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Prevalence and Associated Factors of Computer Vision Syndrome (CVS) among Undergraduate Nursing Students in Peshawar: An Analytical Cross-Sectional Study

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Abstract

Background: Computer vision syndrome is increasingly relevant among health sciences students because academic learning and daily communication depend heavily on digital devices.

Objective: This study determined the prevalence of CVS and its associated factors among undergraduate nursing students in Peshawar, Pakistan.

Methods: An analytical cross-sectional study was conducted from July to December 2025 among 377 undergraduate nursing students aged 18-25 years. Participants were selected through convenience sampling. Data were collected using a structured questionnaire that included sociodemographic characteristics, digital-device exposure, ergonomic practices, and CVS-Smart diagnostic items. A CVS-Smart score of 7-10 was considered a positive CVS case. Data were coded and analyzed using SPSS version 26. Descriptive statistics, chi-square tests, Spearman correlation, and binary logistic regression were applied.

Results: The mean age of the Participants was 21.5 ± 3.5 years, and 74.8% were women. The prevalence of Computer Vision Syndrome (CVS) was found to be 46.9%. Important variables that could predict CVS included gender, more time spent on screen, viewing distance less than 30 cm, poor body position, inadequate break time, and refractive disorders.

Conclusion: CVS was common among undergraduate nursing students in Peshawar. Preventive strategies should emphasize limiting prolonged screen exposure, maintaining adequate viewing distance, correcting refractive errors, improving posture, and adopting regular 20-20-20 breaks.

Introduction

Computer vision syndrome (CVS), also known as digital eye strain (DES), refers to a cluster of visual, ocular surface, and extraocular symptoms associated with prolonged use of computers, laptops, smartphones, tablets, e-readers, and other digital screens (Iqbal et al.; 2024, Kaur et al., 2022). Typical symptoms include eye fatigue, headache, dry eyes, blurred vision, eye irritation, tearing, neck pain, shoulder pain, and back pain (Kaur et al., 2022; Moore et al., 2024). The condition is clinically important because it can affect comfort, academic concentration, productivity, and quality of life among students who use digital devices for both learning and social communication.

The prevalence of DES varies widely across settings because studies differ in population, device exposure, diagnostic definitions, and measurement tools. A recent study among working adults in the United Kingdom and Ireland reported a DES prevalence of 62.6% using a CVS-Q cut-off score (Moore et al., 2024). In Peshawar, Pakistan, (Haider et al., 2023) reported that 74.1% of medical students experienced at least one symptom of DES, with headache and eye pain among the common complaints. These findings show that DES is relevant in both international and local academic populations.

Several factors have been associated with CVS, including prolonged daily screen time, close viewing distance, screen glare, poor posture, bedtime smartphone use, inadequate breaks, and uncorrected refractive error (Almahmoud et al., 2025; Chu et al., 2023; Tahir et al., 2024). Health sciences students may be especially vulnerable because they use screens for lectures, assignments, clinical learning resources, online communication, and entertainment. Despite increasing digital-device use, limited published evidence is available specifically among undergraduate nursing students in private nursing institutes of Peshawar.

The present study was therefore conducted to determine the prevalence of CVS and to assess its association with selected demographic, digital-exposure, visual, and ergonomic factors among undergraduate nursing students in private nursing institutes of Peshawar, Pakistan.

Methodology:

Study Design and Setting: An analytical cross-sectional study design was used. The study was conducted in nursing institutes located in Peshawar, Khyber Pakhtunkhwa, Pakistan.

Study Duration: The study duration was six months, from July to December 2025.

Study Population: The study population consisted of undergraduate nursing students enrolled in nursing institutes in Peshawar.

Sample Size and Sampling Technique: The sample size was 377 students. The sample was selected using a convenience sampling technique. This technique was used because students who were available during data collection and met the eligibility criteria were approached for participation.

Eligibility Criteria: Inclusion criteria were undergraduate nursing students aged 18-25 years, enrolled in nursing institutes of Peshawar, and willing to provide informed consent. Students from other academic disciplines, students outside the specified age range, students who refused consent, and forms with incomplete responses were excluded.

Data Collection Tool: Data were collected using a structured questionnaire consisting of demographic variables, digital-device use characteristics, ergonomic and

environmental factors, visual status variables, and the CVS-Smart diagnostic tool. CVS-Smart includes five scored domains: visual complaints, ocular surface complaints, extraocular complaints, frequency of complaints, and association of complaints with screen use (Iqbal et al., 2024). The total CVS-Smart score ranges from 0 to 10. A score of 7-10 was categorized as a positive CVS case, 5-6 as high probability, 3-4 as low probability, 1-2 as not CVS case, and 0 as normal/no symptoms. In the present dataset, the five CVS-Smart items showed good internal consistency (Cronbach's alpha = 0.82).

Study Variables: The dependent variable was CVS status, coded as positive CVS case versus non-positive CVS case. The independent variables included age, gender, academic year, residence, hostel status, daily screen-time category, daily screen-time hours, use of laptop or tablet, smartphone use at bedtime, viewing distance, posture, break practice, refractive error, use of corrective lenses, screen brightness, screen glare, room lighting, online classes, social media use, and movies or gaming.

Data Analysis: Data were coded, entered, and analyzed using SPSS version 26. Frequencies and percentages were calculated for categorical variables; means and standard deviations were calculated for continuous variables. The prevalence of CVS was calculated with a 95% confidence interval. Chi-square tests were applied to assess bivariate associations between categorical variables and positive CVS status. Spearman correlation was used to assess the relationship between daily screen-time hours and CVS-Smart total score. Binary logistic regression was used to identify factors independently associated with positive CVS status, and adjusted odds ratios (AORs) with 95% confidence intervals were reported. Statistical significance was set at $p < .05$.

Ethical Considerations: Ethical approval was obtained from the Institutional Review Board (IRB) before data collection. Written informed consent was obtained from all participants. Participation was voluntary, and students were informed that they could withdraw at any time without penalty. Data were coded, stored confidentially, and used only for research purposes. No identifying information was reported in the final manuscript.

Results

Sociodemographic and Digital-Exposure Characteristics

A total of 377 undergraduate nursing students participated in the study. The mean age was 21.25 ± 1.43 years. Most respondents were female (282, 74.8%). Urban residence was reported by 234 (62.1%) students. All students reported smartphone use. The mean daily screen time was 5.54 ± 2.20 hours, with 241 (63.9%) reporting five or more hours per day. Detailed characteristics are shown in Table 1.

Table 1

Sociodemographic and digital-exposure characteristics of participants (N = 377).

Variable	Category	n (%) or mean ± SD
Age, years		21.5 ± 3.5
Daily screen time, hours/day		5.54 ± 2.20
Gender	Male	95 (25.2)
	Female	282 (74.8)
Academic year	1st year	88 (23.3)
	2nd year	88 (23.3)
	3rd year	103 (27.3)
	4th year	98 (26.0)
Residence	Urban	234 (62.1)

	Rural	143 (37.9)
Hostel resident	Yes	167 (44.3)
	No	210 (55.7)
Daily screen time category	≤2 hours	29 (7.7)
	3–4 hours	107 (28.4)
	5–6 hours	132 (35.0)
	>6 hours	109 (28.9)
Uses laptop	Yes	246 (65.3)
	No	131 (34.7)
Uses tablet	Yes	89 (23.6)
	No	288 (76.4)
Smartphone at bedtime	Yes	247 (65.5)
	No	130 (34.5)
Viewing distance	<30 cm	227 (60.2)
	≥30 cm	150 (39.8)
Posture	Poor/awkward	203 (53.8)
	Good/neutral	174 (46.2)
Break practice	Rare/Never	160 (42.4)
	Sometimes	128 (34.0)
	Regular 20-20-20	89 (23.6)
Refractive error	Yes	110 (29.2)
	No	267 (70.8)
Uses corrective lenses	Yes	83 (22.0)
	No	294 (78.0)
Screen brightness	Adjusted to environment	198 (52.5)
	Too bright	113 (30.0)
	Too dim	66 (17.5)
Screen glare	Yes	156 (41.4)
	No	221 (58.6)
Room lighting	Inadequate	125 (33.2)
	Adequate	252 (66.8)
Online classes	Yes	301 (79.8)
	No	76 (20.2)
Social media use	Yes	330 (87.5)
	No	47 (12.5)
Movies or gaming	Yes	247 (65.5)
	No	130 (34.5)

Prevalence of Computer Vision Syndrome

Using the CVS-Smart diagnostic criterion of 7-10 points, 177 students were positive CVS cases. The confirmed prevalence of CVS was 46.9% (95% CI [42.0, 52.0]). An additional 70 students (18.6%) were categorized as high probability. The mean CVS-Smart total score was 5.83 ± 3.16. The most frequently reported symptoms were eye fatigue (205, 54.4%), headache (189, 50.1%), neck or shoulder pain (166, 44.0%), and back pain (157, 41.6%). Diagnostic categories and symptoms are shown in Table 2.

Table 2

CVS-Smart status and symptom profile among participants.

Variable	n (%) or mean ± SD
Positive CVS case	177 (46.9)
High probability	70 (18.6)
Low probability	57 (15.1)

Not CVS case	50 (13.3)
No CVS symptoms	23 (6.1)
CVS-Smart total score, mean ± SD	5.83 ± 3.16
Visual complaints count, mean ± SD	2.75 ± 3.02
Ocular surface complaints count, mean ± SD	2.46 ± 2.81
Extraocular complaints count, mean ± SD	3.01 ± 3.05
Eye fatigue	205 (54.4)
Headache	189 (50.1)
Neck or shoulder pain	166 (44.0)
Back pain	157 (41.6)
Blurred vision	129 (34.2)
Dry eyes	121 (32.1)
Sleep disturbance	107 (28.4)
Itching or rubbing	106 (28.1)
Eye redness	102 (27.1)

Association Between Study Variables and Positive CVS Status

Daily screen-time hours showed a positive correlation with CVS-Smart total score (Spearman rs = 0.29, p < .001). In bivariate analysis, positive CVS status was significantly associated with gender (p = .008), daily screen-time category (p < .001), smartphone use at bedtime (p = .022), viewing distance (p < .001), posture (p = .021), and break practice (p = .001). Academic year, residence, hostel status, screen glare, room lighting, online classes, social media use, and movies or gaming were not significantly associated with positive CVS status. Bivariate findings are presented in Table 3.

Table 3

Bivariate association between selected factors and positive CVS status.

Variable	**Category**	**Positive CVS / total (%)**	**p**
Gender	Male	33/95 (34.7)	.008
	Female	144/282 (51.1)	
Academic Year	1st year	42/88 (47.7)	.873
	2nd year	38/88 (43.2)	
	3rd year	49/103 (47.6)	
	4th year	48/98 (49.0)	
Residence	Urban	104/234 (44.4)	.254
	Rural	73/143 (51.0)	
Hostel Resident	Yes	75/167 (44.9)	.546
	No	102/210 (48.6)	
Daily Screen Time Category	≤2 hours	10/29 (34.5)	< .001
	3–4 hours	30/107 (28.0)	
	5–6 hours	71/132 (53.8)	
	>6 hours	66/109 (60.6)	
Smartphone At Bedtime	Yes	127/247 (51.4)	.022
	No	50/130 (38.5)	
Viewing Distance	<30 cm	128/227 (56.4)	< .001
	≥30 cm	49/150 (32.7)	
Posture	Poor/awkward	107/203 (52.7)	.021
	Good/neutral	70/174 (40.2)	

Break Practice	Rare/Never	91/160 (56.9)	.001
	Sometimes	56/128 (43.8)	
	Regular 20-20-20	30/89 (33.7)	
Refractive Error	Yes	59/110 (53.6)	.120
	No	118/267 (44.2)	
Uses Corrective Lenses	Yes	45/83 (54.2)	.168
	No	132/294 (44.9)	
Screen Glare	Yes	77/156 (49.4)	.495
	No	100/221 (45.2)	
Room Lighting	Inadequate	61/125 (48.8)	.691
	Adequate	116/252 (46.0)	
Online Classes	Yes	142/301 (47.2)	.963
	No	35/76 (46.1)	
Social Media Use	Yes	153/330 (46.4)	.654
	No	24/47 (51.1)	
Movies or Gaming	Yes	121/247 (49.0)	.325
	No	56/130 (43.1)	

Multivariable Logistic Regression

The logistic regression model was statistically significant, likelihood-ratio $\chi^2(10) = 72.67$, $p < .001$, with Nagelkerke $R^2 = 0.23$. After adjustment, female gender, longer daily screen time, viewing distance <30 cm, poor or awkward posture, nonregular breaks, and refractive error were independently associated with positive CVS status (Table 4).

Table 4

Multivariable binary logistic regression for factors associated with positive CVS status.

Predictor	AOR	95% CI	p
Female	2.29	1.34-3.89	.002
Screen time (per hour/day)	1.24	1.11-1.38	< .001
Smartphone at bedtime	1.45	0.90-2.34	.127
Viewing distance <30 cm	2.86	1.77-4.60	< .001
Poor/awkward posture	1.81	1.15-2.86	.010
Nonregular breaks	2.25	1.30-3.89	.004
Refractive error	1.86	1.12-3.10	.016
Screen glare	1.28	0.81-2.02	.293
Inadequate lighting	0.86	0.53-1.39	.533
Movies or gaming	1.42	0.88-2.29	.151

Note. AOR = adjusted odds ratio; CI = confidence interval. Reference categories were male, no smartphone at bedtime, viewing distance ≥30 cm, good/neutral posture, regular 20-20-20 breaks, no refractive error, no screen glare, adequate lighting, and no movies/gaming.

Discussion

This analytical cross-sectional study found a confirmed CVS prevalence of 46.9% among undergraduate nursing students in nursing institutes of Peshawar. This indicates that almost one in two students met the CVS-Smart diagnostic threshold. When students with high probability were also considered, nearly two-thirds of the participants had clinically relevant CVS-Smart findings. The results support the view that CVS is a common ocular and ergonomic problem among students who rely heavily on digital devices.

The prevalence observed in this study is lower than the 74.1% symptom prevalence reported among medical students in Peshawar by (Haider et al., 2023). This difference may be explained by differences in diagnostic criteria: the present study used the CVS-Smart threshold for confirmed CVS, while the Peshawar medical student study reported the presence of at least one DES symptom. International studies have also reported variable prevalence, including 62.6% among adult digital-device workers in the United Kingdom and Ireland (Moore et al., 2024) and 44.1% among Palestinian schoolchildren (Almahmoud et al., 2025). These differences reinforce that prevalence estimates depend strongly on population, screen exposure, and measurement approach.
Longer daily screen time was one of the strongest and most consistent factors associated with CVS. Each additional hour of screen time increased the adjusted odds of CVS by approximately 24%. This finding is consistent with previous evidence showing that prolonged digital-device use is associated with higher DES or CVS scores (Almahmoud et al., 2025; Chu et al., 2023; Moore et al., 2024). From a physiological perspective, prolonged near work may increase accommodative demand, reduce blink rate, and increase ocular surface dryness, contributing to visual and ocular symptoms.
Viewing distance was another important factor. Students using devices at a distance below 30 cm had almost three times higher adjusted odds of CVS than those maintaining a distance of 30 cm or more. Poor or awkward posture and nonregular breaks were also independently associated with CVS. These findings are consistent with the extraocular component of CVS-Smart and with literature describing headache, neck pain, shoulder pain, and back pain as part of the CVS/DES symptom complex (Iqbal et al.; 2024; Kaur et al., 2022). Regular breaks such as the 20-20-20 rule may reduce sustained accommodation and musculoskeletal strain.
Female students had higher adjusted odds of CVS than male students. Similar gender-related differences have been reported in other DES studies, including work showing higher symptom scores among females (Moore et al., 2024). Possible explanations include differences in symptom reporting, tear film stability, dry eye predisposition, and screen-use patterns; however, causal interpretation is not possible in a cross-sectional design. Refractive error was also independently associated with positive CVS status after adjustment. Uncorrected or inadequately corrected refractive error may increase visual demand during near work and contribute to eye fatigue, headache, and blurred vision.
The findings have practical implications for nursing institutes. Preventive education should be incorporated into student orientation and health promotion sessions. Students should be advised to maintain an appropriate viewing distance, adjust screen brightness to the environment, avoid prolonged bedtime smartphone use, sit with neutral posture, correct refractive errors, and take regular visual breaks. Institutes should also consider ergonomic awareness campaigns and periodic visual screening for students with persistent symptoms.

Strengths and Limitations

A major strength of this study is the use of a structured diagnostic tool that includes visual, ocular surface, extraocular, frequency, and screen-association domains. The sample size of 377 provides adequate precision for estimating prevalence and assessing associations. The study also used multivariable analysis to control for important covariates.
This study also has limitations. Convenience sampling may limit representativeness and generalizability to all nursing students in Peshawar. The cross-sectional design cannot establish causal relationships. Data were self-reported, which may introduce recall and reporting bias. Clinical ophthalmic examination was not performed; therefore, the CVS-Smart tool should be interpreted as a screening and diagnostic

questionnaire-based measure rather than a substitute for a comprehensive eye examination.

Conclusion

CVS was common among undergraduate nursing students in private nursing institutes of Peshawar, with a confirmed prevalence of 46.9%. Female gender, increased screen time, close viewing distance, poor posture, nonregular breaks, and refractive error were independently associated with CVS. Preventive strategies focusing on ergonomic screen use, appropriate visual correction, and regular breaks are recommended for nursing students.

Recommendations

Nursing institutes should conduct regular awareness sessions about CVS prevention and the 20-20-20 rule.

Students should be encouraged to maintain a screen distance of at least 30 cm for handheld devices and an ergonomic posture during study.

Students with persistent headache, blurred vision, dry eyes, eye fatigue, or neck/shoulder pain should be referred for optometric or ophthalmologic assessment.

Future studies should use probability sampling, include clinical eye examinations, and compare public and private nursing institutes.

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