# Computer Vision Syndrome as Perceived by Undergraduate Nursing Students Versus Clinical Nursing Teachers

**Fatma A. Salem [(1)], Soheir M. Weheida[(2)] Kawther Abdel Ghafar Ali [(3)], Shahira Mohamed Metwely[(4)] Alaa Alkordy [(5)], Sharif Y. El Emam [(6)], Rowaida Niazy [(7)], Shimaa Magdi Farghaly [(8)]**

[(1)] Assistant Prof. of Medical Surgical Nursing, Faculty of Nursing, Tanta University, Egypt.

[(2)] Prof. of Medical Surgical Nursing, Faculty of Nursing, Alexandria University.

[(3)]Assistant. Prof. of Nursing Administration, College of Nursing, Misr University for Science &Technology, Egypt.

[(4)] Lecturer of Community Health Nursing, Faculty of Nursing, 6 October University, Egypt.

[(5)] Lecturer of Neuropsychiatry, Faculty of Medicine, Tanta University, Egypt.

[(6)] Assistant Prof. of Ophthalmology, Faculty of Medicine, Tanta University, Egypt.

[(7)] Lecturer of Applied Information System and Quality Management,International Technical Female College, Saudi Arabia.

[(8a)] Lecturer of Medical Surgical Nursing, Faculty of Nursing, Cairo University, Egypt.

[(8b)] Assistant Prof. of Medical Surgical Nursing, College of Nursing, Jouf University, Sakaka, Saudi Arabia.

**Corresponding Author: fatma.salim@nursing.tanta.edu.eg**

**Mobile No. 02 01067903600 ORCID No. 0009000332686369**

## Abstract:

**Background:** The globalization of technology has led to a proliferation of digital devices, encompassing a range of hardware, including computers, screens, tablets, and smartphones. These devices have become integral to modern life, enabling diverse functionalities and applications across various domains . **Aim** To assess the computer vision syndrome as perceived by the undergraduate nursing students versus clinical teachers. **Methods;Design** Cross sectional descriptive survey. **Setting** study was conducted at the Faculty of Nursing, Tanta University, Egypt. **Subjects** Two groups of subjects included undergraduate nursing students (350) and all clinical nursing teachers (135). **Tools** Tool (I): computer and digital devices questionnaire.Tool (II): Computer Vision Symptoms assessment questionnaire. Tool (III): Perception towards computer and digital device Assessment. **Results:** The current study revealed computer vision syndrome perception level (55,7%) among nursing students compared to 35.6% of the clinical teachers perception,with high statistical significance difference between the two accompanied by low awareness (28% and 29.6%)of both groups about protective measures of CVS. In despite that students spent more time in front of screens than teachers the CVS prevalence rate for students was 55.3%, compared to a higher rate for teachers, 69.75%.**Conclusion:** The study concluded that nursing students had poor perception of CVS compared to good perception of the clinical teachers.**Recommendations:** best practices in CVS interventions such as brain training therapy, program vision exercise and affordable management for treating CVS need to be developed by other researches on variety of large populations, in addition to strengthing the positive perception of CVS among nursing academic staff and students.

**Key words:** Computer Vision Syndrome, Clinical Nursing Teachers. Undergraduate Nursing Students

## Introduction:

The globalization of technology has led to a proliferation of digital devices, encompassing a range of hardware, including computers, screens, tablets, and smartphones. These devices have become integral to modern life, enabling diverse functionalities and applications across various domains **(Barar et al., 2007)**. Digital devices have witnessed varying levels of adoption across countries and age groups. In developed nations, such as the United States, Western Europe, and Japan, the penetration of digital devices is extensive, with a significant percentage of the population utilizing computers, smartphones, and tablets **(Canto-Sancho, Segui-Crespo, et al., 2023; Kaplinsky & Kraemer-Mbula, 2022)**. In these regions, the usage percentages of smartphones and computers are notably high across all age

groups, including the older demographic, owing to the pervasiveness of technology and its applications in everyday life **( Canto-Sancho et al., 2021; Derbew et al., 2021; Paul et al., 2023)**.

Emerging economies and developing countries have rapidly increased digital device adoption, particularly smartphones, due to affordability, accessibility, and improved connectivity infrastructure **(Altalhi et al., 2020; Dessie et al., 2018; Kaplinsky & Kraemer-Mbula, 2022)**. The usage percentages of smartphones and other digital devices tend to be higher among younger age groups in these regions, reflecting a digital generation more attuned to technology **(Abdelaziz & Shaheen, 2023; Horwood et al., 2021)**. However, an increasing trend of older age groups also embracing these devices, emphasizing technological globalization's widening reach and impact **(Silver et al., 2019)**.

Computer vision Syndrome (CVS) is determined by three mechanisms: the extra-ocular mechanism, due to poor posture in front of computer devices, causing musculoskeletal symptoms. The accommodative mechanism produces blurred vision, diplopia, myopia and delays in the change of focus. Finally, the ocular surface mechanism is related to corneal dryness, reduced blink rate, and increased corneal exposure caused by horizontal gaze at the screen of computing devices **(Artime-Rios et al., 2022; Coronel-Ocampos et al., 2022).**

Computer vision Syndrome include eyestrain and fatigue, which is a hallmark symptom of CVS and is characterized by discomfort or pain in the eyes. Prolonged periods of focusing on digital screens can lead to muscle fatigue, making the eyes feel tired and strained. This sensation is often accompanied by soreness or aching around the eyes **(Pavel et al., 2023)**. Extended exposure to digital screens can cause temporary refractive changes in the eyes, resulting in blurred or double vision. Individuals may struggle to maintain a clear focus, especially when transitioning between different distances or looking away from the screen **(Abuallut et al., 2022; Almousa et al., 2023; Singh et al., 2022)**. Insufficient blinking, common during prolonged screen use, can lead to dry and irritated eyes. The reduced blink rate fails to adequately spread tears across the ocular surface, causing discomfort and a gritty eye sensation **(Cantó-Sancho et al., 2023; Talens-Estarelles et al., 2023)**.

Computer vision Syndrome is frequently associated with headaches, migraines, or tension-type headaches. The strain on the eye muscles and surrounding structures can trigger headaches, often radiating from the forehead or temples **( Soonsu Shin et al., 2023)**. Frequent changes in focus between the screen and other objects or varying distances can challenge the eyes' ability to adjust and focus quickly. This difficulty in refocusing can contribute to discomfort and visual fatigue **(Alamri et al., 2022; Noreen et al., 2016; Yan et al., 2008)**. Using digital devices, poor ergonomics and viewing positions can cause musculoskeletal issues, including neck, shoulder, and back pain. Improper posture during device usage may lead to prolonged muscle strain and discomfort. Excessive exposure to bright screens may heighten light sensitivity, making viewing screens and other light sources uncomfortable **(Akiki et al., 2022; Rachman & Oktovin, 2022)**.

Effective management of CVS involves a multifaceted approach, addressing both optical and environmental factors. Optometric interventions, such as prescribing corrective lenses for near or intermediate vision, can significantly alleviate CVS symptoms **(Al Rashidi & Alhumaidan, 2017; Anbesu & Lema, 2023)**. These lenses are designed for computer use, providing optimal visual clarity and reducing strain during prolonged screen exposure. Vision therapy involves a customized program of visual exercises and activities to enhance visual skills and alleviate CVS symptoms **(Alatawi et al., 2022; Moulton et al., 2023)**. This therapy aims to improve eye coordination, focusing ability, and eye movement control, ultimately reducing eye strain and discomfort. Adjusting the workstation ergonomics is a fundamental approach to managing CVS. Optimal screen positioning, proper lighting, and ergonomic seating can reduce strain on the eyes, neck, and back **(Egharevba, 2023; Thilakarathne et al., 2017)**. Occupational therapists and ergonomics

experts are vital in educating individuals about proper workspace setups to mitigate CVS symptoms.

Implementing the 20-20-20 rule during screen use by looking at something 20 feet away for 20 seconds every 20 minutes can reduce eye strain and prevent visual fatigue. Regular breaks from screen use are crucial in allowing the eyes to relax and regain their natural focusing abilities **(Talens-Estarelles et al., 2023)**. Blue light emitted from digital screens is a significant contributor to CVS symptoms. Using blue light filters and screen protectors can help reduce exposure to harmful blue light and alleviate associated discomfort **(Moulton et al., 2023)**. Lubricating eye drops or artificial tears can alleviate dry eyes and discomfort associated with CVS **( Chawla et al., 2019).**

These solutions provide temporary relief by moisturizing the eyes and reducing irritation. Implementing conscious behavioral changes, such as reducing screen time, taking scheduled breaks, and adopting relaxation techniques, can mitigate CVS symptoms.Mindfulness exercises, yoga, and meditation may also help reduce overall stress and eye strain **(Alhasan & Aalam, 2022; Egharevba, 2023; Rodríguez et al., 2023)**.

Effective rehabilitation strategies are pivotal in managing CVS and improving individuals' visual well-being in the digital era. Vision therapy, encompassing eye exercises and activities, enhances visual skills crucial for comfortable screen usage. Additionally, designed eyeglasses with specific coatings and lenses offer a tangible solution to mitigate CVS symptoms. A combined approach utilizing vision therapy and appropriate eyeglasses can significantly contribute to reducing CVS symptoms and enhancing visual comfort during prolonged digital device use **(Adane et al., 2022; Das et al., 2022; Dostalova et al., 2021; Erdinest & Berkow, 2021; Gadain Hassan, 2023; Galindo-Romero et al., 2023; Tanamal et al., 2023)**

Computer vision Syndrome is a significant concern in the context of nurse students and clinical teachers who rely heavily on digital technology. It is imperative to enhance awareness, educate individuals about preventive measures, and emphasize the importance of optimal ergonomic practices. By adopting a proactive approach and fostering a culture of responsible digital device usage, nurse students and clinical teachers can mitigate the risk of CVS and promote long-term ocular health within the healthcare profession **(Iqbal et al., 2018; Rachman & Oktovin, 2022).**

## Significance of the Study

Several recent studies have been reported about the increased prevalence of CVS as 90% of computer users experience it **(AlDarrab et al., 2021; Lema & Anbesu, 2022; Mrayyan et al., 2023; Muma et al., 2019; Nagwa et al., 2019; Peter, 2020; Sanchez-Brau et al., 2020)**. As regrad of African people it was noticed that Alkhartom University has a very high prevalence of computer vision syndrome among medical students . The prevalence of computer vision syndrome has been found to be 94%, and 72.4% of the students reported experiencing at least three symptoms of computer vision syndrome including neck and shoulder pain, headache and others. Most students had poor awareness and bad practices regarding the safe use of electronic devices **(Hassan, 2023)**. While at Cairo University 75% of medical students in Faculty of Medicine suffered from CVS. **(Nagwa et al., 2019)**. But there were no studies done related to the prevalence of CVS among clinical teachers at Egypt.

CVS results in persistent vision-related morbidity and decreased productivity at the workplace. However, this chronic condition is underdiagnosed because it resembles other eye disorders and, moreover, has not been paid much attention by health practitioners or users of optical devices. Therefore, the present study was carried out on the undergraduates' nursing students and the clinical teachers at Tanta Faculty of Nursing to explore perception about CVS.

**Aim of the Study**

This study aims to identify computer vision syndrome as perceived by the undergraduate nursing students versus the clinical teachers at Tanta Faculty of Nursing.

**Research Questions**

1.What is the total level of students' perception of Computer vision Syndrome versus teachers' perception?

2.What is the protective measures used by undergraduate nursing students versus clinical teachers ?

3.What is the prevalence of CVS of the students compared to the teachers?

**Operational Definitions :**

- The clinical teachers: are referred to the clinical demonstrator with bachelor's degree of nursing, who may or may not underwent master's degree and the assistant lecturers with master's degree.

- Visual devices/Vedio Device Terminals (VDT): laptops, computers, smartphones, tablets, iPad.

**Subject and Methods**

**Research Design:**

A cross-sectional survey was implemented. Its' design is a type of observational study in which , the investigator measures the outcome and the exposures in the study participants at the same time. It assess the prevalence and an exposure to the baseline cohert study . **( Setia M.S.2016)**

**Setting:**

The present study was conducted at the Faculty of Nursing, Tanta University which is affiliated to Ministry of Higher Education and Scientific Research. It consists of seven scientific departments; Medical Surgical Nursing ,Pediatric Nursing ,Maternal and Neonatal Health,Critical Care and Emergency Nursing ,Nursing Administration ,Community Health, Nursing and Psychiatric and Mental Health Nursing.

**Subjects:**

The study subjects was composed of two groups.

***The first group*** was the undergraduate nursing students that were enrolled in the second semester of the academic years (2022-2023). The students name lists were obtained from the statistical records of the student's affairs office, Faculty of Nursing, Tanta University, 2023. They were selected by using proportional allocation sampling technique. Total nursing students were 3339 actual number of students and the sample size estimated 350 students represented 60 students from first academic years, 155 students from second academic year, 120 students from third academic year, and 55 students from fourth academic year. The sample size calculation was done by using equation **(Thompson, 2012)**.

$$n = \frac{N\,x\,p(1-p)}{\{[N-1\,x\,(d^2 \div z^2)] + p(1-p)\}} \qquad (1)$$

Where n: sample size, N: Population size in every grade first year 553 students, 1100 students in second year, third year were 1146 students, and fourth year grade were 540 students, whereas Z: confidence level at 95%, d: error proportion (0.05), p**:** probability (50%).

***The second group***, convenient sample consist of 135 clinical teachers (demonstrators and assistant lecturers) enrolled from the scientific departments at Faculty of Nursing were all included in the study during the period of data collection. An official record were obtained from the teaching affairs office. The researchers recruited the clinical teachers only and not all of the academic staff because clinical teachers are responsible about clinical practice of nursing students and they closer in age to the students to exclude age variations which affect on ocular health and vision.

**Exclusive criteria of the participants:**

Any participant with previuos vision correction, surgery/Lasik, chronic eye diseases, and permanent topical eye medication from both samples were excluded for the time of the study.based on their answer of questions related.

- **Tools:**

CVS Questionaire (CVS-Q): It is a long validated questionnaire developed by( **Segui,-delm.,Cabrer-Garcia,Crespo,Verdu,&Ronda,2015**).It was adapted by the reserachers, based on massive literature review (**Dessie et al. 2018, Gonzalez-Perez et al. 2018, Muma et al.2019, Nagwa et al**.,**2019, Peter, 2020, Canto-Sancho et a**l.**2021**, **Mrayyan et al., 2023**) and simplified into three tools in Arabic language that were used for data collection:

**Tool (I): Computer and Digital Devices Uses Questionnaire:** Is a self-administered questionnaire composed of two parts; **Part One** covers the demographic data for each sample group (Student Version & Teacher Version): included student & teacher code, age, gender. **Part Two**: Academic data that composed of academic placement of students in years of the faculty , and Seven Departments of the Nursing Faculty for the clinical nursing teachers placmenet recruited from Tanta University. Seating Position, viewing distances, level of top computer or screen devices and type of screen they are using are also included . **( Canto-Sancho et al., 2022; Lindo-Cano et al., 2022 , Porru, et al., 2023 , Fensie et al., 2023;)**

**Part three : Health Assessment of participants related to computer vision syndrome** . It composed of six multiple/ or yes or no questions based on recent literature review **( Nagwa et al., 2019, Peter, 2020 , Sanchez-Brau et al., 2020, AlDarrab et al., 2021; Lema & Anbesu, 2022; Mrayyan et al., 2023;) .** It describes the general health status, medications taken especially for eye, smoking, the ocular health status, the refractive errors,and the presence of glare. It has been asked about one year back for the use of computer.

**Tool (II): Computer Vision Syndrome Symptoms Assessment Questionnaire:**

It was used to identify the presence of CVS associated symptoms among participants since 12 months use of computer or screen devices . Sixteen symptoms were portrayed with responses scored on a two-point (1= yes) and (zero= no) to calculate the frequency of CVS symptoms. The CVS symptoms included eyes itching , eye redness, excessive blink, eyes tearing, burning, dryness, strain, heavy lids, feeling of a foreign body, blurred vision, diplopia, colored halloes, difficulty in focusing for near vision, feeling of sight worsening, headache and neck pain. Total score were 16 .

**Tool (III): Perception toward Computer and Digital Devices Uses Questionnaire.**

This tool was developed by the researchers based on massive literature review **( Chauhan et al., and González-Pérez et al., 2018,Muma et al., 2019, AOA, 2023)**. It was divided into two sections. **Section one**: to identify the participants groups information about the protective measures of CVS which explored five measures respectively; wearing protective glasses, filter use, adjusting computer contrast to ambient brightness, keeping the eyes hydrated by frequent blink and using of lubricating eye solutions.

**Section two**: participants behaviors and perception about CVS, which comprised of eleven questions. Information about computer vision syndrome? taking a break when dealing with computer and digital devices, uses of eye glasses, eyeglasses contain anti-reflection / or blue light filter ,contact lenses , degree of lightening, adjusting computer screen contrast with the surrounding brightness, use an anti-glare/VDT filter for computer screen , use of eye lubricant solutions while working on the computer ,and frequency of using lubricant **(Chauhan et al., 2018; Lemma et al., 2020)**.Total scoring system for perception assessment were 20. The total level of nursing

students' and clinical teachers' perception were calculated and categorized as: Good = > 70 %, Fair = 60%-70% and poor = <60 %.

**Research Methods**

An official letter explaining the study purpose to get approval from research ethical committee and was addressed to the dean of the faculty of nursing, vice dean of students' affairs and head of departments to get permission for data collection.

**Ethical considerations**:

- Ethical approval letter (Code. no. 157-12-2022) was obtained from ethical committee of Faculty of Nursing, Tanta University.
- Informed consent was obtained from the participants after explanation of the study purpose. Anonymity was assured to all students and clinical teachers.
- Respecting the clinical teachers and students' right to withdraw from the study during the data collection process.

**Validity of the tools:**

A jury composed of five experts to evaluate the content validity of each tool from the following departments Medical Surgical Nursing, nursing administration, community health nursing and Ophthalmology, Neuropsychiatry, Faculty of Medicine Tanta university ,The validity was

**Reliability of the tools:**

Using the Cronbach's alpha test, the study tools' reliability was calculated as tool (I) Nursing Students and Clinical Teachers Self-Administered Questionnaire was 0.805, tool (II) Computer Vision Syndrome Symptoms Assessment Questionnaire was 0.817 while tool (III) Perception toward Computer and Digital Devices Uses Questionnaire was 0.834.

**The pilot study:** Before embarking the actual study, a pilot was carried out on 10% of the study subjects to check the clarity and applicability of the study tools and to identify obstacles that might be faced during data collection. Those subjects were excluded from the actual study sample.

**Data collection :** The researchers collected the data for two months started from first of July till the end of August 2023. The tools of the study were created in Google form and sent to all participants (nursing students) via What's-up Application through the link below:
https://docs.google.com/forms.gle/fJCTi2g53uyxWae78link, and the clinical teachers link: https://forms.gle/Nu9qzvRcNqegZPvE8link.
Daily reminders were sent to the participants to encourage them to respond during the data collection period. The Clinical teachers and nursing students'responses were prevented from being recorded more than once.

**Statistical Analysis:**

The data collected were arranged, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 26, SPSS Inc. Chicago, IL, USA). Range, mean and standard deviation were calculated for quantitative data. For qualitative data, that described a categorical set of data by frequency, percentage or proportion of each category. Independent-samples t-test of significance was used when comparing between two means. Chi-square ($X^2$) test of significance was used in order to compare proportions between qualitative parameters. Significance was adopted at $p < 0.05$, and highly significance was adopted at $p < 0.001$ for interpretation of results of tests of significance **(White, 2019)**.

**Results:**

**Table (1)** shows that mean age and standard deviation of the students were **20.36±2.37**. where teachers mean age were 28.64±2.67. Most of participants were of female gender 69.1% and male 96.3% .

Table 2 shows Assessment of computer and digital devices uses ,The majority of the students and teachers, (89.4%), and 89.6% respectively were using smart phones while more than half of teachers (54.8%) were using laptops.There were a highly statistically significant relationship at p=0.001 between the students and teachers in using Laptop and Tablets.

As regard to the participants behavioral characteristics of seating position in front of computer devices more than one third of the

students (44%) were sitting 90-degree angle (upright) and about half of teachers'seating in semi-fowler position 49.6%. In relation to viewing distances, nearly three quarters of participants mentioned ≤ 50 cm space representing 74.3% and 76.3% respectively. Regarding the time spent on screen/day 47.1% of the students spent >6 hrs., while, more than half of the teachers spent 3-6 hrs. daily. There was a high statistical significance between both study groups regarding the average hrs. spent on screen/day.

**Figure 1** illustrates that more than two thirds of the students (34.3%) and (32.9%) were in third and second academic year respectively at the Faculty of Nursing. Where as around two thirds (58.5%) of the clinical teachers were demonstrators and 41.5% were assistant lecturers. Regarding their distribution departmentally were respectively; 23.7% Medical Surgical, 15.6% Maternity & Neonatal Health, 14.8% Community Health, 13.3% Critical Care & Emergency, 11.4% Pediatric, 10.4 % Mental Health and Psychiatric and 10.4% Nursing Administration.

**Table 3** shows that most of the students 88.9%, 84%,96.9%,85.7%,88.3% and the teachers 89.6%,92.6%., 92.6%,100%,93.3%,8 7.4% respectively were free of chronic disorders, medications use , smoking or tobacco use , eye disorders, and refractive errors. As well , there were no glare for 68.9 %of students and 85.2% of teachers. Meanwhile, there were high statistically significant differences between both study groups in assessment of chronic disorders and presence of glare .

**Table 4** describes the frequencies of the CVS symptoms among the two study groups. The most common shared symptoms were headache, burning eyes, and eye strains. Meanwhile, the students further complained of neck pain 64%, itching eyes 62%, difficult focusing 61.1%, feeling of foreign body in the eyes 58%, tearing eyes 56.6%, eye redness 54.6%, and blurred vision 52.3%,while the other side, teachers complained the same symptoms in higher percentages; neck pain 84.4%, eye redness 77%, difficult focusing 74.1%, and blurred vision 70.4%.

Furthermore more than half of the teachers' symptoms, were dryness 74.1%, itching eyes 68.9%, excessive blink and tearing eyes 65.9%, feeling of foreign body in the eyes 63%, feeling that sight is worsening and heavy eyelids 56.3%, colored halos around objects 53.3%, and double vision 51.1%. The total prevalence rate of the students was 55.3% compared to 69.7% for the teachers.Finally, it was noticed that there were statistical significance differences between the study groups for most of CVS symptoms.

**Figure 2** illustrates the Perception level of students versus teachers toward CVS protective measures . More than one third of the students to nearly half of the teachers were aware of wearing the protective glasses. One quarter of students to 40% of teachers were aware of using the lubricating eye solutions by users. Where, more than one third of students to less than a quarter of teachers were aware of adjusting the contrast of computer to surrounding brightness. On contrast, minority of nursing students were aware of using filter and keeping the eyes hydrated by frequent blinking. While, the teachers weren't aware of this procedure as one of the protective measures.

**Table 5*:*** shows less than half of the students 45.1% versus to 56.3% of teachers were aware of computer vision syndrome. Regarding the perception, most of the students 90%, 88%, 84% and 80% were not using lubricant eye drops, antiglare filter for computer screen and never use lubricant eye drops while working on the computer respectively.

Most of the teachers 92.6%, 91.9%, 87.4%, 85.2% were not using antiglare or filter for viewing digital devices and computer screen, as well as anti-reflection eyeglasses, and lubricant eye drops. Whereas there were majority of both study groups use bright lighting condition around working area while adjusting the contrast of computer/other devices with the surrounding brightness. Regarding taking break while using computer/other digital devices, there were 33.1% of students and 23% of teachers not taking a break at all, on contrary, 48.9% 71.9% respectively were taking a break every hour of work.

It was obvious that there was highly statistical significance difference between students and teachers regarding perception of wearing anti-reflecting eyeglasses and frequently use of lubricant eye drops while working on the computer.

The table also , revealed poor perception for more than half of the undergraduate nursing students compared to more than one third of the clinical teacher. In the positive direction of perception , 33.4% of students revealed good perception compared to higher percentage of the clinical teachers 49.6% with high statistical significanc difference of chi square test . Also the mean score of CVS perception was 9.40±5.32 for nursing students compared to higher perception for clinical teachers 11.59±4.87 with paired sample test (T=4.167) that proved high statistical significance difference between the responses of the two groups.

**Table1: Demographic data of nursing students and clinical nursing teachers ( no=485)**

| | | Nursing Student (n=350) | | Teachers (n=135) | | Test | p-value |
|---|---|---|---|---|---|---|---|
| **Age** | **Range** | 18 – 35 | | 24 – 35 | | T: 30.438 | 0.001** |
| | **Mean ± SD** | 20.36±2.37 | | 28.64±2.67 | | | |
| | | N | % | N | % | | |
| **Gender** | Male | 108 | 30.9% | 5 | 3.7% | 40.195 | 0.001** |
| | Female | 242 | 69.1% | 130 | 96.3% | | |

**Table (2) Assessment of computer and digital devices uses (n=485 )**

| Item | Uses | Nursing students | | Clinical teachers | | $X^2$ | P Value |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | | |
| **Types of used screens** | Smart phones | 313 | 89.4% | 121 | 89.6% | 0.004 | 0.948 |
| | Laptop | 43 | 12.3% | 74 | 54.8% | 96.268 | 0.001** |
| | IPad | 5 | 1.4% | 4 | 3.0% | 1.259 | 0.262 |
| | Computer desk | 25 | 7.1% | 11 | 8.1% | 0.143 | 0.705 |
| | Tablets | 48 | 13.7% | 4 | 3.0% | 11.765 | 0.001** |
| **Seating position in front of visual devices?** | Sitting at 90 °angle | 154 | 44.0% | 59 | 43.7% | 14.128 | 0.001** |
| | Semi fowler | 128 | 36.6% | 67 | 49.6% | | |
| | Supine | 68 | 19.4% | 9 | 6.7% | | |
| **Viewing Distances** | ≤ 50 cm | 260 | 74.3% | 103 | 76.3% | 0.209 | 0.647 |
| | > 50 cm | 90 | 25.7% | 32 | 23.7% | | |
| **Level of top of computer screen** | Above the eye level | 30 | 8.6% | 3 | 2.2% | 5.601 | 0.087 |
| | At the eye level | 204 | 58.3% | 80 | 59.3% | | |
| | Below the eye level | 116 | 33.1% | 52 | 38.5% | | |
| **Average hours spent on screen/day** | ≤ 3 hours/ day | 53 | 15.1% | 27 | 20.0% | 14.466 | 0.001** |
| | 3-6 hours/ day | 132 | 37.7% | 70 | 51.9% | | |
| | > 6 hours / day | 165 | 47.1% | 38 | 28.1% | | |

**Figure 1: Academic Placement of Undergraduate Nursing Students and clinical teachers on second semester 2023 ( no=485).**

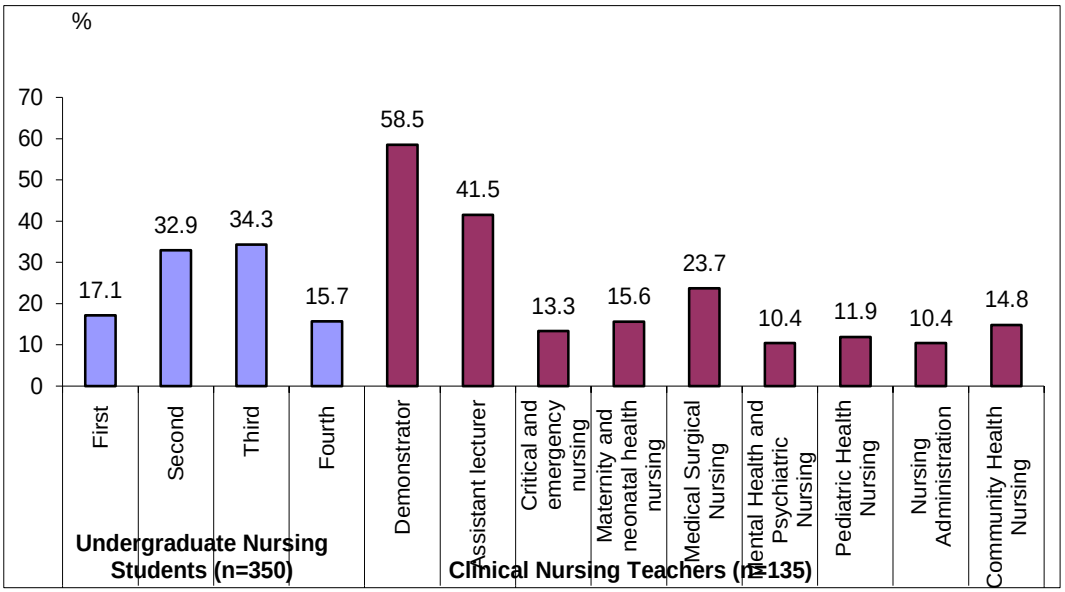


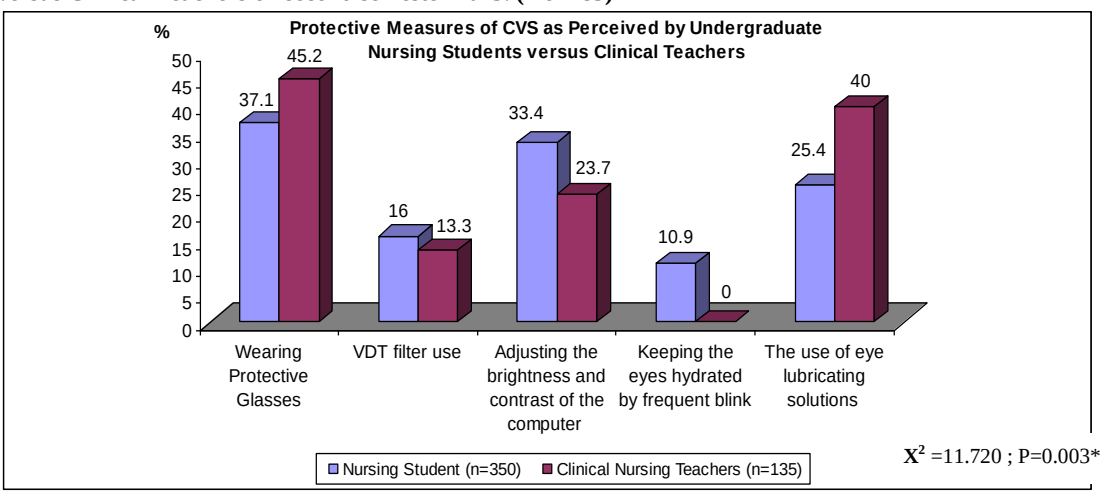

**Table 3: Health Assessment of Students Versus Teachers toward Computer Vision Syndrome on second semester 2023 ( no=485).**

| Medical Data | | Nursing Student (n=350) | | Clinical Teachers (n=135) | | $X^2$ | P-value |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | | |
| **General health status** | No chronic disorders | 311 | 88.9% | 121 | 89.6% | | |
| | Diabetes | 12 | 3.4% | 3 | 2.2% | | |
| | Hypertensive disease | 21 | 6.0% | 0 | 0.0% | | |
| **Having any chronic disorders?** | Epilepsy | 4 | 1.1% | 0 | 0.0% | 39.398 | 0.001** |
| | Thyroid disease | 0 | 0.0% | 4 | 3.0% | | |
| | Rheumatoid arthritis | 2 | 0.6% | 0 | 0.0% | | |
| | Other chronic diseases | 0 | 0.0% | 7 | 5.2% | | |
| **Using Medication for Treatment?** | No | 294 | 84.0% | 125 | 92.6% | 6.118 | 0.013* |
| | Yes | 56 | 16.0% | 10 | 7.4% | | |
| **Smoking or tobacco use?** | Not at all | 339 | 96.9% | 135 | 100.0% | | |
| | Less than daily | 4 | 1.1% | 0 | 0.0% | 4.341 | 0.114 |
| | Daily | 7 | 2.0% | 0 | 0.0% | | |
| **Ocular health status?** | No eye disorders | 300 | 85.7% | 126 | 93.3% | | |
| | Acute conjunctivitis | 13 | 3.7% | 9 | 6.7% | | |
| | Cataract | 9 | 2.6% | 0 | 0.0% | | |
| | Chronic conjunctivitis | 4 | 1.1% | 0 | 0.0% | 16.787 | 0.010* |
| | Eye tracking | 2 | 0.6% | 0 | 0.0% | | |
| | Eyelid disorder | 6 | 1.7% | 0 | 0.0% | | |
| | Chronic eye diseases | 16 | 4.6% | 0 | 0.0% | | |
| **Refractive errors?** | No refractive errors | 309 | 88.3% | 118 | 87.4% | | |
| | Astigmatism | 10 | 2.9% | 5 | 3.7% | 4.045 | 0.257 |
| | Farsightedness | 8 | 2.3% | 0 | 0.0% | | |
| | Near-sightedness | 23 | 6.6% | 12 | 8.9% | | |
| **Presence of glare?** | No | 241 | 68.9% | 115 | 85.2% | 13.304 | 0.001** |
| | Yes | 109 | 31.1% | 20 | 14.8% | | |

**Table 4: Frequencies distributions of CVS associated symptoms among undergraduate nursing students and clinical teachers on second semester 2023 ( no=485).**

| CVS Symptoms | | Nursing Student (n=350) | | Clinical Teachers (n=135) | | $X^2$ | p-value |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | | |
| Eyes Itching | No | 133 | 38.0% | 42 | 31.1% | 2.005 | 0.157 |
| | Yes | 217 | 62.0% | 93 | 68.9% | | |
| Eyes Tear | No | 152 | 43.4% | 46 | 34.1% | 3.529 | 0.060 |
| | Yes | 198 | 56.6% | 89 | 65.9% | | |
| Excessive blink | No | 190 | 54.3% | 46 | 34.1% | 15.931 | 0.001* |
| | Yes | 160 | 45.7% | 89 | 65.9% | | |
| Eye redness | No | 159 | 45.4% | 31 | 23.0% | 20.635 | 0.001* |
| | Yes | 191 | 54.6% | 104 | 77.0% | | |
| Burning eye | No | 93 | 26.6% | 17 | 12.6% | 10.856 | 0.001* |
| | Yes | 257 | 73.4% | 118 | 87.4% | | |
| Feeling of foreign body in the eyes | No | 147 | 42.0% | 50 | 37.0% | 0.995 | 0.319 |
| | Yes | 203 | 58.0% | 85 | 63.0% | | |
| Eye strain | No | 118 | 33.7% | 20 | 14.8% | 17.094 | 0.001* |
| | Yes | 232 | 66.3% | 115 | 85.2% | | |
| Heavy eyelids | No | 194 | 55.4% | 59 | 43.7% | 5.367 | 0.021* |
| | Yes | 156 | 44.6% | 76 | 56.3% | | |
| Dryness in eyes | No | 196 | 56.0% | 35 | 25.9% | 35.325 | 0.001* |
| | Yes | 154 | 44.0% | 100 | 74.1% | | |
| Blurred vision | No | 167 | 47.7% | 40 | 29.6% | 13.024 | 0.001* |
| | Yes | 183 | 52.3% | 95 | 70.4% | | |
| Double Vision | No | 236 | 67.4% | 66 | 48.9% | 14.252 | 0.001* |
| | Yes | 114 | 32.6% | 69 | 51.1% | | |
| Difficulty Focusing | No | 136 | 38.9% | 35 | 25.9% | 7.137 | 0.008* |
| | Yes | 214 | 61.1% | 100 | 74.1% | | |
| Colored Halos around Objects | No | 197 | 56.3% | 63 | 46.7% | 3.652 | 0.057 |
| | Yes | 153 | 43.7% | 72 | 53.3% | | |
| Feeling that sight is worsening | No | 188 | 53.7% | 59 | 43.7% | 3.907 | 0.048* |
| | Yes | 162 | 46.3% | 76 | 56.3% | | |
| Headache | No | 71 | 20.3% | 24 | 17.8% | 0.389 | 0.533 |
| | Yes | 279 | 79.7% | 111 | 82.2% | | |
| Neck pain | No | 126 | 36.0% | 21 | 15.6% | 19.278 | 0.001* |
| | Yes | 224 | 64.0% | 114 | 84.4% | | |
| **CVS Prevalence rate** | | **194** | **55.4%** | **94** | **69.6%** | **8.146** | **0.004*** |

**Figure 2: Protective Measures about CVS as perceived by Undergraduate Nursing Students versus Clinical Teachers on second semester 2023. ( no=485)**




$X^2$ =11.720 ; P=0.003*

**Table 5 : Undergraduate nursing students' versus clinical teachers'Perception toward CVS ( no =485).**

| | | Nursing Students (n=350) | | Clinical Teachers (n=135) | | $X^2$ | p-value |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | | |
| **Are you aware of computer vision syndrome?** | Yes | 158 | 45.1% | 76 | 56.3% | 4.854 | 0.028* |
| | No | 192 | 54.9% | 59 | 43.7% | | |
| How often do you take a break while using computer/other digital devices? | Take a break/hour | 171 | 48.9% | 97 | 71.9% | 23.738 | 0.001* |
| | At times (≥2 hours) | 63 | 18% | 7 | 5.2% | | |
| | Don't take a break | 116 | 33.1% | 31 | 23% | | |
| Do you use eyeglasses? | Yes | 108 | 30.9% | 30 | 22.2% | 3.568 | 0.059 |
| | No | 242 | 69.1% | 105 | 77.8% | | |
| Does your eyeglasses contain anti-reflection / or blue light filter coating? | Yes | 92 | 26.3% | 17 | 12.6% | 10.484 | 0.001** |
| | No | 258 | 73.7% | 118 | 87.4% | | |
| Do you use contact lens? | Yes | 17 | 4.9% | 4 | 3.0% | 0.844 | 0.358 |
| | No | 333 | 95.1% | 131 | 97.0% | | |
| What is the degree of lighting condition around working area? | Bright (high) | 208 | 59.4% | 85 | 63% | 8.674 | 0.013* |
| | Dull (medium) | 102 | 29.1%% | 46 | 34.1% | | |
| | Dark (low) | 40 | 11.4% | 4 | 3% | | |
| Do you adjust the contrast of computer/other devices with the surrounding brightness? | Yes | 198 | 56.6% | 88 | 65.2% | 2.988 | 0.084 |
| | No | 152 | 43.4% | 47 | 34.8% | | |
| Do you use an anti-glare/VDT filter for your computer screen? | Yes | 56 | 16.0% | 11 | 8.1% | 5.045 | 0.025* |
| | No | 294 | 84.0% | 124 | 91.9% | | |
| Generally, do you use lubricant eye drops? | Yes | 67 | 19.1% | 20 | 14.8% | 2.246 | 0.134 |
| | No | 283 | 80.9% | 115 | 85.2% | | |
| How frequently do you use lubricant eye drops while working on the computer? | Frequently | 27 | 7.7% | 8 | 5.9% | 26.866 | 0.001* |
| | Unfrequently | 40 | 11.4% | 42 | 31.1% | | |
| | Never | 283 | 80.9% | 85 | 63% | | |
| What is the purpose of your contact lens? | For computer/other VDT device use | 51 | 14.6% | 14 | 10.4% | 1.520 | 0.468 |
| | For vision | 91 | 26.0% | 38 | 28.1% | | |
| | For other purposes | 208 | 59.4% | 83 | 61.5% | | |
| **Perception Level** | **Poor** | 195 | 55.7% | 48 | 35.6% | 15.918 | 0.001** |
| | **Fair** | 38 | 10.9% | 20 | 14.8% | | |
| | **Good** | 117 | 33.4% | 67 | 49.6% | | |
| **Mean score** | **Range** | 0 – 17 | | 0 – 17 | | T: 4.167 | 0.001** |
| | **Mean ± SD** | 9.40±5.32 | | 11.59±4.87 | | | |

## Discussion

The present study aimed to explore the computer vision syndrome as perceived by the undergraduate nursing students versus clinical nursing teachers of the Faculty of Nursing at Tanta University.

The mean age of the undergraduate nursing students was 20±2.37 compared to the clinical nursing teachers' mean age of 28.64±2.67, which match with the same mean score and standard deviation (20.82±1.83 years) of another two Egyptian studies conducted on nursing at kaferelsheikh University **Ghazy et al., 2023)** mean age 20.2 ±1.2 and medical students at Cairo university **(Nagwa et al., 2019)**. According to **Akkaya et al. (2018)** study finding , age and gender differences between the groups were insignificant **(Akkaya et al., 2018; Ghazy et al., 2023)** . As for the use of smartphones, it has been proven that there were a similar high percentage for both groups , in addition to over fifty percent of laptop usage by the clinical teachers compared to one-seventh of students using Tablets devices with highly statistical significance difference between both study groups at (p=0.001) **(Zalat et al., 2022)**.

The participants behavioral characteristics preferred seating position in front of computers desk, smart phones, laptop, iPad, and Tablets devices were in approximated percentages nearby half among the students (44%) seat in 90-degree angle and semi-fowler position for clinical teachers. In relation to the behavior of viewing distances, around three quarters 74.3% and 76.3% of both studied groups responses were spaced $\leq$ 50 cm, which was consistent with **Kumar (2020)** study on the Indian medical students were used less than 50 cm of viewing distances.

Regarding placing the devices at eye level, nearly two-thirds of the two study groups preferred to place the screen at eye level, while more than a third preferred to place the screen below eye level. This finding likewise the study conducted by **Nagwa et al. (2019)** reported medical students as nearly the two-thirds used screens at the eye level and more than a third used screens below the eye level of nursing students **(Nagwa et al., 2019)**.

The average hours of screen time/day were more than 6 hours for less than half of the nursing students, versus more than half of the clinical teachers spent between 3-6 hours **(Alsaigh et al., 2022)**. This shorter screen time that teachers use reflects their balance between their job commitments and other life activities. This result was also, consistent with the findings of **Nagwa, Marwa** who reported that, the medical students used a computer or laptop for more than 3 hours per day and other optical devices for an average of 5 hours **(Nagwa et al., 2019)**. Another identical survey was conducted on a larger number at a university in central Saudi Arabia and was documented that students spent more than 6 hours working constantly with a device **(AlDarrab et al., 2021)**. Meanwhile, in India, **Kumar (2020)** found the female medical students spent less than 3 hours/day while the males spent from 3-6 hours most often during night time. **Al Tawil et al. (2020)** confirmed that CVS symptoms were associated with prolonged time spent on computers which showed a higher prevalence among business students compared to medical students.

The health assessment of CVS is classified into four domains : visual, ocular, asthenopia, and extra-ocular symptoms **(Dhar-Munshi et al., 2019)**. Regarding the **visual symptoms**, the present study findings revealed that, more than half of the students complained of blurred vision, one third complained of double vision and two thirds complained difficulty focus **(Galindo-Romero et al., 2023)**. The proportions of teachers were higher, as three quarters complained of blurred vision and difficulty focus, while half of them complained of double vision. Blurred vision symptoms seem to be the most common visual symptoms between students and teachers,which was confirmed by Munshi, 2017 that blurred vision is one of the most frequenet symptoms. According to **Kumar (2020)** study, the visual symptoms of CVS was reported by the majority of the Indian medical students.

**For ocular symptoms,** proportions from half to two thirds of the nursing students

reported eye redness, watery, and itching eyes. While one third of them complained from eye dryness **(Moisanen, 2023).** In the other side of the studied participants , around three quarters of the teachers complained of all others ocular symptoms. Regarding **asthenopia symptoms**, two-thirds to three-quarters of the students complained of eye strain and burning eyes, respectively **(Muhid & Khan, 2022)**. While more than one third of them complained of halos around object and feeling that the sight is worsening. In this group of symptoms, many teachers complained from both eye strain and burning eyes, additionally to more than half of them complained of halos around object and feeling that the sight is worsening **(Cantó-Sancho et al., 2022; Li et al., 2022)**.

A similar Egyptian research conducted by **Iqbal et al. (2018)** confirmed that 26% of medical students complained of headache. According to **Shahid et al. (2017)** patients with CVS were frequently see ophthalmologists and optometrists for eye strain, watery eyes, headache, irritation of the eyes, dry eyes, blurred vision, slowness of focus change, and double vision while using computers. In the same line with a meta-analysis study by **Singh et al. (2023)** stated that computer use is widespread and consistently associated with eye strain, the researchers also asserted that there was no evidence-based clinical pathway, guide professionals to best practices in CVS interventions up to the time of the study. These symptoms are common among professionals, university academic staff and bankers, all had a prevalence of computer vision syndrome of 83.5%, 75%, and 73%, respectively **(Singh et al., 2023)**.

Regarding the fourth group of extra-ocular symptoms, the most common shared symptoms by the majorities of both studied groups in proportions from two thirds to three quarters complained of neck pain and headache, followed by eye strains. Meanwhile most of the teachers complain of all the extra-ocular symptoms. Similar studies were done on undergraduate nursing students in Jordan **(Mrayyan et al., 2023)** and university students in Saudi Arbia, **Al Tawil et al. (2020)** had reported that back, neck or shoulder pain and headaches were the typical and most common symptoms of CVS among 82.2% of students.

Previously in Malaysia, where 89.9% of university students between the ages of 18 and 25 years, suffered from headaches along with eye strain **(Thampi et al., 2020).** As well, **Thampi et al. (2020)** stated that 79% of computer users experience at least one symptom, with headaches being the most common complaint even though the screen is placed in the correct position at eye level. The researchers also asserted that CVS represents a serious occupational risk for those who use VDT for an extended period. **Lema and Anbesu (2022)** added that prolonged use of computers and other visual devices is often associated with CVS symptoms.

Regarding the information of undergraduate nursing students and clinical teachers about the use of protective measures for CVS, more than one third of students and near to half of were aware of wearing eyeglasses as a protective measure in reducing the CVS hazards **( Li et al., 2022, Almalki et al., 2023; Ghazy et al., 2023)**. Also, more than one third of students and near to quarter of the teachers were aware of adjusting computer contrast with the brightness of surrounded environment. Minority of the students were aware of frequent eye-blinking compared to no awareness among the teachers. It was clear from this finding that there was a complete lack of awareness on the benefits of this practice in reducing eye strain. In context with **Al Tawil et al. (2020)** medical and business students in Saudi Arbia demonstrated low awareness of protective measures for CVS. It was proven that anyone blinks slightly when using a computer causes dry eyes and blurred vision while working on computers **(Watson, 2021)**. This finding suggests the enhancing of necessary knowledge by linking students' studies to ophthalmology, especially related to the use of optical devices, health education, and correct practices whose efficacy is supported by scientific evidence, as they must be added to educational content or university training.

The same sequence, a small percentage of both groups reported, based on their background, less use of visual aids as a blue light filter, which may indicate the unavailability or lack of popularity of these accessories in the Egyptian computer/smartphone markets. On the contrary, most students in Jordan used protective tools on their digital devices, such as protective films and phone screens, to prevent or accommodate CVS **(Mrayyan et al., 2023)**. However, a systematic review and meta-analysis concluded that there is insufficient evidence to conclusively prove the effectiveness of blue light-blocking lenses in alleviating symptoms of visual fatigue **(Singh et al., 2023)**.

The use of lubricants for eye protection was agreed by only a quarter of the students and a better percentage of less than half of the teachers **( Ranasinghe et al., 2016,Lemma et al., 2020)**. This is what led to provide more than one explanation. The first is the complete understanding among nursing professionals not to use medications without a doctor's prescription, especially in treating the eye, and the second is the lack of knowledge of many about eye drops, their types, their safe or effective use, and the medical conditions in which their use is permitted or prohibited, as everyone is afraid of causing accidental vision damage or blindness **(Lovell-Patel et al., 2023)**. Therefore ,it is important that ophthalmologists to prescribe safe types of eyedrops that can treat simple symptoms to allow for soothing eyes and removing redness, without making frequent visit to ophthalmology clinic for those who suffers the symptoms of extended computers and visual devices uses, as in the case of treating headaches or a slight increase in body temperature **( Nikiforova et al., 2020, Hwang et al., 2021;; Zenbaba et al., 2021)**.

According to the awareness of CVS, more than half of the undergraduate students were aware of CVS, which was in context with **Al Tawil et al. (2020)** who documented that the majority of medical students were aware of CVS. In the same side, **Thampi et al. (2020)** claimed that only one quarter of the computer users were aware of CVS. Oppositely, with a similar study in Kenya, **Muma et al. (2019)** investigated the same variable and had reported that less than half of the university students were aware of CVS. These results call for the need to improve information about this silent syndrome, which is linked to the use of computers and visual devices that coincide with the language of the era and the spread of information technology, whether for general users or healthcare professionals.

Regarding the teachers' information , around more than half were unaware of CVS, which reflect information and knowledge insufficiency. In addition to unavailability of exploratory researches handled the occurrence of this syndrome among the university teachers' or educators.

Regarding the perception of the Nursing faculty at Tanta University, the current findings proven that near half of the students take a break every hour when using the PC and the visual devices, and three quarters of the teachers behaved similarly. This healthy behavior on the part of students and teachers congruent with [abudawood 2020] as claimed that 90.8% of students reported taking breaks frequentlty typically occurring every 30 to 60 minutes . Conversely this finding contradict the meta-analysis study by **Lema and Anbesu (2022)**, who claimed that taking breaks was not a habitual activity. While, lesser extent percentages from both samples take a break every 2 hours or more. From other side, the unhealthy habit of not taking a break at all when using computers and digital devices appeared by more than one third of the students and around one quarter of teachers had followed the same behavior **(Mowatt et al., 2018; Segui-Crespo et al., 2022; Seresirikachorn et al., 2022; Wadhwani et al., 2022)**. Also, almost two thirds of the students and teachers used a bright lighting condition around the work area, adjusting the contrast of the computer/other devices to the ambient brightness. In partial contrast with **Kumar (2020)** the medical students were sometimes take a break and reduce the brightness of the screen while well illuminating the surrounding environment.

As regard to wearing eyeglasses, the majority of both groups didn't wear either eyeglasses or contact lens for protecting their eyes. Most of students and teachers didn't use

antiglare or filter as well as lubricating their eyes with eye drops **(Sanchez-Brau et al., 2020; Sanchez-Brau et al., 2021; Singh et al., 2023)**. Congruent with this finding is **Nagwa et al. (2019)** as reported about fifty percent of the medical students didn't wear neither eyeglasses or contact lenses. But the majority of the present participants who were wearing eyeglasses, their screen had antireflection/blue light filter coating.

In general, majority of the students and teachers didn't use lubricating eye drops. While this lower percentage used the eye drops unfrequently when working on computer. Majority of the students and teachers reported that they wear either eyeglasses or contact lens for reading purposes **(Bogdanici et al., 2017; Tesfaye et al., 2022; Zalat et al., 2022)**. Hence, there is a necessity for behavioral interventions to assist computer users in addressing this pandemic of visual impairment given that computer vision syndrome is linked to a significant health burden with consequent detrimental effects on work **(Ranasinghe et al., 2016)**.

The sustainability of visual comfort is an imperative health need for the users of computers and other visual devices especially with the increased visual displays of advanced visuals technologies and increased demand of universities to accustom the students with the education platforms and learning discovery through the internet/ intranet webs, in the meantime interacting with the teachers on sending and receiving text messages on cell phones and the teaching work on the platforms **( Motchan, and Randolph, 2017, Artime Rios et al., 2019; Galindo-Romero et al., 2021;; S. Shin et al., 2023)**.

The overall perception of more than half of the undergraduate nursing students at the faculty of nursing was poor as induced from the results, which was consistent with another identical researches **Kumar (2020)**, the researchers respectively found that the university students in Kenya and the medical students in India had low perception of CVS. Meanwhile, the good perception was revealed with approximately half of current clinical teachers, with a significant statistical difference compared to the students' responses. Despite that, the more over than one third of the teachers were having poor perception of CVS. This discrepancy in the perception between the students and the teachers was indicative to low knowledge level of computer vision syndrome.

The teachers' and students'respective mean scores point out a significant statistical difference between the two groups replies (T = 4.170). These findings of the present study require many interactive programs to improve the contacts that reduce eye strain and other symptoms resulting from the use of computers and other visual devices. Therefore, researchers turned to creating a readable and illustrated awareness leaflet that explains and displays corrective healthy behaviors during using the computer and visual devices, such as placing the computer at a distance greater than half a meter and at eye level with applying eye drops to soothe the eyes, especially if the users spent extended timing in front of the screens. As well as taking frequent breaks at least every hour to reduce the users' discomfort and improve body posture, and ergonomics especially with long-term use of computers and visual devices. In the same line, An Egyptian study **El Swerky et al. (2022)**intervened a program to improve occupational overuse, that had suggested adjustment of workstation and environmental setting to reduce the computer risks.

## Conclusion:

The current study findings drawn poor perception about CVS for more than half of the nursing students, compared to more than one third of the clinical teachers. In spite that there was good perception for more than one third of students with mean score of 9.40±5.32 compared to nearly half of the clinical teachers with mean score of 11.59±4.87, paired test was T=4.167 with high statistical significance difference between both study groups .

## Recommendations

Since computer vision syndrome has become problem among computers other visual display devices and users, the following actions are recommended:

- Develop evidence-based pathway to guide professionals to best practices of CVS interventions.
- Support occupational safety among users at the workplace for sustainable visual health.
- Increase awareness of students and teachers to overcome the negative effects of computers and DVTs devices.
- Replication of the study on large probability sampling are needed .

**Acknowledgement:**

The researchers appreciate all the teachers and students for seriously participating and providing personal data that helped achieve the purpose of the study.

**Conflict of interest**: no declared conflicts of interest exist.

**References**

**Abdelaziz, K., & Shaheen, M. (2023).** Analysis of the Outcomes of the Screen-Time Reduction in Computer Vision Syndrome: A Cohort Comparative Study [Letter]. *Clin Ophthalmol*, *17*, 329-330. https://doi.org/10.2147/OPTH.S405004

**Abuallut, I., Ajeebi, R. E., Bahari, A. Y., Abudeyah, M. A., Alyamani, A. A., Zurayyir, A. J., Alharbi, A. H., Al Faqih, A. A., Suwaydi, A. Z., Alqasemi, M. I., Alnami, B. A., & Al Zahrani, K. J. (2022).** Prevalence of Computer Vision Syndrome among School-Age Children during the COVID-19 Pandemic, Saudi Arabia: A Cross-Sectional Survey. *Children (Basel)*, *9*(11). https://doi.org/10.3390/children9111718

**Adane, F., Alamneh, Y. M., & Desta, M. (2022).** Computer vision syndrome and predictors among computer users in Ethiopia: a systematic review and meta-analysis. *Trop Med Health*, *50*(1), 26. https://doi.org/10.1186/s41182-022-00418-3

**Akiki, M., Obeid, S., Salameh, P., Malaeb, D., Akel, M., Hallit, R., & Hallit, S. (2022).** Association Between Computer Vision Syndrome, Insomnia, and Migraine Among Lebanese Adults: The Mediating Effect of Stress. *Prim Care Companion CNS Disord*, *24*(4). https://doi.org/10.4088/PCC.21m03083

**Akkaya, S., Atakan, T., Acikalin, B., Aksoy, S., & Ozkurt, Y. (2018)**. Effects of long-term computer use on eye dryness. *Northern clinics of Istanbul*, *5*(4), 319.

**Al Rashidi, S. H., & Alhumaidan, H. (2017).** Computer vision syndrome prevalence, knowledge and associated factors among Saudi Arabia University Students: Is it a serious problem? *Int J Health Sci (Qassim)*, *11*(5), 17-19. https://www.ncbi.nlm.nih.gov/pubmed/29114189

**Al Tawil, L., Aldokhayel, S., Zeitouni, L., Qadoumi, T., Hussein, S., & Ahamed, S. S. (2020).** Prevalence of self-reported computer vision syndrome symptoms and its associated factors among university students. *European journal of ophthalmology*, *30*(1), 189-195.

**Alamri, A., Amer, K. A., Aldosari, A. A., Althubait, B. M. S., Alqahtani, M. S., Al Mudawi, A. A. M., Al Mudawi, B. A. M., Alqahtani, F. A. M., & Alhamoud, N. S. Y. (2022)**. Computer vision syndrome: Symptoms, risk factors, and practices. *J Family Med Prim Care*, *11*(9), 5110-5115. https://doi.org/10.4103/jfmpc.jfmpc_1627_21

**Alatawi, S. K., Allinjawi, K., Alzahrani, K., Hussien, N. K., Bashir, M., & Ramadan, E. N. (2022).** Self-Reported Student Awareness and Prevalence of Computer Vision Syndrome During COVID-19 Pandemic at Al-Baha University. *Clin Optom (Auckl)*, *14*, 159-172. https://doi.org/10.2147/OPTO.S374837

**AlDarrab, A., Khojah, A. A., Al-Ghazwi, M. H., Al-Haqbani, Y. J., Al-Qahtani, N. M., Al-Ajmi, M. N., Alenezi, S. H., Almasoud, M. K., & Al-Yahya, A. F. (2021).** Magnitude and determinants of computer vision syndrome among college students at a Saudi university. *Middle East African Journal of Ophthalmology*, *28*(4), 252.

**Alhasan, A. S., & Aalam, W. A. (2022).** Magnitude and Determinants of Computer Vision Syndrome Among Radiologists in Saudi Arabia: A National Survey. *Acad Radiol*, *29*(9), e197-e204. https://doi.org/10.1016/j.acra.2021.10.023

**Almalki, A. M., Alblowi, M., Aldosari, A. M., Khandekar, R., & Al-Swailem, S. A. (2023).** Population perceived eye strain due to digital devices usage during COVID-19 pandemic. *International Ophthalmology*, *43*(6), 1935-1943.

**Almousa, A. N., Aldofyan, M. Z., Kokandi, B. A., Alsubki, H. E., Alqahtani, R. S., Gikandi, P., & Alghaihb, S. G. (2023).** The impact of the COVID-19 pandemic on the prevalence of computer vision syndrome among medical students in Riyadh, Saudi Arabia. *Int Ophthalmol*, *43*(4), 1275-1283. https://doi.org/10.1007/s10792-022-02525-w

**Alsaigh, R. R., Assas, G. E., Yahia, N. H., Sharaf, N. F., Shaikh, S. F., Alghamdi, H. M., Badr, H. A., & Alghamdi, S. A. (2022).** The relationship between screen time exposure and the presence of anxiety-related disorders among adolescents during the COVID-19 pandemic: A cross-

sectional study. *Belitung Nursing Journal*, *8*(3), 251-257.

**Altalhi, A., Khayyat, W., Khojah, O., Alsalmi, M., & Almarzouki, H. (2020).** Computer Vision Syndrome Among Health Sciences Students in Saudi Arabia: Prevalence and Risk Factors. *Cureus*, *12*(2), e7060. https://doi.org/10.7759/cureus.7060

**Anbesu, E. W., & Lema, A. K. (2023).** Prevalence of computer vision syndrome: a systematic review and meta-analysis. *Sci Rep*, *13*(1), 1801. https://doi.org/10.1038/s41598-023-28750-6

**AOA. (2023).** *Computer vision syndrome*. American Optometric Association Retrieved 21 October from https://www.aoa.org/healthy-eyes/eye-and-vision-conditions/computer-vision-syndrome?sso=y

**Artime-Rios, E., Suarez-Sanchez, A., Sanchez-Lasheras, F., & Segui-Crespo, M. (2022).** Computer vision syndrome in healthcare workers using video display terminals: an exploration of the risk factors. *J Adv Nurs*, *78*(7), 2095-2110. https://doi.org/10.1111/jan.15140

**Artime Rios, E. M., Sanchez Lasheras, F., Suarez Sanchez, A., Iglesias-Rodriguez, F. J., & Segui Crespo, M. D. M. (2019).** Prediction of Computer Vision Syndrome in Health Personnel by Means of Genetic Algorithms and Binary Regression Trees. *Sensors (Basel)*, *19*(12). https://doi.org/10.3390/s19122800

**Barar, A., Apatachioaie, I. D., Apatachioaie, C., & Marceanu-Brasov, L. (2007).** [Ophthalmologist and "computer vision syndrome"]. *Oftalmologia*, *51*(3), 104-109. https://www.ncbi.nlm.nih.gov/pubmed/18064965 (Oftalmologul practician si "computer vision syndrome".)

**Bogdanici, C. M., Sandulache, D. E., & Nechita, C. A. (2017)**. Eyesight quality and Computer Vision Syndrome. *Rom J Ophthalmol*, *61*(2), 112-116. https://doi.org/10.22336/rjo.2017.21

**Canto-Sancho, N., Porru, S., Casati, S., Ronda, E., Segui-Crespo, M., & Carta, A. (2023).** Prevalence and risk factors of computer vision syndrome-assessed in office workers by a validated questionnaire. *PeerJ*, *11*, e14937. https://doi.org/10.7717/peerj.14937

**Canto-Sancho, N., Ronda, E., Cabrero-Garcia, J., Casati, S., Carta, A., Porru, S., & Segui-Crespo, M. (2022).** Rasch-Validated Italian Scale for Diagnosing Digital Eye Strain: The Computer Vision Syndrome Questionnaire IT(c). *Int J Environ Res Public Health*, *19*(8). https://doi.org/10.3390/ijerph19084506

**Canto-Sancho, N., Sanchez-Brau, M., Ivorra-Soler, B., & Segui-Crespo, M. (2021).** Computer vision syndrome prevalence according to individual and video display terminal exposure characteristics in Spanish university students. *Int J Clin Pract*, *75*(3), e13681. https://doi.org/10.1111/ijcp.13681

**Canto-Sancho, N., Segui-Crespo, M., Zhao, G., & Ronda-Perez, E. (2023).** The Chinese version of the Computer Vision Syndrome Questionnaire: translation and cross-cultural adaptation. *BMC Ophthalmol*, *23*(1), 298. https://doi.org/10.1186/s12886-023-03031-y

**Chauhan, S., Dhasmana, R., & Raj, A. (2018).** Knowledge, awareness and practice of CVS in digital device users. *Sudanese Journal of Ophthalmology*, *10*(1), 18.

**Chawla, A., Lim, T. C., Shikhare, S. N., Munk, P. L., & Peh, W. C. G. (2019).** Computer Vision Syndrome: Darkness Under the Shadow of Light. *Can Assoc Radiol J*, *70*(1), 5-9. https://doi.org/10.1016/j.carj.2018.10.005

**Coronel-Ocampos, J., Gómez, J., Gómez, A., Quiroga-Castañeda, P. P., & Valladares-Garrido, M. J. (2022).** Computer visual syndrome in medical students from a private university in Paraguay: a survey study. *Frontiers in public health*, *10*, 935405.

**Das, A., Shah, S., Adhikari, T. B., Paudel, B. S., Sah, S. K., Das, R. K., Shah, C. P., & Adhikari, P. G. (2022).** Computer vision syndrome, musculoskeletal, and stress-related problems among visual display terminal users in Nepal. *PLoS One*, *17*(7), e0268356. https://doi.org/10.1371/journal.pone.0268356

**Derbew, H., Nega, A., Tefera, W., Zafu, T., Tsehaye, K., Haile, K., & Temesgen, B. (2021).** Assessment of Computer Vision Syndrome and Personal Risk Factors among Employees of Commercial Bank of Ethiopia in Addis Ababa, Ethiopia. *J Environ Public Health*, *2021*, 6636907. https://doi.org/10.1155/2021/6636907

**Dessie, A., Adane, F., Nega, A., Wami, S. D., & Chercos, D. H. (2018).** Computer Vision Syndrome and Associated Factors among Computer Users in Debre Tabor Town, Northwest Ethiopia. *J Environ Public Health*, *2018*, 4107590. https://doi.org/10.1155/2018/4107590

**Dhar-Munshi, S., Amed, S., & Munshi, S. (2019).** Computer vision syndrome: an update. *British Journal of Neuroscience Nursing*, *15*(Sup2), S10-S11.

**Dostalova, N., Vrubel, M., & Kachlik, P. (2021).** Computer vision syndrome - symptoms and prevention. *Cas Lek Cesk*, *160*(2-3), 88-92. https://www.ncbi.nlm.nih.gov/pubmed/34134500 (Syndrom počitačoveho viděni - projevy a možnosti předchazeni.)

**Egharevba, H. O. (2023).** Evaluating the Strength of Evidence on the Effectiveness of Accommodative Support Lens on Computer Vision Syndrome.

**El Swerky, F. M., Shafik, S. A., & Elhameed, F. K. A. (2022).** Health prevention program for occupational overuse syndrome for computer users. *International journal of health sciences*, 1717-1735. https://doi.org/10.53730/ijhs.v6nS5.9494

**Erdinest, N., & Berkow, D. (2021).** [Computer Vision Syndrome]. *Harefuah*, *160*(6), 386-392. https://www.ncbi.nlm.nih.gov/pubmed/34160157

**Fensie, A., Pierre, T. S., Jain, J., & Sezen-Barrie, A. (2023).** Engaged learning during distraction: a case study of successful working moms in distance education. *Journal of Computing in Higher Education*, 1-46.

**Gadain Hassan, H. A. (2023).** Computer Vision Syndrome Among Medical Students at the University of Khartoum, Sudan: Prevalence and Associated Factors. *Cureus*, *15*(5), e38762. https://doi.org/10.7759/cureus.38762

**Galindo-Romero, C., Rodríguez-Zamora, C. L., García-Ayuso, D., Di Pierdomenico, J., & Valiente-Soriano, F. J. (2023).** Computer vision syndrome-related symptoms in presbyopic computer workers. *International Ophthalmology*, 1-9.

**Galindo-Romero, C., Ruiz-Porras, A., Garcia-Ayuso, D., Di Pierdomenico, J., Sobrado-Calvo, P., & Valiente-Soriano, F. J. (2021).** Computer Vision Syndrome in the Spanish Population during the COVID-19 Lockdown. *Optom Vis Sci*, *98*(11), 1255-1262. https://doi.org/10.1097/OPX.0000000000001794

**Ghazy, K., H., E Abuzahra, S., & Lotfy Ahmed, A. (2023).** Effect of Awareness Strategy on Prevention of Digital Eye Strain among Nursing Students in COVID-19 Pandemic Era. *International Egyptian Journal of Nursing Sciences and Research*, *3*(2), 307-326.

**González-Pérez, M., Susi, R., Barrio, A., & Antona, B. (2018).** Five levels of performance and two subscales identified in the computer-vision symptom scale (CVSS17) by Rasch, factor, and discriminant analysis. *PLoS One*, *13*(8), e0202173.

**Hassan, H. A. G. (2023).** Computer Vision Syndrome Among Medical Students at the University of Khartoum, Sudan: Prevalence and Associated Factors. *Cureus*, *15*(5).

**Horwood, S., Anglim, J., & Mallawaarachchi, S. R. (2021).** Problematic smartphone use in a large nationally representative sample: Age, reporting biases, and technology concerns. *Computers in Human Behavior*, *122*, 106848.

**Hwang, Y., Shin, D., Eun, J., Suh, B., & Lee, J. (2021).** Design Guidelines of a Computer-Based Intervention for Computer Vision Syndrome: Focus Group Study and Real-World Deployment. *J Med Internet Res*, *23*(3), e22099. https://doi.org/10.2196/22099

**Iqbal, M., El-Massry, A., Elagouz, M., & Elzembely, H. (2018).** Computer vision syndrome survey among the medical students in Sohag University Hospital, Egypt. *Ophthalmology Research: An International Journal*, *8*(1), 1-8.

**Kaplinsky, R., & Kraemer-Mbula, E. (2022).** Innovation and uneven development: The challenge for low-and middle-income economies. *Research Policy*, *51*(2), 104394.

**Kumar, B. S. (2020).** A study to evaluate the knowledge regarding computer vision syndrome among medical students. *Biomed Pharmacol J*, *13*(1), 469-473.

**Lema, A. K., & Anbesu, E. W. (2022).** Computer vision syndrome and its determinants: A systematic review and meta-analysis. *SAGE Open Med*, *10*, 20503121221142402. https://doi.org/10.1177/20503121221142402

**Lemma, M. G., Beyene, K. G. M., & Tiruneh, M. A. (2020).** Computer vision syndrome and associated factors among secretaries working in ministry offices in Addis Ababa, Ethiopia. *Clinical optometry*, 213-222.

**Lindo-Cano, E. F., García-Monge, V. A., Castillo-Cadillo, K. J., Sánchez-Tirado, E. A., Távara, I. M., & Morales, J. (2022).** Computer-digital Vision Syndrome Among University Students of Lima City. *The Open Public Health Journal*, *15*(1).

**Lovell-Patel, R., Ajiboye, A., & Manfrin, A. (2023).** Evaluation of the effectiveness of the Super Enhanced Single Vision Lens 01 (SESL01) in reducing symptoms of computer vision syndrome (CVS): A study protocol for a double-blind, two-arm parallel randomized controlled trial. *Contemp Clin Trials*, *125*, 107046. https://doi.org/10.1016/j.cct.2022.107046

**Manindr Singh Setia . (2016).** Methodology Series Module 3: Cross-sectional Studies Indian J Dermatol. 2016 May-Jun; 61(3): 261–264. doi: 10.4103/0019-5154.182410

**Moisanen, S. (2023).** The Effect of Anthocyanins on Accommodation in Visual Display Terminal Work.

**Motchan, B. L. (2017).** Safety Eyewear for Computer Vision Syndrome. *Occup Health Saf*, *86*(6), 86. https://www.ncbi.nlm.nih.gov/pubmed/30299012

**Moulton, E. A., Galor, A., Ciolino, J. B., & Jacobs, D. S. (2023).** Is blue light a red herring in a rodent model of "computer vision syndrome"? *Pain*, *164*(7), 1640.

**Mowatt, L., Gordon, C., Santosh, A. B. R., & Jones, T. (2018).** Computer vision syndrome and ergonomic practices among undergraduate university students. *Int J Clin Pract*, *72*(1). https://doi.org/10.1111/ijcp.13035

**Mrayyan, M. T., Alseid, A. R. H., Ghoolah, T. S., Al-Shaikh Ali, M. H., & Mrayan, M. (2023).** Investigating the Prevalence of Computer Vision Syndrome (CVS) Among Undergraduate Nursing Students: A Cross-Sectional Study. *SAGE Open Nurs*, *9*, 23779608231191883. https://doi.org/10.1177/23779608231191883

**Muhid, A., & Khan, J. (2022).** The monitoring of DOACs in primary care, a quality improvement project. *Concomitant COVID 19 Infection And NTDS: 68 Patient Case Series*, *7*(10).

**Muma, S., Aduda, D. O., & Onyango, P. (2019).** Level of Awareness, Perception And Uptake Of Interventions For Computer Vision Syndrome Among University Students, Maseno, Western Kenya.

**Nagwa, E., Marwa, M. A., Fatma, F. Y., & Ehsaan, M. A. (2019).** Computer vision syndrome and associated factors among students of Faculty of Medicine, Cairo University. *The Medical Journal of Cairo University*, *87*(December), 4877-4881.

**Nikiforova, A. A., Gusova, B. A., Korotkikh, S. A., Fedorov, A. A., & Kaysinova, A. S. (2020).** [The scientific rationale for the use of electroneurostimulation of the cervical sympathetic ganglia in patients with computer vision syndrome]. *Vopr Kurortol Fizioter Lech Fiz Kult*, *97*(4), 17-25. https://doi.org/10.17116/kurort20209704117 (Nauchnoe obosnovanie primeneniya elektroneirostimulyatsii sheinykh simpaticheskikh gangliev u patsientov s komp'yuternym zritel'nym sindromom.)

**Noreen, K., Batool, Z., Fatima, T., & Zamir, T. (2016).** Prevalence of computer vision syndrome and its associated risk factors among under graduate medical students of urban karachi. *Pakistan Journal of Ophthalmology*, *32*(3).

**Paul, M., Maglaras, L., Ferrag, M. A., & AlMomani, I. (2023).** Digitization of healthcare sector: A study on privacy and security concerns. *ICT Express*.

**Pavel, I. A., Bogdanici, C. M., Donica, V. C., Anton, N., Savu, B., Chiriac, C. P., Pavel, C. D., & Salavastru, S. C. (2023).** Computer Vision Syndrome: An Ophthalmic Pathology of the Modern Era. *Medicina*, *59*(2), 412. https://www.mdpi.com/1648-9144/59/2/412

**Peter, R. G. (2020).** *Computer Vision Syndrome (CVS): the assessment of prevalence and associated risk factors among the students of the American University of Armenia* American University of Armenia].

**Rachman, A., & Oktovin, O. (2022).** Prevalence Of Events And Reports Symptoms Of Computer Vision Syndrome (CVS) In Nursing Students In Indonesia During Virtual Face Learning Current Time Of The Covid-19 Pandemic. *Jurnal eduhealth*, *13*(02), 745-749.

**Ranasinghe, P., Wathurapatha, W., Perera, Y., Lamabadusuriya, D., Kulatunga, S., Jayawardana, N., & Katulanda, P. (2016).** Computer vision syndrome among computer office workers in a developing country: an evaluation of prevalence and risk factors. *BMC research notes*, *9*, 1-9.

**Randolph, S. A. (2017).** Computer Vision Syndrome. *Workplace Health Saf*, *65*(7), 328. https://doi.org/10.1177/2165079917712727

**Rodríguez, L. V., Lozano, N. E., de la Peña Triana, H., Vargas, J. V., Botía, D. M., Vinasco, A. P., Rincón, M. T., Pérez, C. A., Carreño, M. S., & Suescun, G. C. (2023).** Computer visual syndrome in university students in times of pandemic. *Archivos de la Sociedad Española de Oftalmología (English Edition)*, *98*(2), 72-77.

**Sanchez-Brau, M., Domenech-Amigot, B., Brocal-Fernandez, F., Quesada-Rico, J. A., & Segui-Crespo, M. (2020).** Prevalence of Computer Vision Syndrome and Its Relationship with Ergonomic and Individual Factors in Presbyopic VDT Workers Using Progressive Addition Lenses. *Int J Environ Res Public Health*, *17*(3), 1003. https://doi.org/10.3390/ijerph17031003

**Sanchez-Brau, M., Domenech-Amigot, B., Brocal-Fernandez, F., & Segui-Crespo, M. (2021).** Computer vision syndrome in presbyopic digital device workers and progressive lens design. *Ophthalmic Physiol Opt*, *41*(4), 922-931. https://doi.org/10.1111/opo.12832

**Segui-Crespo, M., Canto-Sancho, N., Sanchez-Brau, M., Davo-Blanes, M. C., Martinez, J. M., Caballero, P., & Ronda-Perez, E. (2022).** [CVS-Q teen(c): computer vision syndrome in adolescents and its relationship with digital textbooks]. *Gac Sanit*, *37*, 102264. https://doi.org/10.1016/j.gaceta.2022.102264 (CVS-Q teen(c): sindrome visual informatico en adolescentes y su relacion con libros de texto digitales.)

**Seresirikachorn, K., Thiamthat, W., Sriyuttagrai, W., Soonthornworasiri, N., Singhanetr, P., Yudtanahiran, N., & Theeramunkong, T. (2022).** Effects of digital devices and online learning on computer vision syndrome in students during the COVID-19 era: an online questionnaire study. *BMJ Paediatr Open*, *6*(1). https://doi.org/10.1136/bmjpo-2022-001429

**Shahid, E., Burhany, T., Siddique, W. A., Fasih, U., & Shaikh, A. (2017).** Frequency of computer vision syndrome in computer users. *Pakistan Journal of Ophthalmology*, *33*(2).

**Shin, S., Yang, E. H., Lee, H. C., Moon, S. H., & Ryoo, J. H. (2023).** The relationship between visual display terminal usage at work and

symptoms related to computer vision syndrome. *Ann Occup Environ Med*, *35*, e1. https://doi.org/10.35371/aoem.2023.35.e1

**Silver, L., Smith, A., Johnson, C., Taylor, K., Jiang, J., Anderson, M., & Rainie, L. (2019).** Mobile connectivity in emerging economies. *Pew Research Center*, *7*.

**Singh, S., Downie, L. E., & Anderson, A. J. (2023).** Is critical flicker-fusion frequency a valid measure of visual fatigue? A post-hoc analysis of a double-masked randomised controlled trial. *Ophthalmic and Physiological Optics*, *43*(2), 176-182.

**Singh, S., McGuinness, M. B., Anderson, A. J., & Downie, L. E. (2022).** Interventions for the Management of Computer Vision Syndrome: A Systematic Review and Meta-analysis. *Ophthalmology*, *129*(10), 1192-1215. https://doi.org/10.1016/j.ophtha.2022.05.009

**Talens-Estarelles, C., Cerviño, A., García-Lázaro, S., Fogelton, A., Sheppard, A., & Wolffsohn, J. S. (2023).** The effects of breaks on digital eye strain, dry eye and binocular vision: Testing the 20-20-20 rule. *Contact Lens and Anterior Eye*, *46*(2), 101744.

**Tanamal, B., Naibey, R., Wadiastuti, S., Yulidia, H., & Pesurnay, Y. (2023).** Computer Vision Syndrome (CVS) in Medical Students Reduced by Eye Exercise and Acupressure. *Babali Nursing Research*, *4*(2), 314-329.

**Tesfaye, A. H., Alemayehu, M., Abere, G., & Mekonnen, T. H. (2022).** Prevalence and Associated Factors of Computer Vision Syndrome Among Academic Staff in the University of Gondar, Northwest Ethiopia: An Institution-Based Cross-Sectional Study. *Environ Health Insights*, *16*, 11786302221111865. https://doi.org/10.1177/11786302221111865

**Thampi, B., Antony, J., & Vijayan, V. (2020).** Awareness and Symptoms of Computer Vision Syndrome among Computer Users. *Kerala Medical Journal*, *13*(4), 127-130.

**Thilakarathne, M., Udara, H., Thucyanthan, B., & Ranasinghe, P. (2017).** Prolonged computer use and its effects on vision among undergraduates in University of Colombo, School of Computing.

**Thompson, S. K. (2012).** *Sampling* (Vol. 755). John Wiley & Sons.

**Wadhwani, M., Manika, M., Jajoo, M., & Upadhyay, A. D. (2022).** Online survey to assess computer vision syndrome in children due to excessive screen exposure during the COVID 19 pandemic lockdown. *J Family Med Prim Care*, *11*(9), 5387-5392. https://doi.org/10.4103/jfmpc.jfmpc_1771_21

**Watson, S. (2021).** *What Is Computer Vision Syndrome?* Retrieved November 29 from https://www.webmd.com/eye-health/computer-vision-syndrome

**White, S. (2019).** *Basic & clinical biostatistics*. McGraw Hill Professional.

**Zalat, M. M., Amer, S. M., Wassif, G. A., El Tarhouny, S. A., & Mansour, T. M. (2022).** Computer vision syndrome, visual ergonomics and amelioration among staff members in a Saudi medical college. *International Journal of Occupational Safety and Ergonomics*, *28*(2), 1033-1041.

**Zenbaba, D., Sahiledengle, B., Bonsa, M., Tekalegn, Y., Azanaw, J., & Kumar Chattu, V. (2021).** Prevalence of Computer Vision Syndrome and Associated Factors among Instructors in Ethiopian Universities: A Web-Based Cross-Sectional Study. *ScientificWorldJournal*, *2021*, 3384332. https://doi.org/10.1155/2021/3384332