	25	50%	1,075	0,118
	≥4 hours	3	25%	25	50%		

In the data above, the results of the bivariate chi-square analysis regarding the relationship between the characteristic variables and the dependent variable are extraocular. In this analysis, what is considered is the p-value (<0.05). It indicates a significant relationship between the independent and dependent variables. Based on the table above, there is no significant relationship between the variable duration of laptop use and extraocular (p = 0.118). These results indicate p>0.05, so H0 is accepted, and Ha is rejected.

Table 11. Bivariate Test

No	Characteristics	Asthenopia No		AsthenopiaYes		OR	P
		Number	%	Number	%	IK95%	
1	Resting Time						
	≥15 minutes	14	50%	19	56%	1,075	0,644
	< 15 minutes	14	50%	15	44%		

In the data above, the results of the bivariate chi-square analysis regarding the relationship between the characteristic variables and the dependent variable are

asthenopia. In this analysis, what is considered is the p-value, where the p-value <0.05 indicates a significant relationship between the independent and dependent variables. Based on the table above, there was no significant relationship between the variable length of pause and asthenopia (p=0.664). These results indicate p>0.05, so H0 is accepted, and Ha is rejected.

Table 12. Bivariate Test

No	Characteristics	Ocular surface No		Ocular surface Yes		OR	P
		Number	%	Number	%	IK95%	
1	Resting Time						
	≥15 minutes	28	80%	5	19%	1,075	0,000
	< 15 minutes	7	20%	22	81%		

The data above shows the results of bivariate chi-square analysis regarding the relationship between characteristic variables and the dependent variable is, the ocular surface. In this analysis, what is considered is the p-value (<0.05). It indicates a significant relationship between the independent and dependent variables. Based on the table above, there is no significant relationship between the variable length of pause and the ocular surface (p=0.083). These results indicate p>0.05, so H0 is accepted, and Ha is rejected.

Table 13. Bivariate Test

No	Characteristics	Visual Disturbance No		VisualDisturbance Yes		OR	P
		Number	%	Number	%	IK95%	
1	Resting Time						
	≥15 minutes	29	81%	4	15%	1,075	0,000
	< 15 minutes	7	19%	22	85%		

In the data above, the results of the bivariate chi-square analysis regarding the relationship between the characteristic and dependent variables are Visual Disturbance. In this analysis, what is considered is the p-value (<0.05). It indicates a significant relationship between the independent and dependent variables. Based on the table above, there is a significant relationship between the long pause variable and the visual (p = 0.000). These results indicate p <0.05, so H0 is rejected and Ha is accepted.

Table 14. Bivariate Test

No	Characteristics	Extra-ocular disorder No		Extra-ocular disorderYes		OR	P
		Number	%	Number	%	IK95%	
1	Resting Time						
	≥15 minutes	9	75%	24	48%	1,075	0,092
	< 15 minutes	3	25%	26	52%		

In the data above, the results of the bivariate chi-square analysis regarding the relationship between the characteristic variables and the dependent variable are extraocular. In this analysis, what is considered is the p-value (<0.05). It indicates a significant relationship between the independent and dependent variables. Based on the table above, there is no significant relationship between the variable length of pause and extraocular (p=0.092). These results indicate p>0.05, so H0 is accepted, and Ha is rejected.

Table 15. Bivariate Test

No	Characteristics	Asthenopia No		Asthenopia Yes		OR	P
		Number	%	Number	%	IK95%	
1	Adequate Lighting						
	Yes	25	89%	20	59%	1,075	0,000
	No	3	11%	14	41%		

In the data above, the results of the bivariate chi-square analysis regarding the relationship between the characteristic variables and the dependent variable asthenopia. In this analysis, what is considered is the p-value, where the p-value <0.05 indicates a significant relationship between the independent and dependent variables. Based on the table above, there is a significant relationship between the light adequacy variable and asthenopia (p = 0.007). These results indicate p <0.05, so H0 is rejected and Ha is accepted.

Table 16. Bivariate Test

No	Characteristics	Ocular surface No		Ocular surface Yes		OR	P
		Number	%	Number	%	IK95%	
1	Adequate Lighting						
	Yes	35	100%	10	37%	1,075	0,000
	No	0	0%	17	63%		

The data above shows the results of bivariate chi-square analysis regarding the relationship between characteristic variables and the dependent variable that is the ocular surface. In this analysis, what is considered is the p-value, where the P-value <0.05 indicates there is a significant relationship between the independent and dependent variables. Based on the table above, there is a significant relationship between the light adequacy variable and the ocular surface (p = 0.000). These results indicate p <0.05, so H0 is accepted and Ha is rejected.

Table 17. Bivariate Test

No	Characteristics	Visual Disturbance No		Visual Disturbance Yes		OR	P
		Number	%	Number	%	IK95%	
1	AdequateLighting						
	Yes	36	100%	9	36%	1,075	0,000
	No	0	0%	17	64%		

In the data above, the results of the bivariate chi-square analysis regarding the relationship between the characteristic variables and the dependent variable visual disturbance. In this analysis, what is considered is the p-value, where the p-value <0.05 indicates a significant relationship between the independent and dependent variables. Based on the table above, there is a significant relationship between the light adequacy variable and the visual (p = 0.000). These results indicate p <0.05, so H0 is rejected and Ha is accepted.

Table 18. Bivariate Test

No	Characteristics	Extra-ocular disorder No		Extra-ocular disorder Yes		OR	P
		Number	%	Number	%	IK95%	
1	Adequate Lighting						
	Yes	12	100%	33	66%	1,075	0,018
	No	0	0%	17	34%		

In the data above, the results of the bivariate chi-square analysis regarding the relationship between the characteristic variables and the dependent variable extraocular disorder. In this analysis, what is

considered is the p-value(<0.05). It indicates significant relationship between the independent and dependent variables. Based on the table above, there is a significant relationship between the light adequacy variable and extraocular (p = 0.018). These results indicate p<0.05, so H0 is rejected and Ha is accepted.

The Relationship of Interaction with Laptops per Day with the Incidence of Computer Vision Syndrome in UKI Medical Faculty Students

The duration of computer interaction is defined as the average intensity of the time used by the respondent while interacting with the computer, measured in one day and divided based on the predetermined time classification. Research at the University of South Carolina categorizes computer use into three categories, namely: light (< 2 hours), moderate (2-4 hours) and heavy (> 4 hours) per day. Hoesia's research in 16 cities in Indonesia shows that the average computer user per day is less than 5 hours. Azkadina's research categorizes the average computer use time in 1 day which is less than 4 hours per day and more or equal to 4 hours a day. The researchers divided the length of interaction using a laptop [29]. An individual who works in front of a computer for more than 4 hours continuously has a twenty-six times more risk of suffering from CVS than working in front of a computer for less than 4 hours continuously. Ophthalmic symptoms occur after 2 to 3 hours of continuous computer use.

Juliana's research and supported by Mujadidi's research stated that CVS is experienced by computer users who interact for more than 3 hours per day. Meanwhile, Wibawa's research showed a significant increase in CVS complaints among computer users for more than 5 hours per day. Based on the test from this study, it was found that there was a significant relationship between laptop interaction on the occurrence of visual disturbances and ocular surface disturbances (p<0.05). Meanwhile, there is no significant relationship between asthenopia (tired eyes) complaints, and this is because respondents who use the computer for less than 4 hours and more than or equal to 4 hours both complain of eye fatigue. In line with the research conducted by Azkadina in his research on the relationship between individual residual factors of computer users on the occurrence of CVS, he found that the relationship between the length of time working and eye fatigue was not significantly related (p < 0.436) [30].

The Relationship of the Long Time Lapse of Using a Laptop with the Incidence of Computer Vision Syndrome in UKI Medical Faculty Students

The use of computers today has covered all levels of society, both desktop and laptop computers. Lately, the use of laptops is increasingly becoming a choice compared to desktop computers. In addition to having a positive impact, it turns out that the use of a laptop also has a negative impact because the monitor design attached to the keyboard will cause problems for its users. The increasing use of laptops among students and often used for a long time is at risk of causing health complaints. The duration of computer use is closely related to the symptoms that appear in the eyes and the length of time these symptoms disappear. The use of computers without break time can reduce the accommodation ability of the eyes so that the symptoms of Computer Vision Syndrome get worse. Research shows that your work quality improves if you take regular breaks during computer use. Taking several breaks reduces the discomfort felt by computer users and increases work productivity compared to taking a break once in a long time at certain times.

A previous study conducted by Yan et al. stated that resting for 15 minutes while using a computer was a protective factor against the emergence of CVS complaints, so it can be concluded that rest is the most appropriate effort to prevent CVS

symptoms. In this study, there was a significant relationship between the length of the pause on the onset of complaints. Dewi K et al. conducted a study on computer operators and found that more respondents rested less than 15 minutes after using the computer for more than 2 hours. As many as 76% experienced ocular complaints [13].

The Relationship of Length of Exposure to Laptops with the Incidence of Computer Vision Syndrome in UKI Medical Faculty Students

In this study, all 62 respondents (100%) used a computer for more than or equal to 5 years, and the researcher could not analyze it because the data did not vary (homogeneous). Wang reported that the incidence of CVS was more in computer users for more than ten years. Meanwhile, Branden et al. reported that the incidence of CVS was higher in computer users who worked for less than five years. It is due to differences in demographic data [31].

The Relationship of Light Adequacy on Laptops with Computer Vision Syndrome Incidence in UKI Medical Faculty Students

According to Yan et al., the intensity of lighting experienced following the workspace can reduce visual fatigue experienced by workers. Good workspace lighting should not be too bright or too dim, if the light intensity is too bright, it will cause glare on the computer screen that interferes with work vision, but if the lighting is too dim, then the eyes have to work harder so that the eye muscles get tired more easily. Excessive light intensity, overhead lighting sources, and sunlight from outside were the most influential on visual discomfort, so the position and intensity of light needed to be adjusted to reduce eye fatigue [7]. Based on this study, it was found that there was a significant relationship between light adequacy and the occurrence of CVS. It is following previous research conducted stated that 71.4% of computer users are at risk of CVS with poor lighting in their workspace [32].

CONCLUSION

Based on the results of data analysis and discussion in the previous chapter, it is concluded that this study is as follows: a) Based on two research results, it was found that there was no relationship between the variable duration of laptop use and the incidence of asthenopia (p=0.148) and extraocular disorder (p=0.118). At the same time, the ocular surface (p = 0.000) and visual (p = 0.000) had a relationship with the duration of laptop use because the ocular and visual surface variables had a P-value <0.05. In other words, the duration of using a laptop has a relationship with the ocular surface and visual disturbance; b) Based on the results of the study, it can be seen that there is no relationship between the variable length of resting time and the incidence of asthenopia (p=0.664) and extraocular disorder (p=0.092) because both variables have a P value> 0.05. At the same time, the variable length of resting me has a relationship with the ocular surface variable (p=0.083) and visual (p=0.000) because both variables have a P-value <0.05. In other words, the length of resting time variable has a relationship only with the ocular and visual surface variables; and c) Based on the results of the study, it was found that the light adequacy variable had a relationship with asthenopia (p = 0.000), ocular surface (p = 0.000), and visual (p = 0.001), and extra-ocular (p = 0.018) because the four variables had P values<0.05.

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