

# **Computer Vision Syndrome (CVS): the assessment of prevalence and associated risk factors among the students of the American University of Armenia**

Master of Public Health Integrated Experience Project

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## Table of Contents

<b>List of Abbreviations</b> .....	3
<b>Acknowledgments</b> .....	4
<b>Abstract</b> .....	5
<b>1. Introduction</b> .....	6
<i>1.1 Background</i> .....	6
<i>1.2 Risk factors</i> .....	7
<i>1.3 Situation in Armenia</i> .....	9
<i>1.4 Study aim</i> .....	10
<i>1.5 Research questions</i> .....	10
<b>2. Methods</b> .....	11
<i>2.1 Study design and instrument</i> .....	11
<i>2.2 Study population</i> .....	12
<i>2.2.1 Inclusion criteria</i> .....	12
<i>2.2.2 Exclusion criteria</i> .....	12
<i>2.3 Sample size calculation</i> .....	12
<i>2.4 Sampling strategy</i> .....	13
<i>2.5 Study setting and data collection</i> .....	13
<i>2.6 Study Variables</i> .....	14
<i>2.7 Data Management and Analysis</i> .....	14
<i>2.7.1 Data entry</i> .....	14
<i>2.7.2 Statistical methods</i> .....	15
<i>2.8 Pilot Study</i> .....	15
<b>3. Ethical considerations</b> .....	15
<b>4. Budget and Timeline</b> .....	16
<b>5. Conclusion</b> .....	16
<b>References</b> .....	17
<i>Table 1: Results of the descriptive analysis of the data collected in the pilot study</i> .....	22
<i>Table 2: Study budget</i> .....	24
<i>Table 3: Study timeline</i> .....	25
<b>Appendices</b> .....	26
<i>Appendix 1: Questionnaire</i> .....	26
<i>Appendix 2: Journal form</i> .....	37

## **List of Abbreviations**

<b>AUA</b>	American University of Armenia
<b>CVS</b>	Computer Vision Syndrome
<b>DES</b>	Digital Eye Strain
<b>VDT</b>	Video Display Terminal
<b>CVS-Q</b>	Computer Vision Syndrome Questionnaire
<b>IRB</b>	Institutional Review Board
<b>SD</b>	Standard Deviation

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## **Abstract**

The use of Video Display Terminal (VDT) devices, such as computers, laptops, tablets, smartphones, e-readers, and other digital devices, has now become an important part of human life. The frequent usage of VDT devices has given rise to a complex of ocular and non-ocular symptoms termed Computer Vision Syndrome (CVS), which might occur in individuals with varying frequency and intensity. Prolonged duration of computer use, abnormal seating position and viewing distances, and lack of protective practice while using digital devices have been shown to be associated with CVS. Few studies have measured the prevalence and population-specific CVS-associated risk factors.

The proposed study aims to assess the prevalence of CVS and associated risk factors among undergraduate students, aged 18 and above, at the American University of Armenia (AUA). A cross-sectional survey with the self-administered questionnaire, which was developed using a validated tool such as CVS-Q and other questionnaires used locally and internationally, will be conducted among the AUA undergraduates. The dependent variable will be the presence or absence of CVS, and the independent variables will include duration of computer use, seating position, screen distance, screen glare, use of blue-light emitting devices, brightness of the surrounding environment, uncorrected refractive errors, presence of chronic systemic and eye diseases, smoking, medication use and protective practices utilized by students, such as taking breaks, blinking behavior, screen contrast adjustment, lubricant eye drops, and anti-glare filter use.

Data analysis will be done in SPSS version 23.0. A descriptive analysis will be done using means, SDs, and percentages. Simple logistic regression will be completed to assess bivariate associations between CVS and the independent variables. Multiple logistic regression will assess the association of CVS with the independent variables in the adjusted analysis.

The study obtained ethical approval from the AUA Institutional Review Board (IRB). A pilot study was conducted using to assess the feasibility and appropriateness of the proposed sampling approach and study tool. The study found a 78.6% prevalence of CVS in the pilot sample. The proposed study can help to develop a strategy to prevent ophthalmic complications due to the use of VDT devices in Armenian population.

## 1. Introduction

### 1.1 Background

The great advancements in information technology and the increasing usage of digital devices, observed globally over the past decades, have given rise to a number of symptoms termed Computer Vision Syndrome (CVS).<sup>1,2</sup> According to the American Optometric Association, CVS, also known as Digital Eye Strain (DES), is a complex of eye and vision-related symptoms experienced due to the prolonged use of computers, laptops, cell phones, tablets, e-readers, and other digital devices which are collectively called as the devices with Video Display Terminals (VDT).<sup>3</sup> Globally, the number of people affected by CVS was estimated at around 60 million among those using a computer for more than 3 hours in 2009, with about one million new cases of CVS occurring each year.<sup>4</sup>

The symptoms associated with CVS are grouped into four categories: 1) visual symptoms—such as slowness of focus change, double vision, blurred vision, 2) ocular surface-related symptoms such as irritated eyes, watery eyes, dry eyes, and issues with contact lens use, 3) asthenopic symptoms such as eye strain, tired eyes, glare sensitivity, and sore eyes, and 4) extra-ocular symptoms such as headache, neck pain, shoulder pain.<sup>5</sup> In clinical settings, CVS is diagnosed through a comprehensive eye examination. It includes *patient history*, in which the patients are asked for the presence of problems related to their general health, drug usage, and the environmental factors to confirm that the symptoms experienced are solely associated with computer use. It is then followed by a *visual acuity measurement* to assess the extent of vision impairment. *Refractive errors* such as myopia, hypermetropia, or astigmatism are checked to determine the need for correction for clear vision. Subsequently, the optometrist checks *eye focus and eye movement* and explores how both eyes work together to find the problems that might affect focusing ability. Based on the results from these tests, the optometrists rule out the eye pathologies (such as uncorrected refractive errors, convergence

insufficiency, intermittent strabismus, undetected lazy eye (amblyopia), eye tracking or eye teaming disorders, and/or other eyes/vision problems) that mimic CVS, and confirm the diagnosis of CVS.<sup>6-8</sup>

While working with VDTs, within some seconds, our eyes start focusing on the screen and the muscles of eyes contracts simultaneously for accommodation.<sup>9</sup> If the condition is prolonged, eye fatigue, irritation of eyes, eye strain, and redness with further vision disturbance may occur.<sup>9</sup> Also, continuous staring at the screen reduces the blinking rate of the eye, thereby causing dryness in the eye, which in turn leads to eye disease associated with dryness.<sup>10</sup>

### ***1.2 Risk factors***

Many risk factors might contribute to the development and worsening of the symptoms of CVS. They include poor lighting of the computer screen (such as screen brightness and contrast) and brightness in the working area, continuous glaring of a digital screen and prolonged staring at the digital screen without blinking the eyes or looking at the screen without rest, duration of the computer use, improper viewing distances of the screen, leaning forward close to the device for clear vision and focusing, poor or abnormal seating position, improper work station set-up, use of blue-light emitting devices, smoking, uncorrected refractive errors and some drugs that aggravate the symptoms of CVS(COX-2 inhibitors, anti-epileptic drugs, anti-hypertensive drugs).<sup>7,8,11-15</sup>

Loh et al. (2008) described that lighting conditions in the room and imbalance of light between the room and the screen as the most important modifiable risk factor that increases the glare discomfort and contributes to the development of CVS.<sup>16</sup> The intensity of the CVS symptoms is directly proportional to the hours spent on the computer or other video digital devices.<sup>17</sup> The studies conducted among students showed that those who continuously used

the computer for 3 hours each day, experienced the symptoms of CVS more frequently than those who used it for less than 3 hours per day.<sup>18</sup> Reddy et al. reported that working for more than 2 hours each day on the computer was significantly associated with a higher likelihood of CVS, whereas taking a break in between by looking at distant objects significantly lessened the CVS symptoms.<sup>19</sup> Dessie et al. (2016) reported that the odds of developing CVS among those computer users who took a regular break while using a computer were significantly lower compared to those who did not, (OR: 0.84, 95% CI (0.53, 0.97)) in the adjusted analysis.<sup>20</sup> Several studies reported that improper viewing distances between the eye and the computer screen (less than 50cm) and the level of the top of the computer screen at or above the eye level aggravate the symptoms of CVS.<sup>19,21,22</sup>

CVS creates ocular discomfort with a subsequent decrease in work productivity.<sup>1,20</sup> The dry eye disease, one of the CVS symptoms, has several impacts on eye depending on its severity, ranging from epithelial erosion and corneal inflammation to different severe corneal pathologies, such as corneal ulceration and corneal opacity.<sup>23</sup> The repeated and consistent eye strain under CVS can lead to reduced visual acuity and blurred distance vision even after stopping working with the screen. The situation might worsen if the condition is left untreated.<sup>24,25</sup> Poor sleep quality or insomnia are the other consequences of CVS that have been revealed in a number of studies.<sup>26,27,28</sup>

Several studies have measured the prevalence of CVS and its associated risk factors among diverse populations. The study conducted in Ethiopia stated that nearly 70% of people who used computers suffered from CVS, with the majority of cases used computers for more than 4.6 hours each day.<sup>20</sup> The study conducted among the students of several universities in Malaysia identified that 89.9% of the study population had CVS.<sup>19</sup> In a survey among computer office workers in Sri Lanka, CVS has strongly associated with pre-existing eye



diseases such as myopia, oculomotor abnormalities, cataract, glaucoma, presbyopia, and wearing contact lenses while working.<sup>29</sup> The study, which measured the effect of prolonged computer use and CVS among the undergraduates of the University of Colombo, reported that 70.5% of the participants experienced visual symptoms of CVS.<sup>30</sup>

Some steps have been recommended by the American Optometric Association to reduce the frequency of the symptoms of CVS.<sup>3</sup> Taking a break of 20-second for every 20 minutes of continuous work by seeing distant objects at 20 feet away were found to be significantly reducing the frequency of CVS symptoms.<sup>31</sup> Using VDT filters has been recommended to reduce VDT glare intensity, but their effectiveness has been shown to differ across the studies and is to be explored further.<sup>1,19,29</sup> In the meta-analysis study, using spectacles for VDT devices and blue-light blocking contact lens, which is the lens specially used for VDT devices, were shown to reduce CVS significantly.<sup>2</sup>

People who have already developed CVS symptoms such as dry eyes, irrespectively of blinking habit, should keep their eyes hydrated with the help of artificial tears (eye lubricant).<sup>32,33</sup>

### ***1.3 Situation in Armenia***

In the last few decades, there has been a significant increase in Internet use in Armenia. According to the report published by the National Statistical Service of the Republic of Armenia, as of December 2018, 72.4% of the population of Armenia has been using the Internet, a substantial increase from 0.1% recorded in 2000.<sup>24</sup> According to the recent estimates, the E-participation index of Armenia was 0.5674 in 2018, which was higher than the world average E-participation index 0.5491 in the same year; this suggests high accessibility of the Internet and digital device usage.<sup>34</sup> The high accessibility of the Internet

directly reflects the frequent use of computers and other VDT devices.<sup>24</sup> Yet, no studies have explored the effect of VDT use on eye health in the Armenian population.

#### ***1.4 Study aim***

The primary aim of the proposed study is to assess the prevalence of CVS and explore factors contributing to it among the students of the American University of Armenia (AUA). The secondary aim is to explore the awareness of CVS and recommended means of its prevention and symptom reduction in the study population.

#### ***1.5 Research questions***

The proposed study will address the following research questions:

- What is the prevalence of CVS among the undergraduate students of the AUA?
- Are socio-demographic factors (gender, age, socio-economic status) associated with CVS among the AUA undergraduate students?
- Are the seating position, screen distance, duration of device use, device-related risk factors (glaring of a digital display, poor lighting of the computer screen (brightness and contrast), prolonged staring at the digital screen without blinking, looking at the screen without rest, improper screen viewing distances, poor or abnormal seating position), associated with CVS among the AUA undergraduate students?
- What is the level of awareness and practice of the CVS preventive and symptom-reducing measures (taking breaks every 20 minutes, use of spectacles such as anti-reflection coated eyeglasses or blue light filter eyeglasses for computer, use of VDT filter, keeping the eyes hydrated by frequent blink, use of eye lubricating solution, brightness adjustment in VDT device) among AUA undergraduate students?

## 2. Methods

### 2.1 Study design and instrument

A cross-sectional survey will be conducted among the undergraduate students of the AUA using a self-administered questionnaire. The study will use the validated CVS-Q questionnaire to measure the prevalence of CVS and its symptoms, such as eye fatigue, headache, blurred vision, double vision, itching eyes, dryness, tearing, eye redness and pain, excessive blinking, feeling of a foreign body, burning or irritation, difficulty in focusing for near vision, feeling of sight worsening, and sensitivity to light.<sup>35</sup> The CVS-Q questionnaire measures the frequency of the above-mentioned symptoms with the response options of “never,” “occasionally,” and “often or always.” If the participants report having symptoms “occasionally,” or “often,” they will be asked to rate the intensity of the symptoms, choosing between the options “moderate” or “intense.” The total score will be calculated using the following formula:  $\sum_{i=1}^{16} (\text{frequency of symptom occurrence})_i * (\text{intensity of symptom})_i$ . If the total score is  $\geq 6$ , then the participant is considered to have CVS.<sup>35</sup>

The duration of computer use will be measured by the average number of hours spent on VDT daily. The level of the computer screen will be measured by asking about the placement of the screen at, above, or below the eyes. The lighting condition in the working place will be measured by asking about the brightness in the working area, such as very bright, bright, or dull. The questionnaire contains questions about the use of preventive measures such as wearing protective glasses, VDT filter use, adjusting the brightness and contrast of the computer with the surrounding light, keeping the eyes hydrated by frequent blink, and the use of eye lubricating solutions while working on the computer. Also, the questionnaire includes questions on socio-demographic characteristics.

The developed questionnaire was pre-tested among 25 undergraduate and five graduate students of the American University of Armenia.

## ***2.2 Study population***

The study population will include undergraduate students age 18 years and above enrolled in general education courses at the AUA.

### ***2.2.1 Inclusion criteria***

The respondents should be enrolled in any of the undergraduate programs at the American University of Armenia.

### ***2.2.2 Exclusion criteria***

The students below 18 years of age will be excluded from the study since consent from the parents of those students will not be feasible to obtain. To identify the ineligible participants, a screening question about age was included in the questionnaire.

## ***2.3 Sample size calculation***

The sample size for the proposed study was calculated using the simple proportion formula:<sup>36</sup>

$$\text{Sample size (n)} = [Z_{\alpha/2}^2 * p * (1-p)] / E^2$$

Where,

$$Z_{\alpha/2} = 1.96, p = 0.705^{30}, E = 8\%$$

$$n = (1.96^2 * 0.705 * 0.295) / 0.08^2 = 125$$

After adjusting for the design effect of 2, the sample size increased to 250.

#### ***2.4 Sampling strategy***

The sampling frame for the study is the list of all General Education classes in each program scheduled for the fall semester 2020, with the number of respective students expected to attend each class. The number of general education classes expected to run in the fall semester is 180 (in reference to the spring semester of 2020). The average number of students expected to attend each class is 25. The calculated sample size is then divided by the average number of students (25) to obtain the number of classes to be approached. The calculated number of classes to be approached is 10. Through a simple random sampling method, the classes will be selected using the Excel random number generator from the list of all General Education classes. If the number of participants who completed the questionnaire does not meet the pre-calculated sample size, another class from the list will be chosen randomly to meet the required sample size.

#### ***2.5 Study setting and data collection***

The students will be approached in respective classrooms at the end of each chosen General Education course session upon the prior permission from the course instructor. On the pre-selected day of data collection, before the beginning of the class session, the student investigator will invite the students who are above 18 years of age to stay in class and participate in the study. The student investigator will approach the willing participants who remain in class and instruct them about the purpose and risks of the study. The students will be instructed to go through the consent form before completing the questionnaire. The student investigator will be present in the classroom while the participants fill the questionnaire. The questionnaires will be collected from the students right after completion.

The journal form will be maintained to register the number of eligible participants and to calculate the refusal rate. The journal form will include details such as randomly selected

general education course/class number, number of people present in the classroom on the day of data collection, number of eligible people in the classroom, number of eligible people who participated, and number of those who refused to participate in the study (Appendix 2). The refusal rate for the survey will be calculated by dividing the total number of eligible participants who completed the questionnaire by the total number of eligible participants present in the classroom at the time of data collection.

## ***2.6 Study Variables***

The dependent variable of the study is the presence of CVS (dichotomous).

The independent variables will include age (continuous), gender (dichotomous), socio-economic status (ordinal), duration of computer use (categorical), frequent blinking of eyelids (dichotomous), viewing distance of the screen (dichotomous), level of top of the computer screen (ordinal), seating position (dichotomous), glare on the computer screen (dichotomous), brightness of the surroundings (categorical), CVS awareness (dichotomous), taking breaks (categorical), wearing glass (dichotomous), contact lens (dichotomous), screen brightness adjustment (dichotomous), use of VDT filter (dichotomous), use of eye lubricants (dichotomous), presence of chronic eye diseases (dichotomous), smoking (dichotomous), medication use (dichotomous), presence of other chronic diseases (dichotomous), presence of refractive errors (dichotomous).

## ***2.7 Data Management and Analysis***

### ***2.7.1 Data entry***

The student investigator will enter and analyze the collected data in the SPSS (Statistical Package for the Social Sciences- Version 23.0). Single data entry will be done. For data

verification, 10% of the collected data will be chosen randomly and compared with the database entries, and range checks will be done.

### ***2.7.2 Statistical methods***

A descriptive analysis will be done using means, SDs, and percentages. Simple logistic regression will assess bivariate associations between CVS and independent variables.

Multiple logistic regression will evaluate the association of CVS with the independent variables in the adjusted analysis.

### ***2.8 Pilot Study***

After receiving IRB approval, the student investigator conducted a pilot study to check the feasibility of the proposed sampling approach and the study questionnaire. Two General Education courses were selected using the same proposed approach, and the data were collected among the students present at the time of data collection. All approached instructors agreed to cooperate. All students who were present in the respective classrooms were found eligible to participate in the study. No refusals were recorded. The pilot study was conducted among 14 students, and the prevalence of CVS in the pilot sample was 78.6% (11 students). Table 1 demonstrates the rest of the findings of the descriptive analysis of pilot data.

## **3. Ethical considerations**

The Institutional Review Board of the American University of Armenia approved the study. The Consent form, attached to the questionnaire, will have to be read by the participants before agreeing to participate and answering the survey questions. Volunteer participation of the respondents will be assured and explained in the Consent Form. No personally identifiable information about the participants will be collected. Only the research team will have access to the collected data. Appendix 2 presents the Consent form in English.

#### **4. Budget and Timeline**

The student investigator will serve as Research Coordinator, guided by two co-researchers, the Advisors of the thesis project. The total budget of the project will sum up to 637,900AMD. Table 2 provides detailed information about the estimated budget. Based on the availability and schedule of the sampled classes, the data collection is expected to last one month. The data entry, analysis, and report writing will take approximately 1.5 months. Table 3 demonstrated the detailed timeline of survey tasks.

#### **5. Conclusion**

The aim of the proposed study is to assess the prevalence of CVS and associated risk factors among the undergraduate students of the American University of Armenia (AUA) via a cross-sectional survey with a self-administered questionnaire. The pilot study showed the feasibility and appropriateness of the proposed methodological approach. Assessing the prevalence of CVS and the factors that contribute to it among AUA undergraduates could support the development of recommendations for specific CVS prevention strategies in the student population. Also, the proposed investigation might provide evidence for larger-scales interventions to reduce the public health burden of CVS in Armenia.



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## Tables

**Table 1: Results of the descriptive analysis of the data collected in the pilot study**

	<b>Participants with CVS (n = 11)</b>	<b>Participants without CVS (n = 3)</b>	<b>Total participants (n = 14)</b>
Age, mean (SD)	19.81 (0.75)	19.83 (1.15)	19.71 (0.83)
Gender, % (n)			
<b>Male</b>	9.1 (1)	66.7 (2)	21.4 (3)
<b>Female</b>	90.9 (10)	33.3 (1)	78.6 (11)
Program, % (n)			
<b>BA Business</b>	27.3 (3)	-	21.4 (3)
<b>BA English &amp; Communications</b>	54.5 (6)	66.7 (2)	57.1 (8)
<b>BS Computer Science</b>	9.1 (1)	-	7.1 (1)
<b>BS Engineering Sciences</b>	9.1 (1)	-	7.1 (1)
<b>BS Data Science</b>	-	33.3 (1)	7.1 (1)
Year, % (n)			
<b>First</b>	9.1 (1)	33.3 (1)	14.3 (2)
<b>Second</b>	27.3 (3)	33.3 (1)	28.6 (4)
<b>Third</b>	27.3 (3)	-	21.4 (3)
<b>Fourth</b>	36.3 (4)	33.3 (1)	35.7 (5)
Family's general standards of living, % (n)			
<b>Substantially below average</b>	-	-	-
<b>Little below average</b>	18.2 (2)	100 (3)	35.7 (5)
<b>Average</b>	45.4 (5)	-	35.7 (5)
<b>Little above average</b>	18.2 (2)	-	14.3 (2)
<b>Substantially above average</b>	9.1 (1)	-	7.1 (1)
<b>Refuse to answer</b>			
Smoking status, % (n)			
<b>Yes</b>	18.2 (2)	-	14.3 (2)
<b>No</b>	81.8 (9)	100 (3)	85.7 (12)
Medication use, % (n)			
<b>Yes</b>	45.4 (5)	-	35.7 (5)
<b>No</b>	54.5 (6)	100 (3)	64.3 (9)
Presence of chronic systemic diseases, % (n)			
<b>Yes</b>	45.4 (5)	-	35.7 (5)
<b>No</b>	54.5 (6)	100 (3)	64.3 (9)
Presence of chronic ophthalmic diseases, % (n)			
<b>Yes</b>	-	-	-
<b>No</b>	100 (11)	100 (3)	100 (14)

Seating position, % (n)			
<b>Appropriate</b>	45.5 (5)	66.7 (2)	50.0 (7)
<b>Inappropriate</b>	54.5 (6)	33.3 (1)	50.0 (7)
Viewing distances, % (n)			
<b>≤ 50 cm</b>	36.4 (4)	100 (3)	50.0 (7)
<b>&gt; 50 cm</b>	63.6 (7)	-	50.0 (7)
Level of top of computer screen, % (n)			
<b>Above the eye level</b>	18.2 (2)	66.7 (2)	28.6 (4)
<b>At the eye level</b>	36.4 (4)	33.3 (1)	35.7 (5)
<b>Below the eye level</b>	45.4 (5)	-	35.7 (5)
Presence of screen glare, % (n)			
<b>Yes</b>	36.4 (4)	-	28.6 (4)
<b>No</b>	63.6 (7)	100 (3)	71.4 (10)
Duration of VDT device used in years, mean (SD)	10.2 (2.4)	9 (1.7)	9.9 (2.2)
Average hours/day spent on VDT devices, mean (SD)	8 (2.5)	4 (1)	7.1 (2.8)
Break Frequency, % (n)			
<b>Every 20 minutes of work</b>	-	66.7 (2)	14.3 (2)
<b>Every 60 minutes of work</b>	63.6 (7)	-	50.0 (7)
<b>Every 2 hours of work</b>	9.1 (1)	33.3 (1)	14.3 (2)
<b>More than every 2 hours</b>	27.3 (3)	-	21.4 (3)
Presence of voluntary blinking habits, % (n)			
<b>Yes</b>	27.3 (3)	33.3 (1)	28.6 (4)
<b>No</b>	72.7 (8)	66.7 (2)	71.4 (10)
Light condition of the working area, % (n)			
<b>Bright</b>	27.3 (3)	33.3 (1)	28.6 (4)
<b>Dull</b>	72.7 (8)	33.3 (1)	64.3 (9)
<b>Dark</b>	-	-	-
<b>Don't know</b>	-	33.3 (1)	7.1 (1)
The habit of adjusting the screen contrast with room brightness, % (n)			
<b>Yes</b>	100 (11)	66.7 (2)	92.9 (13)
<b>No</b>	-	33.3 (1)	7.1 (1)
Use of VDT filter, % (n)			
<b>Yes</b>	72.7 (8)	33.3 (1)	64.3 (9)
<b>No</b>	27.3 (3)	66.7 (2)	35.7 (5)
Use of Eye lubricant drops, % (n)			
<b>Yes</b>			
<b>No</b>	9.1 (1)	-	7.1 (1)
	90.9(10)	100 (3)	92.9 (13)
Aware of CVS, % (n)			
<b>Yes</b>	-	33.3 (1)	7.1 (1)
<b>No</b>	100 (11)	66.7 (2)	92.9 (13)

**Table 2: Study budget (in AMD, 1 USD=0.0021 AMD)**

<i>Item</i>	<i>Type of salary</i>	<i>Number of Units</i>	<i>Unit Cost in AMD</i>	<i>Total in AMD</i>
<b><i>Personnel</i></b>				
<i>Project Coordinator</i>	Fixed, monthly	2	150,000	300,000
<i>Statistician</i>	Fixed, monthly	0.5	150,000	75,000
<b><i>Administrative cost</i></b>				
<i>Office rent</i>	Monthly	2	100,000	200,000
<i>Electricity/Kw</i>	-	600	47	28,200
<i>Print</i>	-	270	110	29,700
<i>Office supplies (paper, pen, pencils)</i>	-	-	5,000	5,000
<b><i>Grand Total in AMD</i></b>				<b>637,900</b>



*Table 3: Study timeline*

Project implementation									
Months	I month		II month		III month		IV month		V month
Days	1-15	16-30	1-15	16-30	1-15	16-30	1-15	16-30	1-15
<i>Questionnaires printing preparation</i>	✓								
<i>Data collection</i>		✓	✓						
<i>Data entry &amp; Data cleaning</i>		✓	✓	✓					
<i>Data analysis</i>					✓				
<i>Report writing &amp; Documentation</i>						✓	✓		
<i>Manuscript development</i>								✓	✓

## **Appendices**

### ***Appendix 1: Questionnaire***

#### ***Screening question:***

1. Are you 18 years of age or above?

1. No (*The study includes students with the age group 18 years and above, there is no need for you to participate. Thank you for your willingness to participate*)

2. Yes (*Please proceed in filling the questionnaire*)

## ***Consent form***

### ***Computer Vision Syndrome (CVS): the assessment of prevalence and associated risk factors among the students of the American University of Armenia***

Hello, I am Rishba Getzie Peter, a second-year graduate student of the Master of Public Health program at the American University of Armenia (AUA). As part of my graduate capstone, I am conducting a study to assess the prevalence of Computer Vision Syndrome (CVS) and its associated risk factors among the AUA undergraduate students.

You are one of the 250 participants of the study because you are an undergraduate student of AUA. We will ask you to participate in this survey once, and I am not going to ask you to provide any additional information in the future. Your participation in this study is completely voluntary. Your decision to participate or refuse will have no consequences for you.

You are asked to fill a self-administered questionnaire, attached to this consent form, which contains questions on your practice while using the computer or other video display terminal devices, symptoms that you may experience while using the devices, and demographic data. You may skip any question you think is inappropriate or even stop the interview at any time.

The information you provide will pose no risks for you and will not affect your studies at the AUA in any way. Your answers are very important for the research team to assess the prevalence of CVS and provide recommendations based on the survey results. The survey is completely confidential, and any identifiable information will not be recorded on the questionnaire and will not be presented. Only the research team will have access to the collected data, and it will be used only for research purposes without revealing your identity. It will take no more than 15 minutes to complete the questionnaire. If you have any questions about this study, you can contact the Principal Investigator of the study Aida Giloyan, Turpanjian School of Public Health, AUA (+37460 612535). If you feel offended by this study or you think that you have not been treated properly, you can contact the Human Protections Administrator Varduhi Hayrumyan, AUA (email: auairb@aua.am +37460612561).

If you are willing to participate, please proceed to fill the questionnaire.

Thank you.

***Computer Vision Syndrome (CVS): the assessment of prevalence and associated risk factors among the students of the American University of Armenia***

***Self-administered survey questionnaire***

***Interview date: \_\_/\_\_/\_\_ (dd/mm/yy)***

***ID number: \_\_/\_\_\_***

***Instructions for Completing the Questionnaire***

***Please carefully read each question and the possible response options. Then choose the option that best represents your response and check (✓) the box next to the option number.***

***Some questions should be answered by words or by a number. There are blank lines next to these questions for you to write your response. Please follow the instructions in Italics. These instructions will help you to complete the questionnaire and indicate which questions to skip for your particular case.***

***Some questions may look like the same, but each one is different. Please, take time to answer each of them.***

***a) Socio-demographic information***

1. Your age at your last birthday? \_\_\_\_\_ ( in years)
2. What is your gender?
  1. Male
  2. Female
3. Which program do you study at?
  1. BA Business
  2. BA English & Communications
  3. BS Computer Science
  4. BS Engineering Sciences
  5. BS Data Science
4. Which year of the program are you in?

- 1. First
- 2. Second
- 3. Third
- 4. Fourth

5. How would you rate your family's general standard of living?

- 1. Substantially below average
- 2. Little below average
- 3. Average
- 4. Little above average
- 5. Substantially above average
- 6. I don't know
- 7. I refuse to answer

6. On average, how much money does your family spend monthly? (**Read answers**)

- 1. Less than 100 000 drams (<200 USD)
- 2. 101 000 – 200 000 drams (~201 – 400 USD)
- 3. 201 000 – 300 000 drams (~401 – 600 USD)
- 4. 301 000 – 400 000 drams (~601 – 800 USD)
- 5. More than 400 000 drams (~801 USD)
- 6. I don't know
- 7. I refuse to answer

7. Please specify the number of all people living in your family (**including adults, children below 18 years and you**)? \_\_\_\_\_

**b) Health status:**

**General health:**

8. Do you use any medication usually?

- 1. Yes (**Please specify the medication you use**)

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- 2. No (**Go to Q.10**)

9. For what condition do you use medication? \_\_\_\_\_

10. Do you have any following chronic disorders (**Check all that apply**)?

- 1. Hypertensive disease (Արյան թարձր ճնշում)
- 2. Diabetes (Շաքարային դիաբետ)
- 3. Thyroid disease (Վահանազեղծի հիվանդություն)
- 4. Epilepsy (Էպիլեպսիա)
- 5. Sjogren's syndrome (Շյոգրենի սինդրոմ)
- 6. Rheumatoid arthritis (Ռևմատոիդ արթրիտ)
- 7. Collagen vascular diseases (Անոթների կոլագենային հիվանդություններ)
- 8. Allergy (Ալերգիա) (**Please specify**)\_\_\_\_\_
- 9. Other chronic diseases (**Please specify**)\_\_\_\_\_
- 10. No chronic disorder
- 11. I don't know
- 12. I refuse to answer

11. Did you ever smoke tobacco daily?

- 1. Yes
- 2. No (**Go to Q.15**)

12. Do you currently smoke tobacco?

- 1. Daily
- 2. Less than daily (**Go to Q.15**)
- 3. Not at all (**Go to Q.15**)

13. How many cigarettes on average do you smoke per day? \_\_\_\_\_ (cigarettes)

14. Overall how many years have you smoked daily \_\_\_\_\_ (Years)

15. Is smoking allowed inside your home?

- 1. Yes
- 2. No (**Go to Q.18**)

16. Are there members of your household who smoke regularly inside your home?

- 1. Yes
- 2. No

17. How often does anyone smoke inside your home?

- 1. Daily
- 2. Weekly
- 3. Monthly
- 4. Less than monthly

***Ocular health:***

18. Do you have any chronic eye diseases? ***(Check all that apply)***

- 1. Acute conjunctivitis (Սուր կոնյուկտիվիտ)
- 2. Chronic conjunctivitis (Զրոնիկ կոնյուկտիվիտ)
- 3. Eyelid disorder (Կռպերի հիվանդություններ)
- 4. Eye tracking or eye teaming disorders (Ակնաշարժ ֆունկցիայի խանգարում)
- 5. Cataract (Կատարակտ)
- 6. Glaucoma (Գլաուկոմա)
- 7. Diabetic retinopathy (Դիաբետիկ ռետինոպաթիա)
- 8. Other chronic eye diseases ***(Please specify)*** \_\_\_\_\_
- 9. No eye disorder
- 10. I don't know
- 11. I refuse to answer

19. Do you have any refractive errors? ***(Check all that apply)***

- 1. Myopia/ near-sightedness (Կարճատեսություն)
- 2. Hypermetropia/ farsightedness (Հեռատեսություն)
- 3. Astigmatism (Աստիգմատիզմ)
- 4. No refractive errors
- 5. I don't know
- 6. I refuse to answer

*The following section will include questions about your daily practice while using Video Display Terminal devices.*

*Computers, laptops, tablet, e-reader, mobile phones are the devices collectively called Video Display Terminal (VDT) devices. In the following questions, VDT devices mean all the devices listed above. While answering the questions, consider the device which you most commonly use for all-purpose including a computer, personal laptop, e-reader tablet and provide suitable responses:*

***c) Seating position, screen distance, and device-related factors***

20. What is your seating position while you are using the VDT devices?
- 1. My face is just at the level of the computer screen / other VDT devices
  - 2. My face is **not** at the level of the computer screen / other VDT devices
21. What is the viewing distance while using the VDT devices?
- 1. Less than or equal to 50 cm ( $\sim < \frac{3}{4}$  of your arm length)
  - 2. Greater than 50 cm ( $> \frac{3}{4}$  of your arm length)
22. What is the level of the top of your computer screen/ other VDT devices?
- 1. Above the level of eyes
  - 2. At the level of eyes
  - 3. Below the level of eyes
23. Is there any **glare** (“*presence of bright light that disturbs the vision due to direct or reflected sunlight or overhead lamps*”) on the computer screen/ other VDT devices screen?
- 1. Yes
  - 2. No

***d) Duration of device use***

24. Duration of computer use/ other VDT devices (years)? \_\_\_\_\_ (years)
25. How many days per week do you use computer/ other VDT devices? (***circle one of the options***)      1   2   3   4   5   6   7



26. Approximately, how many hours per day do you work on the computer/ other VDT devices? \_\_\_\_\_(hours/day)

***e) Awareness about Computer Vision Syndrome:***

27. Are you aware of computer vision syndrome?

- 1. Yes
- 2. No (***Go to Q.29***)

28. Based on your opinion, what measures/steps could be taken to prevent CVS? (***Please list some possible means***)

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***f) Protective habits while using VDT devices***

29. How often do you take a break while using computer/other VDT devices?

- 1. Every 20 minutes of work
- 2. Every 60 minutes of work
- 3. Every 2 hours of work
- 4. More than every 2 hours

30. Do you use eyeglasses?

- 1. Yes
- 2. No (***Go to Q.33***)

31. What is the purpose of your eyeglasses?

- 1. For computer/ other VDT device use (***Go to Q.33***)
- 2. For vision
- 3. For other purpose, specify\_\_\_\_\_

32. Does your eyeglasses contain anti-reflecting and/or blue light filter coating?

- 1. Yes
- 2. No

33. Do you use contact lens?

- 1. Yes
- 2. No (***Go to Q.35***)

34. What is the purpose of your contact lens?

- 1. For computer/ other VDT device use
- 2. For vision
- 3. For other purpose, specify \_\_\_\_\_

35. Have you had eye surgery in the past?

- 1. Yes (*Please specify*) \_\_\_\_\_
- 2. No

36. Do you have a habit of frequent voluntary blinking?

- 1. Yes
- 2. No

37. What is the lighting condition of your working area?

- 1. Very bright
- 2. Bright
- 3. Medium dull
- 4. Dull
- 5. Dark
- 6. I don't know
- 7. I refuse to answer

38. Do you adjust the contrast of your computer/ other VDT devices with the surrounding brightness?

- 1. Yes
- 2. No

39. Do you use an anti-glare / VDT filter / blue light filter for your computer screen?

- 1. Yes
- 2. No

40. Do you use lubricant eye drops while working on the computer?

- 1. Yes
- 2. No (*Go to Q.42*)

41. How frequently do you use lubricant eye drops while working on the computer?

- 1. Always
- 2. Often
- 3. Sometimes
- 4. Rarely
- 5. Never

42. ***Computer Vision Syndrome***

Please indicate whether you experienced any of the following symptoms during the time you used the computer in the past 12 months.

For each symptom, check with (✓) in the box:

a. First, **the frequency**, that is, how often the symptom occurs, considering that:

**NEVER** = the symptom does not occur at all

**OCCASIONALLY** = sporadic episodes or once a week

**OFTEN OR ALWAYS** = 2 or 3 times a week or almost every day

b. Second, **the intensity** of the symptom:

Remember: if you indicated NEVER for frequency, you should not mark anything for intensity.

*In the following example, if you experience neck-pain occasionally with intense pain, it is checked in the box **occasionally** under the **frequency** section, and **intense** under the **intensity** section.*

	a. <i>Frequency</i>			b. <i>Intensity</i>	
	Never (0)	Occasionally (1)	Often/Always (2)	Moderate (1)	Intense (2)
<b><i>Neck pain</i></b>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

**Please, answer the questions starting from here:**

	a. <i>Frequency</i>			b. <i>Intensity</i>	
	Never (0)	Occasionally (1)	Often/Always (2)	Moderate (1)	Intense (2)
1. Burning eyes	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2

	<i>a. Frequency</i>			<i>b. Intensity</i>	
	Never (0)	Occasionally (1)	Often/Always (2)	Moderate (1)	Intense (2)
2. Itching eyes	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
3. Feeling of foreign body in the eyes	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
4. Tearing eyes	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
5. Excessive blinking	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
6. Eye redness	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
7. Eye Pain	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
8. Heavy eyelids	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
9. Dryness in eyes	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
10. Blurred vision	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
11. Double vision	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
12. Difficulty focusing for near vision	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
13. Increased sensitivity to light	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
14. Coloured halos around objects	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
15. Feeling that sight is worsening	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2
16. Headache	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 2

Thank you!

*Appendix 2: Journal form*

*Computer Vision Syndrome (CVS): the assessment of prevalence and associated risk factors among the students of the American University of Armenia*

<b>Selected general education course/class number</b>	<b>Number of people present in class</b>	<b>Number of eligible people in the class</b>	<b>Number of eligible people participated</b>	<b>Number of eligible people refused</b>

Total number of eligible participants approached \_\_\_\_\_

Refusal rate of the study \_\_\_\_\_