

## Prevalence of Computer Vision Syndrome and Associated Factors among Postgraduate Students at University of Gondar, Northwest Ethiopia, 2019

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### ABSTRACT

**Introduction:** Computer vision syndrome is one of the major public health problems. However, the prevalence and associated factors were unknown among postgraduate students, making provision and intervention treatment more difficult. This study was intended to fill this gap.

**Methods:** An institution-based cross-sectional study was conducted using a pre-tested structured self-administered questionnaire. The data were entered into epidemiological information version 7 and exported to SPSS for analysis. p-value <0.05 was considered statistically significant.

**Results:** A total of 359 students participated in this study, with a response rate of 96.38%. The prevalence of computer vision syndrome was 84.4% (95% CI, 80.10-88.00). Students who used a computer for more than 4.6 hours per day (AOR: 3.763, 95% CI : 1.732, 8.176), the position of computer (AOR: 3.949, 95% CI: 1.308,11.921), using a computer without a break (AOR: 2.891, 95% CI: 1.397, 5.985), presence of glare on a computer (AOR: 3.864, 95% CI: 1.601,9.329), and older age (AOR=3.295, 95% CI: 1.245, 8.722) and (AOR: 4.828, 95% CI: 1.121, 20.797) were statistically associated with computer vision syndrome.

**Conclusion:** In this study, the most common symptoms were blurred vision, eye irritation, and headache. Age, time spent on computer, the habit of taking a break, the level of computer and presence of glare were associated with the development of CVS.

**Keywords:** Computer vision syndrome; Postgraduate students; Gondar; Ethiopia

### INTRODUCTION

Computer vision syndrome (CVS) or digital eye strain (DES) is a vision problem related to the use of computers or digital screens that make the near work more difficult [1]. High visual demand and visual attention make any computer user susceptible to CVS. Common symptoms of CVS include eyestrain, irritation, burning sensation, redness, headache, blurred vision, and neck or shoulder pain that generally increase with extended computer use [1,2]. The symptoms of computer vision syndrome may vary depending on several factors [3-5].

Globally, DES is one of the major public health problems. It results in reduced productivity at work, increased error rate, reduced job satisfaction, and impaired visual abilities. Worldwide data showed that nearly 60 million people suffer from CVS, and one million new cases occur each year

[6]. Computer vision syndrome affects 90% of the people who work on computers for three hours or more per day [7].

In America, about 75% of computer users who worked for long hours at the computer had complaints of visual symptoms [6]. This is expected to be worse in developing countries where fewer people are aware and take treatment, but the majority are less aware and ignorant about the condition [8].

In Africa, limited studies on CVS have been carried out in spite that computer use has attained a significant increased especially as technology is advanced [9].

In Ethiopia, the prevalence of CVS ranges from 69.5% [4] to 73.9% [10].

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Consequently, many organizations can facilitate and manage their businesses using a computer.

It reduces the quality of life of computer users [11,12]. Therefore, adjusting ergonomics is very important [12-15]. Therefore, as the number of postgraduate students are increasing [16], studying CVS among them is indispensable.

**MATERIALS AND METHODS**

An institution-based cross-sectional study was carried out from May 29 to June 9, 2019 at University of Gondar. The sample size was calculated using a single population proportion formula for the proportion of CVS. To achieve this, the proportion of CVS among computer users 73% [5], power 80, a 95% confidence level, an odds ratio of 2.04, and 10% for the non-response rate were considered for which the sample size came to 359. Systematic random sampling was used to select the study participants. To ensure representativeness, the sample was taken from all colleges proportionally.

The study was conducted after ethical clearance was obtained from the University of Gondar, College of Medicine and Health Science and Comprehensive Specialized Hospital, School of Medicine Ethical Review Committee. A letter of permission was obtained from the University of Gondar postgraduate programs coordinating office. Written informed consent was obtained from each student after explaining the purpose of the study. They have the full right to participate and refuse or withdraw at any time they want. Confidentiality of the information obtained was assured by coding the data.

**Operational definition**

**Postgraduate students:** Anyone who has already obtained the first degree, and is now pursuing a second, third, or above degree.

**Computer vision syndrome:** In one or both eyes at least one of the asthenopia symptom [5].

**Computer user:** A student who uses the computer for their day-to-day activities at least two hours per day [17].

**Awareness:** Having heard of computer vision syndrome [9].

**Appropriate sitting position:** A small tilt of eyes downward, in relation to the horizontal line, between 10o and 20o and the distance between the user and computer is 40 to 70 cm [1,17,18].

**Data collection tool and procedures**

The questionnaire was adapted from previous studies [5,8]. It was initially prepared in English, translated into Amharic (local language) by language experts, and re-translated into English to check consistency in the meaning of words and concepts. Meter and pictures were used to measure viewing distance and to clarify the sitting position and level of the computer respectively. Ophthalmic examination was done by trained optometrists.

**Data management and analysis**

After cleaning, the collected data were entered into Epi-info Version 7 and exported to SPSS version 22.0 for analysis. Descriptive were performed for most variables.

Bi-variable and multivariable logistic regression was employed to determine the associated factors. An adjusted odds ratio with a 95% confidence interval and p value of <0.05 was used to identify the predictors of the outcome variable.

**RESULTS**

**Socio-demographic characteristics of the study participants**

A total of 359 students participated in this study, with a response rate of 96.38%. The majority of the participants were male (77.7%). The median age of the participants was 28 years, with an inter-quartile range of 4 years. More than half of the respondents were single (61.00%) and less than half were married (39.00%) (Table 1).

**Table 1:** Socio-demographic characteristics of the study participants to determine the prevalence of CVS July 2019, (n=346).

Variables	Computer vision syndromes		
	Yes	No	
Sex	Male	223(82.90%)	46(17.10%)
	Female	69(89.60%)	8(10.40%)
Age	24-26	78(78.00%)	22(22.00%)
	27-28	87(81.30%)	20(18.70%)
	29-30	77(89.50%)	9(10.50%)
	31-46	50(94.30%)	3(5.70%)
Marital status	Single	176(83.40%)	35(16.60%)
	Married	116(85.90%)	19(14.10%)
Academic years	First year	126(82.90%)	26(17.10%)
	Second year	152(87.40%)	22(12.60%)
	Third year and above	14(70.00%)	6(30.00%)

Academic status	Doctor	37(77.10%)	11(22.90%)
	Masters	154(30.4%)	22(12.50%)
	Degrees	100(82.60%)	21(17.4%)

**Prevalence and associated factors with computer vision syndrome**

The self-reported prevalence of computer vision syndrome among postgraduate students was 84.40% (95% CI: 80.1, 88.0). Blurred vision, eye irritation, and headache were the most commonly reported symptoms of CVS, with a prevalence of 34.10%, 28.30%, and 28.30%, respectively.

In the bivariate analysis, age, sex, academic year, academic status, history of eye disease, seating position, level of computers, time spent on the computer, habit of taking a break, the habit of adjusting brightness and contrast, eyeglass use, and the presence of glare were associated with predictors. In the multivariate analysis, age groups 29-30 [AOR=3.295 (95% CI: 1.245, 8.722)], age groups 31-46 [AOR=4.828 (95% CI: 1.121, 20.797)], prolonged computer use [AOR=3.763 (95% CI: 1.732, 8.176)], the position of computer above eyes level [AOR=3.949 (95% CI:

1.308, 11.921)] and at the eyes level [AOR=2.239 (95% CI: 1.068, 4.696)], habit of taking a break [AOR=(95% CI: 2.891, 1.397, 5.985)] and the presence of glare on computer [AOR=3.864 (95% CI: 1.601, 9.329)] were directly associated with computer vision syndrome.

Accordingly, the age groups 29-30 were 3.29 times more likely to develop CVS compared to the age group 24-26. Similarly, the age groups with a range of 31 to 46 were 4.83 times more likely to develop CVS compared to the age groups 24-26. Furthermore, the presence of glare on the computer was 3.86 times more likely to cause CVS as compared to absence of glare. Students who did not have the habit of a break were 2.89 times more likely to develop CVS compared with students who had a habit of a break during computer use.

In addition, students who spent more time (>4.6 hours/day) on the computer were 3.76 times more likely to develop CVS than students who spent less time (<=4.6 hours/day) on the computer. The study also showed that students who used a computer above eye level were 3.95 times more likely to develop CVS compared with students who used a computer below eye level. Similarly, students who used a computer at eye level were two times more likely to develop CVS compared with students who used a computer below eye level (Table 2).

Variable	Computer vision syndrome		COR (95%CI)	AOR (95%)	
	Yes	No			
Age	24-26	78(78.00%)	22(22.00%)	1	1
	27-28	87(81.30%)	20(18.70%)	1.227(0.623-2.418)	1.530(0.679-3.449)
	29-30	77(89.50%)	9(10.50%)	2.413(1.045-5.573)	3.295(1.245-8.722)*
	31 and above	50(94.30%)	3(5.70%)	4.701(1.337-16.53)	4.828(1.121-20.797)*
Sex	M	223(82.90%)	46(17.10%)	0.562(0.253-1.248)	2.622(0.977-7.041)
	F	69(89.60%)	8(10.40%)	1	1
Previous academic status	Doctor	37(77.10%)	11(22.90%)	1	1
	Masters	154(87.5%)	22(12.50%)	2.081(0.928-4.668)	1.488(0.563-3.936)
	Degree	101(82.79%)	21(17.21%)	1.416(0.623-3.218)	1.675(0.624-4.496)
Academic year	1st year	126(82.90%)	26(17.10%)	1	1
	2nd year	152(87.40%)	22(12.60%)	1.426(0.771-2.637)	1.273(0.582-2.782)
	3rd year and above	14(70.00%)	6(30.00%)	0.481(0.169-1.370)	0.829(0.223-3.082)
Eye disease	No	234(82.40%)	50(17.60%)	1	1
	Yes	58(93.50%)	4(6.50%)	3.098(1.075-8.927)	3.222(0.941-11.036)
Seating position	Appropriate	180(79.3%)	47(20.7%)	1	1

	Inappropriate	112(94.1%)	7(5.9%)	4.178(1.825-9.565)	2.400(0.928-6.206)
	Above	63(91.3%)	6(8.7%)	3.416(1.330-8.773)	3.949(1.308-11.921)*
Position of computer	At the eye	146(87.4%)	21(12.6%)	2.262(1.204-4.249)	2.239(1.068-4.696)*
	Below	83(75.5%)	27(24.5%)	1	1
Habit of break	Yes	131(79.9%)	33(20.1%)	1	1
	No	161(88.5%)	21(11.5%)	1.931(1.067-3.497)	2.891(1.397-5.985)*
Time spent	<=4.6	39(65.00%)	21(35.00%)	1	1
	>4.6	253(88.50)	33(11.50%)	4.128(2.171-7.85)	3.763(1.732-8.176)*
Eye glass	Yes	87(88.8%)	11(11.2%)	1.659(0.817-3.368)	1.247(0.506-3.075)
	No	205(82.7%)	43(17.3%)	1	1
Adjust brightness	Yes	244(83.0%)	50(17.00%)	1	1
	No	48(92.30%)	4(7.70%)	2.459(0.848- 7.129)	1.331(0.379-4.680)
Glare	Yes	132(94.3%)	8(5.7%)	4.744(2.163-10.404)	3.864(1.601-9.329)*
	No	160(77.7%)	46(22.3%)	1	1

**Table 2:** Bivariable and multivariable regression of CVS among postgraduate students at University of Gondar, July 2019, n=346.

**DISCUSSION**

In this study, the prevalence of computer vision syndrome was 84.40 (95% CI: 80.1-88.0). This study was higher than previous results from a bank worker (73%) and secretaries and data processors (73.9%) in Gondar city and Debre Tabor (69.5%), in Ethiopia (4, 5, 10). The possible reason is that postgraduate students spend more time on computers than bank staff and secretaries. This is because students are studying and doing their project day and night, but at night, bank staff and office workers get rest [19].

This finding is also higher than reports from studies in Nigeria 74% (14), Nepal 74% (23), Sri Lanka 67.4% (25), Syria 55.46% (2), and America 65% (5). The possible explanation is, participants in the above studies may use home remedies to prevent the symptoms.

However, the prevalence of computer vision syndrome in this study was lower (89.9%) than the study conducted in Malaysia [20]. This suggests a difference in the methods of measuring CVS. The study in Malaysia includes extraocular symptoms such as neck and shoulder pain as CVS in addition to visual symptoms [20], but not in our study.

The most common symptoms reported in this study were blurred vision (34.1%), followed by eye irritation (28.3%) and headache (28.3%). This finding is in line with other studies [8, 20-22]. This may be due to the fact that the computer emits electromagnetic radiation that can trigger the ciliary muscle in

the eye; consequently, repeated exposure to the computer screen has contributed to the development of symptoms [23].

The odds of having CVS among students who used a computer above the level of the eyes and at the level of the eyes were 3.94 and 2.23 times greater than those who used a computer below the level of the eyes respectively. This study is agreed with other studies [20,24]. This may be due to back and neck muscle strain [25]. Besides, higher viewing angles expose a wider region of conjunctiva and cornea to air and cause the likelihood of irritant-like symptoms [26].

Students' who were exposed to glare were 3.86 times more likely to develop CVS as compared to students who were not exposed. This finding is in line with other studies [25,27]. This may be due to glare can cause a delay in reading that results in visual fatigue and eye strain [25].

Being age groups 29-30 and 31-46 were 3.29 and 4.82 times more likely to develop CVS as compared to age groups 24-26, respectively. This finding is in line with other studies [10,28]. This may be due to structural and physiological changes in the visual system due to ageing. These changes result in poor visual function, which further leads to eye fatigue and eye strain [29]. However, younger age was reported to develop CVS than older age groups. This may be due to the difference in the study setting and socio-demography.

Students who did not have a habit of taking a break during computer use were 2.89 times more likely to develop CVS than students who had the habit of taking a break during computer use. This finding is also reported in other studies [5,24]. This may be due to the fact that the eyes normally cannot remain focused on the pixel-generated images on a computer screen for

a long time, but refocus frequently. This results in the development of CVS.

## CONCLUSION

In this study, the most common symptoms were blurred vision, eye irritation, and headache. Age, time spent on computer, the habit of taking a break, the level of computer and presence of glare were associated with the development of CVS.

## Limitation of the study

Being a cross-sectional study may not show cause-and-effect relationship. The CVS symptoms were self-reported so that symptoms that might not be recognized by users would be left unreported. The findings may be affected by recall bias.

## Availability of data and materials

All data in this study are included in the manuscript. However, the minimal data are available from the corresponding author upon reasonable request.

## AUTHOR CONTRIBUTORSHIP

The principal investigator, Solomon Belay participated in tool development, the data collection and analysis. Abiy Maru Alemayehu participated in design the study, data collection and analysis. Also Mohammed Seid Hussen contributed to acquisition of data, analysis and interpretation of data. All authors have read and approved the final manuscript.

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## REFERENCES

- American Optometric Association. The effects of computer use on eye health and vision.1997.
- Blehm C, Vishnu S, Khattak A, Mitra S, Yee RW. Computer vision syndrome: A review. *Sur Ophthalmol.*2005;50(3):253-262.
- Mani S, LijiMenon M, Harishankar S, Mathew A. The prevalence of computer vision syndrome among information technology students in a rural engineering college. *Int J Curr Res.*2016;8(12):43845-43848.
- Dessie A, Adane F, Nega A, Wami SD, Chercos DH. Computer vision syndrome and associated factors among computer users in debre tabor town, northwest Ethiopia. *J Environ Public Health.* 2018;2018.
- Assefa NL, Weldemichael DZ, Alemu HW, Anbesse DH. Prevalence and associated factors of computer vision syndrome among bank workers in Gondar City, northwest Ethiopia, 2015. *Clin Optom.*2017;9:67-76.
- Schill AL, Chosewood LC. The NIOSH Total Worker Health Program: An Overview.2013.
- Iqbal M, El-Massry A, Elagouz M, Elzembely H. Computer vision syndrome survey among the medical students in Sohag University Hospital, Egypt. *Ophthalmol Res Int J.*2018:1-8.
- Akinbinu TR, Mashalla YJ. Knowledge of computer vision syndrome among computer users in the workplace in Abuja, Nigeria.2013.
- Alemayehu M, Nega A, Tegegne E, Mule Y. Prevalence of self reported computer vision syndrome and associated factors among secretaries and data processors who are working in University of Gondar, Ethiopia. *J BiolAgri Healthcare.*2014;4(15):33-37.
- Hayes JR, Sheedy JE, Stelmack JA, Heaney CA. Computer use, symptoms, and quality of life. *Optometry and vision science.* 2007;84(8):E738-755.
- Mashalla YJ. Impact of computer technology on health: Computer Vision Syndrome (CVS). *Med Pract Rev.*2014;5(3):20-30.
- Kokab S, Khan MI. Computer Vision Syndrome: A Short Review. *J Evolution Med Dental Sci.*2012;1(6):1223-1226.
- Gowrisankaran S, Sheedy JE. Computer vision syndrome: A review. *Work.*2015;52(2):303-314.
- Mowatt L, Gordon C, Santosh AB, Jones T. Computer vision syndrome and ergonomic practices among undergraduate university students. *Int J Clin Pract.*2018;72(1):e13035.
- Semela T. Breakneck expansion and quality assurance in Ethiopian higher education: Ideological rationales and economic impediments. *High Edu Policy.*2011;24(3):399-425.
- Hazarika AK, Singh PK. Computer vision syndrome. *SMU Med J.* 2014;1(2):132-138.
- Parihar JK, Jain VK, Chaturvedi P, Kaushik J, Jain G, Parihar AK. Computer and visual display terminals (VDT) vision syndrome (CVDTS). *Med J Armed Forces Ind.*2016;72(3):270-276.
- Basnet A, Basnet P, Karki P, Shrestha S. Computer vision syndrome prevalence and associated factors among the medical student in Kist Medical College. *Nepalese Med J.*2018;1(1):29-31.
- Reddy SC, Low CK, Lim YP, Low LL, Mardina F, Nursaleha MP. Computer vision syndrome: A study of knowledge and practices in university students. *Nepalese J Ophthalmol.*2013;5(2):161-168.
- Ranasinghe P, Wathurapatha WS, Perera YS, Lamabadusuriya DA, Kulatunga S, Jayawardana N, et al. Computer vision syndrome among computer office workers in a developing country: an evaluation of prevalence and risk factors. *BMC Res Notes.* 2016;9(1):150.
- Logaraj M, Madhupriya V, Hegde SK. Computer vision syndrome and associated factors among medical and engineering students in Chennai. *Ann Med Health Sci Res.*2014;4(2):179-185.
- Chawla A, Lim TC, Shikhare SN, Munk PL, Peh WC. Computer vision syndrome: Darkness under the shadow of light. *Canadian AssocRadiol J.*2019;70(1):5-9.
- Agarwal S, Goel D, Sharma A. Evaluation of the factors which contribute to the ocular complaints in computer users. *J Clinical Diagnostic Res.*2013;7(2):331.
- Wimalasundera S. Computer vision syndrome. *Galle Med J.* 2009;11(1).
- Cole BL. Do video display units cause visual problems? A bedside story about the processes of public health decision - making. *ClinExp Optometry.*2003;86(4):205-220.
- Lee DS, Ko YH, Shen IH, Chao CY. Effect of light source, ambient illumination, character size and interline spacing on visual performance and visual fatigue with electronic paper displays. *Displays.*2011;32(1):1-7.
- Ranasinghe P, Wathurapatha WS, Perera YS, Lamabadusuriya DA, Kulatunga S, Jayawardana N, et al. Computer vision syndrome among computer office workers in a developing country: an evaluation of prevalence and risk factors. *BMC Res Notes.* 2016;9(1):150.
- Owsley C. Vision and aging.2011;51(13):1610-1622.
- Rahman ZA, Sanip S. Computer user: demographic and computer related factors that predispose user to get computer vision syndrome. *Int J Bus Humanit Technol.*2011;1(2):84-91.