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# Navigating the Digital Learning Era: Computer Vision Syndrome Among Health Science Students

## Navegando la era del aprendizaje digital: síndrome de visión por computadora en estudiantes de ciencias de la salud

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**SUMMARY**

**Introduction:** *The digital learning era has introduced new challenges to student well-being, particularly concerning visual health. The rapid advancement of online learning enabled by modern digital technologies has led to increased screen time among university students. An initial survey found that a significant number of health science students reported Computer Vision Syndrome (CVS) symptoms due to extended digital learning. This study aimed to analyze factors associated with the severity of CVS.*

**Methods:** *A descriptive correlational study with a cross-sectional design was conducted among 323 undergraduate health science students selected via simple random sampling; data were obtained from the CVS questionnaire to assess symptoms and perceptions of CVS risk factors and prevention. The CVS-Q questionnaire was used to measure the dependent variable, CVS severity. Data analysis was conducted using the Chi-Square test ($p < 0.05$).*

**Results:** *Most students experienced mild CVS (55.7 %), and 85.4 % reported more than eight CVS-related symptoms. Significant associations were found between CVS severity and both the purpose of device use ($p = 0.025$) and viewing distance ($p = 0.005$), while other variables showed no significant correlation.*

**Conclusion:** *These findings suggest that prolonged digital learning exacerbates the severity of CVS among health science students. Most participants experienced at least six of the sixteen CVS symptoms. The results highlight the necessity of preventive strategies and greater ergonomic awareness to minimize the risk of CVS in educational settings.*

**Keywords:** *computer vision syndrome; digital learning; risk factors; students*

**RESUMEN**

**Introducción:** *La era del aprendizaje digital ha introducido nuevos desafíos para el bienestar*

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*estudiantil, particularmente en lo que respecta a la salud visual. El rápido avance del aprendizaje en línea, impulsado por las tecnologías digitales modernas, ha llevado a un mayor tiempo de pantalla entre los estudiantes universitarios. Una encuesta inicial encontró que un número significativo de estudiantes de ciencias de la salud reportaron síntomas del síndrome de visión por computadora (CVS) debido al aprendizaje digital extendido. Este estudio tuvo como objetivo analizar los factores asociados con la gravedad del CVS.*

**Métodos:** *Se realizó un estudio correlacional descriptivo con un diseño transversal entre 323 estudiantes de ciencias de la salud de pregrado, seleccionados mediante muestreo aleatorio simple; los datos se obtuvieron mediante el cuestionario CVS para evaluar los síntomas y las percepciones sobre los factores de riesgo y la prevención del CVS. El cuestionario CVS-Q se utilizó para medir la variable dependiente, la gravedad del CVS. El análisis de datos se realizó mediante la prueba de Chi-Cuadrado ($p < 0,05$).*

**Resultados:** *La mayoría de los estudiantes experimentaron CVS leve (55,7 %) y el 85,4 % reportó más de ocho síntomas relacionados con el CVS. Se encontraron asociaciones significativas entre la gravedad del CVS y el propósito del uso del dispositivo ($p = 0,025$) y la distancia de visualización ($p = 0,005$), mientras que otras variables no mostraron correlación significativa.*

**Conclusión:** *Estos hallazgos sugieren que el aprendizaje digital prolongado exacerba la gravedad del CVS en estudiantes de ciencias de la salud. La mayoría de los participantes presentaron al menos seis de los dieciséis síntomas de CVS. Los resultados resaltan la necesidad de estrategias preventivas y de una mayor conciencia ergonómica para minimizar el riesgo de CVS en entornos educativos.*

**Palabras clave:** *Síndrome visual informático, aprendizaje digital, factores de riesgo, estudiantes.*

## INTRODUCTION

Modern digital technology has become widespread amid a global shift toward remote learning, compelling students to rely heavily on digital devices to continue their education. Numerous studies indicate that users of digital devices may spend up to 12 hours per day in front of screens (1). The pervasive use of electronic devices is now deeply embedded in modern life, with individuals across all age groups utilizing screens for both professional and recreational purposes (2). The widespread accessibility of the internet and the increasing digitization of resources have, in many cases, supplanted traditional reading materials such as printed books. Although these technological advancements offer numerous benefits, excessive and unregulated screen exposure can pose significant health risks (3).

One of the most prevalent conditions associated with prolonged screen use is Computer Vision Syndrome (CVS), defined as "a complex of eye and vision problems related to near work experienced during computer use." The terms visual fatigue (VF) and digital eye strain (DES) are also used interchangeably to describe the condition, highlighting the diverse range of digital devices implicated in its onset. Symptoms of CVS can be categorized into three main groups: visual (e.g., blurred vision, diplopia, and visual discomfort), ocular (e.g., dry eyes, redness, irritation, and eye strain), and extraocular (e.g., headaches and musculoskeletal pain in the neck, shoulders, and back) (4).

Multiple factors, including poor posture, inadequate ambient lighting, lack of screen filters, excessive screen brightness, and improper viewing distances, influence the development and severity of CVS symptoms. Despite the condition's preventability, over 60 million people worldwide are affected, with approximately one million new cases reported each year (1). CVS has been identified as a major occupational health concern, with visual symptoms contributing to a 4 %-8 % decline in task performance. Although it does not cause permanent ocular damage, the syndrome significantly impacts quality of life and daily functioning (5).

Among university students, particularly those in health-related disciplines, the effects of CVS are increasingly evident. Symptoms often lead to reduced academic performance, impaired concentration, and poor time management, with severe cases associated with up to a 40 % reduction in productivity (6). Given these consequences, this study aims to assess the factors influencing the severity of Computer Vision Syndrome among health sciences students, thereby informing targeted interventions to mitigate its impact.

## METHODS

This study employed a descriptive correlational design with a cross-sectional approach, enabling examination of relationships between variables without implementing interventions. The target population consisted of undergraduate students enrolled in the Faculties of Medicine, Nursing, and Public Health. A total of 323 students met the inclusion criteria, which required active participation in online learning activities and voluntary completion of the study questionnaire. Participants were selected using simple random sampling to ensure representativeness and minimize selection bias.

Data were collected using a structured online questionnaire developed based on the ergonomic balance framework. The instrument comprised three main sections: Demographic characteristics, purpose of digital device use, average daily screen time, screen viewing distance, and subjective visual perception.

The instrument's validity and reliability were established through a pilot study, with Cronbach's alpha coefficients exceeding 0.7, indicating acceptable internal consistency. Data analysis was performed using SPSS version 25. The Chi-Square test was employed to assess associations between independent variables and the severity of Computer Vision Syndrome (CVS), which was categorized into mild, moderate, and severe levels. A p-value of $< 0.05$ was considered statistically significant.

## RESULTS

A total of 359 undergraduate students from three Health Faculties agreed to complete the questionnaire. They were then selected based on the study's inclusion and exclusion criteria, resulting in 323 students experiencing CVS.

Table 1

Demographic data

| Characteristic | Criteria | N | Percentage (%) |
|---|---|---|---|
| Faculty | Medicine | 108 | 33.4 |
| | Public Health | 123 | 38.1 |
| | Nursing | 92 | 28.5 |
| Total | | 323 | 100 |
| Age | 15 | 1 | 0.3 |
| | 18 | 23 | 7.1 |
| | 19 | 72 | 22.3 |
| | 20 | 82 | 25.4 |
| | 21 | 74 | 22.9 |
| | 22 | 57 | 17.7 |
| | 23 | 12 | 3.7 |
| | 24 | 2 | 0.6 |
| Total | | 323 | 100.0 |
| Mean (age) | | 20.34 | |
| Minimum (age) | | 15 | |
| Maximum (age) | | 24 | |
| Standard deviation (age) | | 1.358 | |

Table 2

Distribution of CVS Symptoms

| Symptoms | Never | Occasionally moderate | Occasionally intense | Always moderate | Always intense | N | % |
|---|---|---|---|---|---|---|---|
| Blurred vision | 63 (19.5) | 217 (67.2) | 5 (1.5) | 37 (11.5) | 1 (0.3) | 323 | 100 |
| Difficulty focusing on near objects | 99 (30.7) | 200 (61.9) | 7 (2.2) | 17 (5.3) | 0 (0) | 323 | 100 |
| Double vision | 196 (60.7) | 116 (35.9) | 3 (0.9) | 8 (2.5) | 0 (0) | 323 | 100 |
| Dry eyes | 68 (21.1) | 191 (59.1) | 12 (3.7) | 50 (15.5) | 2 (0.6) | 323 | 100 |
| Abnormal blinking | 165 (51.1) | 135 (41.8) | 3 (0.9) | 16 (5.0) | 4 (1.2) | 323 | 100 |
| Feeling of worsening vision | 73 (22.6) | 193 (59.8) | 15 (4.6) | 36 (11.1) | 6 (1.9) | 323 | 100 |
| Eye strain | 76 (23.5) | 188 (58.2) | 15 (4.6) | 41 (12.7) | 3 (0.9) | 323 | 100 |
| Headache | 42 (13.0) | 187 (57.9) | 32 (9.9) | 54 (16.7) | 8 (2.5) | 323 | 100 |
| Increased light sensitivity | 95 (29.4) | 166 (51.4) | 20 (6.2) | 40 (12.4) | 2 (0.6) | 323 | 100 |
| Sore eyes | 77 (23.8) | 185 (57.3) | 18 (5.6) | 39 (12.1) | 4 (1.2) | 323 | 100 |
| Red eyes | 152 (47.1) | 145 (44.9) | 5 (1.5) | 21 (6.5) | 0 (0) | 323 | 100 |
| Watery eyes | 113 (35.0) | 163 (50.5) | 10 (3.1) | 35 (10.8) | 2 (0.6) | 323 | 100 |
| Eye fatigue | 9 (2.8) | 182 (56.3) | 24 (7.4) | 98 (30.3) | 10 (3.1) | 323 | 100 |
| Neck or shoulder pain | 39 (12.1) | 140 (43.3) | 24 (7.4) | 104 (32.2) | 16 (5.0) | 323 | 100 |
| Back or waist pain | 28 (8.7) | 153 (47.4) | 17 (5.3) | 110 (34.1) | 15 (4.6) | 323 | 100 |
| Finger or wrist discomfort | 65 (20.1) | 178 (55.1) | 12 (3.7) | 59 (18.3) | 9 (2.8) | 323 | 100 |

The data distribution results showed that 323 students experienced symptoms of DVS, ranging from the most common symptoms to tired eyes (97.2 %), back/waist pain (91.3 %), neck/shoulder pain (87.9 %), headache (87 %), blurred vision (80.5 %), finger/wrist discomfort (79.9 %), dry eyes (78.9 %), perceived worsening of vision (77.4 %), eye strain (76.5 %), sore eyes (76.2 %), increased sensitivity to light (70.6 %), difficulty focusing on close objects (69.3 %), watery eyes (65 %), red eyes (52.9 %), abnormal blinking (48.9 %), and double vision (39.3 %).

Table 2 shows that the most commonly reported symptom among students was tired eyes (314 students [97.2 %]), whereas double vision had the lowest proportion (127 students [39.3 %]). In addition, the most frequent symptom reported with severe intensity was neck/shoulder pain among 16 students (5 %).

Table 3

Distribution of the Severity Level of CVS among Students

| Severity level of CVS | Frequency | Percentage (%) |
|---|---|---|
| Normal | 22 | 6.4 |
| Mild | 180 | 52.2 |
| Moderate | 138 | 40.0 |
| Severe | 5 | 1.4 |
| Total | 345 | 100.0 |

The majority of students (323, 93.6 %) experienced CVS, while only 22 (6.4 %) did not report symptoms.

Table 4

Cross Tabulation of Factors Related to the Severity Level of CVS among Students

| Variable | Category | Level of CVS | | | | | | Total | | P - value |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Mild | | Moderate | | Severe | | | | |
| | | f | % | f | % | f | % | N | % | |
| Purpose of digital device use | Learning | 81 | 25.1 | 72 | 22.3 | 4 | 1.2 | 157 | 48.6 | 0.025 |
| | Entertaining | 92 | 28.5 | 66 | 20.4 | 1 | 0.3 | 159 | 49.2 | |
| | Working | 7 | 2.2 | 0 | 0 | 0 | 0 | 7 | 2.2 | |
| | Total | 180 | 55.8 | 138 | 42.7 | 5 | 1.5 | 323 | 100.0 | |
| Duration of daily device use (hours) | <2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.630 |
| | 2-4 | 5 | 1.5 | 2 | 0.6 | 0 | 0 | 7 | 2.2 | |
| | 5-7 | 32 | 9.9 | 19 | 5.9 | 1 | 0.3 | 52 | 16.1 | |
| | 8-10 | 66 | 20.5 | 46 | 14.2 | 1 | 0.3 | 113 | 35.0 | |
| | 11-13 | 43 | 13.3 | 30 | 9.3 | 1 | 0.3 | 74 | 22.9 | |
| | 14-16 | 20 | 6.2 | 19 | 5.9 | 1 | 0.3 | 40 | 12.4 | |
| | >16 | 14 | 4.3 | 22 | 6.8 | 1 | 0.3 | 37 | 11.4 | |
| | Total | 180 | 55.7 | 138 | 42.7 | 5 | 1.5 | 323 | 100.0 | |
| Viewing distance | <40 cm | 105 | 32.5 | 104 | 32.2 | 4 | 1.2 | 213 | 65.9 | 0.005 |
| | ≥40 cm | 75 | 23.3 | 34 | 10.5 | 1 | 0.3 | 110 | 34.1 | |
| | Total | 180 | 55.8 | 138 | 42.7 | 5 | 1.5 | 323 | 100.0 | |
| Subjective Perception | Poor | 3 | 0.9 | 0 | 0 | 0 | 0 | 3 | 0.9 | 0.167 |
| | Fair | 65 | 20.1 | 39 | 12.1 | 1 | 0.3 | 105 | 32.5 | |
| | Good | 112 | 34.7 | 99 | 30.7 | 4 | 1.2 | 215 | 66.6 | |
| | Total | 180 | 55.7 | 138 | 42.8 | 5 | 1.5 | 323 | 100.0 | |

The Chi-Square test indicates that the purpose of device use is statistically significant ($p=0.025$). This shows a significant association between the purpose of digital device use and the severity of CVS among students. It can also be interpreted that there is a relationship between the viewing distance students use and the severity of CVS they experience. However, neither the duration of daily device use nor subjective perception is significantly correlated with CVS.

## DISCUSSION

Undoubtedly, the advent of computer screens and modern technologies such as computers, tablets, smartphones, and other electronic devices has revolutionized society, making information more accessible and widely available (7). These devices have become indispensable tools for learning, communication, and daily activities. However, the rapid increase in their use has also incurred substantial health, economic, and social costs. Among these, Computer Vision Syndrome (CVS) has emerged as one of the most commonly reported complaints among digital device users (7,8).

Viewing and reading on digital screens is markedly different from reading printed materials, as text displayed on electronic screens is often less legible due to reduced contrast between the letters and the background (9). Online learning requires students to rely heavily on electronic devices such as computers, laptops, and smartphones to

attend classes (10). A previous study also found that older students tended to browse the internet on computers, laptops, or desktops, whereas younger students more commonly relied on smartphones (11).

The growth of digital technology has expanded its application across education, work, and entertainment. In the educational context, students rely on digital devices to access learning resources and communicate with peers and teachers. For entertainment, activities such as social media, gaming, and streaming can provide relaxation, but prolonged exposure substantially increases the risk of CVS. For example, using digital devices for mobile gaming for more than an hour per day has been shown to elevate CVS-related symptoms (12).

Nearly half of students (49.2 %) reported spending the most time on entertainment activities, including gaming, music, video streaming, and social media. Correlation analysis revealed a significant association between the purpose of device use and CVS severity (P=0.025). This indicates that the more time students spend on entertainment or study-related device use, the more likely they are to experience varying degrees of CVS. Supporting this, a previous study reported that 78 % of digital device users preferred smartphones, with 80 % primarily using them for entertainment (13). In addition, prolonged exposure carries serious ocular risks; using digital devices for more than 4 hours per day can lead to refractive errors, a condition in which light entering the eye cannot be properly focused, resulting in blurred vision (14). The American Optometric Association (2017) highlights the most common CVS symptoms as eye strain, headaches, blurred vision, dry eyes, and neck and shoulder pain.

A low level of perception among students tends to correlate with high CVS (Computer Vision Syndrome) scores, with symptoms including xerophthalmia, eye fatigue, headaches, and a burning sensation in the eyes (15). This study contradicts that research, as the analysis found that the level of perception was not significantly related to the severity of CVS. However, the reported symptoms are in line with those in the previous study: the most commonly reported symptoms include eye fatigue, back/waist pain, neck/shoulder pain, headaches, and discomfort in the fingers and wrists. Eye fatigue and headaches are common symptoms reported in prior research. The mode of perception level among respondents in this study was 'good', suggesting that a CVS's perception does not necessarily reduce the risk factors for that disease, as it depends heavily on how that perception is applied in daily life.

Therefore, it is crucial to prioritize digital device use based on necessity and adopt healthy usage habits to reduce risks. Excessive and unregulated use not only contributes to CVS but also exacerbates its severity. A limitation of this research, however, is the lack of detailed categorization regarding the duration of use for each purpose, which may provide further insights in future studies.

## CONCLUSION

The findings indicate that both the intended use of digital devices and the viewing distance from screens are closely associated with the severity of Computer Vision Syndrome (CVS) symptoms among students participating in online learning. This underscores the importance of individual habits and awareness in shaping visual health outcomes. Therefore, addressing both behavioural patterns and environmental influences that contribute to CVS should be considered a shared responsibility among educational institutions, healthcare professionals, and students. Initiatives such as digital health education, ergonomic practice workshops, and regular eye examinations may help promote safer screen use and mitigate the adverse effects of prolonged digital exposure. Further investigation is recommended to examine these factors across broader populations and diverse learning environments, to establish more effective, preventive approaches.

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