

Research article

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Prevalence of computer vision syndrome among medical students at Pham Ngoc Thach University of Medicine

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Abstract

Introduction: Computer Vision Syndrome (CVS) is considered an abnormality of the visual system that occurs when using electronic devices for a long time. With the explosive development of digital technology, CVS has become a syndrome of concern. This survey evaluated the prevalence of CVS in general medical students at Pham Ngoc Thach University of Medicine. At the same time, learn about the differences in the prevalence of CVS between courses, and identify common symptoms and factors related to CVS.

Method: A cross-sectional study using the convenience sampling method was conducted. Students were asked to fill out an electronic self-administered survey. The survey collected information on demographics, electronic device usage habits, and symptoms of CVS using the validated CVS-Q questionnaire. In addition, the Chi-square test, Fisher's Exact, and logistic regression were also used to evaluate associations between CVS and other factors.

Result: Among the total of 344 samples, there were 174 females (50.58%) and 170 males (49.42%). Of these, 84.59% suffered from CVS, with dry eye being the most common symptom (15.7%), followed by itching (15.4%), and feeling eyesight is worsening (15.4%). The least common symptom was double vision (3.2%). The prevalence of CVS from the first to the sixth year was 85.8%; 86.9%; 84.8%; 86.8%; 82.2%; and 78.2%. A significant positive correlation was observed between CVS with time spent using the devices (OR = 0.336; 95%CI: 0.143 – 0.789), gender (OR = 2.00; 95%CI: 1.112 – 3.741), taking breaks while using the device (OR = 2.00; 95%CI: 1.078 - 3.535), adjusting brightness, contrast (OR = 2.00; 95%CI: 1.031 – 4.062) and distance from eye to devices (OR = 3.548; 95%CI: 1.285 – 9.797).

Conclusion: CVS is common among medical students; significant risk factors should be addressed to reduce the symptoms and improve work productivity. It is a necessity to raise awareness among medical students regarding computer-related health problems.

Keywords: Computer vision syndrome, CVS, digital devices, dry eye, fatigue eye, vision hygiene.

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1. INTRODUCTION

Electronic devices such as phones, laptops, computers, tablets... are being used by people with high frequency to keep up with world trends in finding information.

This means that the increased need to look closely at electronic screens leads to increased risks affecting visual health, one of which is CVS. AOA defines CVS as “a group of eye and vision-related problems that

results from prolonged usage of computers, tablets, e-readers, and cell phones which causes increased stress to near vision in particular” [1]. Due to the convenience of digital technology and the characteristics of the field of study, many studies in Vietnam show that medical students are subjects who spend a lot of time using electronic devices [2,3]. Moreover, international studies reported that the incidence of CVS in medical students in recent years is not less than 70% [4,5]

Symptoms of CVS are very diverse such as dry eyes, blurred vision, eye fatigue, double vision, tearing... To explain these symptoms, some studies show that the eye cannot maintain accommodation on pixels that have inconsistent brightness and contrast [6]. Furthermore, it may be due to reducing the frequency of blinking causing dry eyes, or unintentional squinting causing eye fatigue. Some studies have found a relationship between contraction of the ciliary muscle when accommodation and contraction of the trapezius muscle causing symptoms of neck and shoulder pain [7,8]. Above all, psychological stress also plays an important role as it stimulates the sympathetic nervous system, thereby reducing the activity of eye muscles and relaxing accommodation [9]. More specifically, some factors can affect computer users’ eyes such as screen elements (brightness, contrast, small screen, small font size), habits of using electronic devices, environmental light...

To improve the quality of life and convenience, all tasks of reading, writing, viewing, researching, searching... can be performed in one electronic tool. However, the presence of CVS due to long-term use of electronic devices reduces work productivity, increases error rates, and affects quality of life, sleep, and mental health [10]. This study was conducted to survey the prevalence of CVS in medical students. In addition, we also evaluated

relationships between electronic device usage habits and the incidence of CVS.

2. METHOD:

2.1. Participants

Selection criteria: Study participants were students majoring in General Medicine at the Pham Ngoc Thach University of Medicine from the first to sixth year.

Exclusion criteria:

- Students who have had refractive surgery or other eye surgery.

- Students currently suffering from eye diseases (conjunctivitis, keratitis, corneal ulcers, cataracts, retinopathy, vitreous disease, uveitis, eyelid inflammation, hemorrhage conjunctiva, glaucoma, stye, chalazion, strabismus/squint, amblyopia, dry eye).

2.2 Sample size:

Our sample size is 233 students by using the formula of Krejcie and Morgan (1970) with $P = 82.5\%$ (according to research by Johanna Coronel-Ocampos and colleagues [11] in 2022)

$$S = \frac{X^2 NP(1 - P)}{d^2(N - 1) + X^2 P(1 - P)}$$

2.3 Study design: sectional descriptive design.

2.4 Data collection tool: An online self-reported questionnaire, which consisted of three main parts, was used to collect data. Part 1 explores demographics, part 2 is questions about electronic device usage habits, and the final part is a standardized CVS-Q questionnaire that explores symptoms of CVS score.

2.5. Data analysis: Microsoft Excel 2019 was used to enter and examine data software and SPSS 20.0 software was used to analyze data. Quantitative variables are described as mean and standard deviation, while qualitative variables are described as frequencies and percentages. Additionally,

the Chi-square test, Fisher’s exact, logistic regression, and odds ratios (OR) were used to test and measure the association between categorical study and outcome variables. For statistical significance and precision, we used a p-value of <0.05 and a 95% confidence interval (CI).

2.6. Medical ethics: The research has been approved by the Ethics Council in Biomedical Research of the Pham Ngoc Thach University of Medicine according to

decision No. 1072/TDHYKPNT - HDDD dated March 12, 2024.

3. RESULT

3.1 Characteristics of Participants

The study included 354 medical students. After excluding 6 students who had eye surgery and 4 students suffering from eye diseases, the number of students included in the study was 344 students. Ages in the study ranged from 18 - 25 years with an average age of 21 ± 1.79.

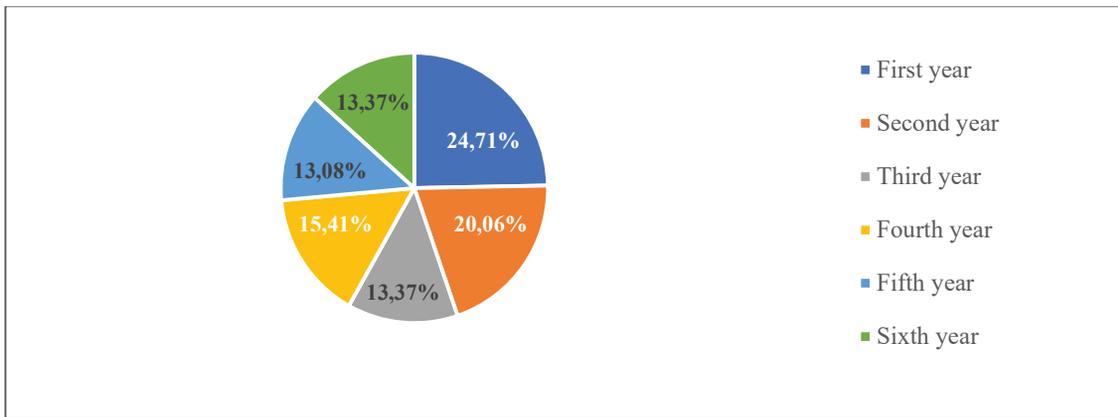


Chart 1: The ratio of students by each year

First-year students account for the highest participation rate with 24.71%, the lowest participation rate is fifth-year students (13.08%)

Table 1: Characteristics and habits of using electronic devices

Feature		Quantity	Percentage
Gender	Male	170	49.42%
	Female	174	50.58%
The use of oral drugs has side effects on the eyes	Yes	21	6.10%
	No	323	93.90%
Smoking cigarettes/vape	Yes	8	2.30%
	No	337	97.70%
Taking breaks while using the device	Yes	153	44.50%
	No	191	55.50%
Using blue light filter	Yes	170	49.40%
	No	174	50.60%
Adjust brightness, contrast	Yes	223	65.00%
	No	121	35.00%
Time using devices per day	Below 2 hours	35	10.20%
	From 2 to 4 hours	60	17.40%
	From 4 to 6 hours	99	28.80%
	More than 6 hours	150	43.60%

Purpose	Study	341	99.10%
	Relax	329	95.60%
	Work	178	51.70%
	Others	0	0%
Distance from eye to device's screen	Below 40cm	170	49.40%
	From 40cm to 76cm	153	44.5%
	More than 76cm	21	6.10%
Surrounding brightness	Very bright	10	2.90%
	Bright	289	84.00%
	Dim	31	9.00%
	Dark	14	4.10%
Position	Handheld	304	88.40%
	Sitting at the table	299	86.90%
	Lay down	256	74.40%
Type of devices	Mobile phone	329	95.60%
	Laptop	280	81.40%
	Tablet	140	40.70%
	Television	52	15.10%
	Computer	49	14.20%
	Game	5	1.50%
	E-reader	0	0
	Others	1	0.30%
Quantity of devices	01 device	25	7.30%
	More 02 devices	319	92.70%

3.2 Prevalence of CVS

The prevalence of CVS among medical students was 84.59%, and there was no difference between school years ($p > 0.05$).

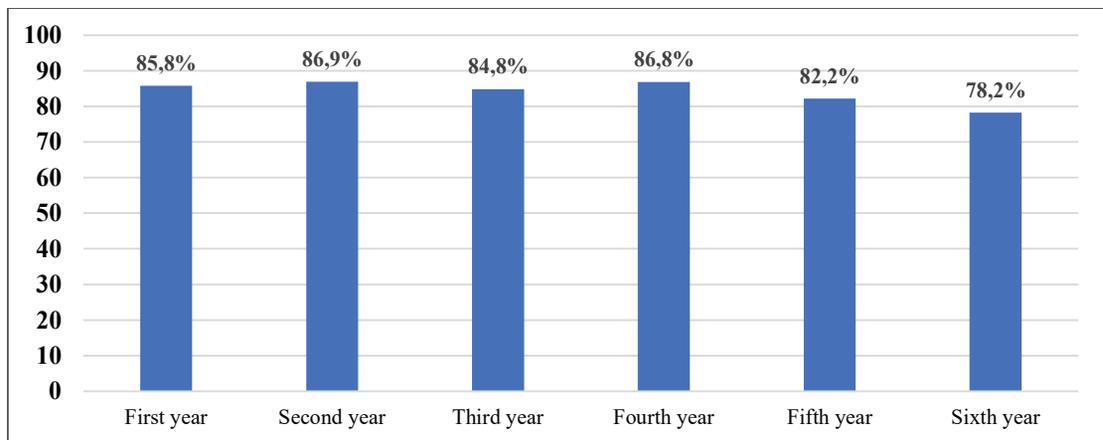


Chart 2: The prevalence of CVS by each year

The prevalence of CVS was nearly equal across school years. Of these, the second year had the highest incidence rate (86.9%) and the sixth year had the lowest incidence rate (78.2%).

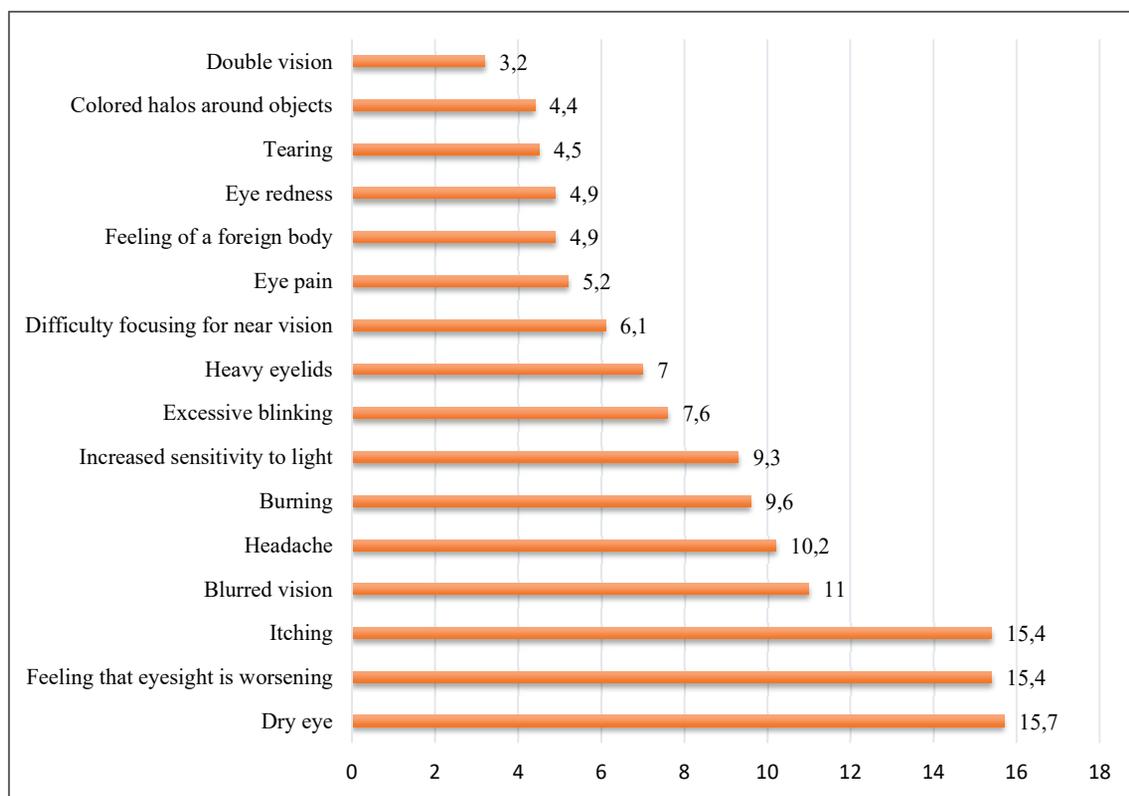


Chart 3: The frequency of symptoms of CVS

The most common symptom was “Dry eye” with 15.7%, followed by “Itching” and “Feeling that eyesight is worsening” with 15.4%. The least common symptom was “Double vision” with 3.2%.

3.3 The correlation with CVS

Table 2: The correlation with CVS

	OR	95% CI	P value
School year			
▪ First-year			0.824***
▪ Second-year	0.913	0.360 – 2.311	0.847
▪ Third- year	1.092	0.398 – 2.998	0.865
▪ Fourth-year	0.926	0.340 – 2.523	0.880
▪ Fifth-year	1.315	0.495 – 3.498	0.583
▪ Sixth-year	1.690	0.667 – 4.280	0.269
Gender			
▪ Male			
▪ Female	2.00	1.112 – 3.741	0.02*
Age	1.091	0.928 – 1.282	0.292***
The use of oral drugs has side effects on the eyes			
▪ Yes			
▪ No	1.781	0.402 – 7.883	0.754**

Smoking cigarettes/vape			
▪ Yes	1.282	0.154 – 10.636	1.000**
▪ No			
Time using devices per day			
▪ < 2 hours/ day			0.058****
▪ From 2 to 4 hours/ day	0.288	0.100 – 0.834	0.022
▪ From 4 to 6 hours/day	0.390	0.158 – 0.959	0.040
▪ >6 hours/day	0.336	0,143 – 0.789	0.012
Type of devices			
▪ Mobile phone	1.192	0.261 – 5.443	1.000**
▪ Computer	1.503	0.698 – 3.233	0.295*
▪ Laptop	0.743	0.366 – 1.512	0.412*
▪ Television	0.998	0.441 – 2.260	0.996*
▪ Tablet	0.645	0.364 – 1.201	0.165*
▪ E-reader	-	-	-
▪ Game	1.380	1.151 – 12.592	0.569**
▪ Others	0.845	0.808 – 0.885	1.000**
Quantity of devices			
▪ 01 device			
▪ More 02 devices	1.41	0.505 – 3.941	0.563**
Taking breaks while using the device			
▪ Yes			
▪ No	2.00	1.078 – 3.535	0.026*
Purpose			
▪ Study	0.360	0.032 – 4.401	0.396**
▪ Relax	2.628	0.338 – 20.421	0.483**
▪ Work	0.881	0.490 – 1.582	0.670*
Blue light filter			
▪ Yes	1.217	0.676 – 2.190	0.513*
▪ No			
Adjust the brightness, contrast			
▪ Yes			
▪ No	2.00	1.031 – 4.062	0.038*
Distance from eye to devices			
▪ < 40cm			0.049****
▪ From 40 to 76 cm	1.386	0.741 – 2.593	0.307
▪ >76 cm	3.548	1.285 – 9.797	0.015

Surrounding brightness			
▪ Very bright	0.000	0.000	0.999
▪ Bright	2.720	0.348 – 21.367	0.340
▪ Dim	0.897	0.074 – 10.392	0.931
▪ Dark			0.387***
Position			
▪ Handheld	0.695	0.301 – 1.605	0.392*
▪ Sitting at table	2.811	0.838 – 9.428	0.802*
▪ Lay down	0.950	0.488 – 1.848	0.880*

The statistical table shows that factors related to having CVS include: gender ($p = 0.02$, $OR = 2.00$); device usage time per day ($p < 0.05$); usage distance ($p < 0.05$, $OR = 3.50$); eye rest habits ($p = 0.026$, $OR = 2.00$); habit of adjusting brightness and contrast ($p = 0.038$, $OR = 2.00$). In addition, we have not found a relationship between the remaining factors and CVS.

4. DISCUSSION

The prevalence of CVS in our study was 84.49% in a total of 344 students. This is a relatively high rate and similar to other recent studies [11,12]. Moreover, although there are differences in the rate of CVS in different countries when researching university students, most authors reported a CVS rate of more than 50% [13,14]. Therefore, raising awareness about CVS and modifying risk factors is essential, as digital devices have become indispensable in current and future life.

Our study included students taking oral medications that may have ocular side effects, which may have influenced the results, but because the numbers were small, the effect was negligible. We recorded that the least common symptoms were “Double vision” (3.2%) and “Colored halos around objects” (4.4%). This finding is similar to some other Asian studies [15,16]. Additionally, the symptom with

the highest recorded frequency in this study was “Dry eyes” with 15.7% of the total 344 choices. This is similar to Catherine Wang’s research when the author noted that the most frequently occurring symptoms were headaches and dry eyes [13]. Above all, this result coincides with TFOS’s statement that people of Asian ethnicity are more likely to have dry eyes [17].

Among the factors our research team found to be associated with developing CVS, gender and time spent using electronic devices are two almost unchangeable factors. We found that female students are 2 times more likely to have CVS than males, this may be due to differences in hormones, chromosomes, and sex steroids (eg androgen, estrogen) in the two sexes [18]. Using electronic devices for less than 2 hours is a protective factor for developing CVS. However, because of the high need for electric devices in our modern day, the ability to decrease time using electric devices seems to be harder than before. Many studies show that the longer you use the device, the more likely you are to get CVS [19]. This comes from the effort to equal between the accommodation system and the vergence system to make the image clear and single. Moreover, using electric devices for a long time can increase the incomplete blink frequency, leading to poor

distribution of tears over the ocular surface, making people who suffer from CVS feel dry, and itchy eyes [20]. However, several other factors we found can be modified to reduce the likelihood of developing CVS. Univariate regression testing shows that using electronic devices less than 40cm away has an odds ratio of 3.5 times the risk of getting CSV compared to keeping the device 76cm away. This is similar to other studies [21,22] where the authors also suggested that shortening the distance over a long time when using electronic devices stimulates the accommodation signal, which can cause and develop eye fatigue. In addition, having the habit of resting your eyes also helps reduce the odds of getting CVS by up to 2 times. This is in line with the study performed by Lema et al [23], in which not having the habit of resting while using electronic devices was associated with a 2.24 times higher risk of CVS than the other group. While resting, your eyes can blink more to renew the tear film and look far away to relax accommodation. Finally, adjusting the brightness contrast, our study found that no adjustment habit caused an odds ratio of risk 2 times higher than the other group. A study carried out by Abudawood and et al [24] also found that screen brightness was associated significantly with the development of CVS. The screen brightness and the room lighting should be balanced, glare and reflection from the screen or lighting from the room can contribute to the symptoms of CVS.

In addition, we have not found a relationship between the remaining factors and CVS. This may be due to the study's small sample size or the limitation of using a self-reported survey, which easily misses some of the findings needed in the clinic. Moreover, future studies should compare

the prevalence of CVS on students in universities in different countries using similar methods and find out where the differences come from (individual, environmental, social, or other factors).

5. CONCLUSION

CVS is common among medical students. The prevalence of CVS was found to be 84.59%. Second-year students had the highest incidence rate (86.9%) and sixth-year students had the lowest incidence rate (78.2%). The most frequently occurring symptom was "Dry eyes" with 15.7% and "Double vision" was the least common symptom (3.2%). Factors associated with developing CVS found in the study include gender, time spent using electronic devices, distance, habits of adjusting brightness contrast, and resting the eyes while using electronic devices. Significant risk factors should be addressed to reduce the symptoms and improve work productivity.

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