Original Research

# AWARENESS OF COMPUTER VISION SYNDROME AND DIGITAL SCREEN USE PATTERNS AMONG STUDENTS AND HEALTHCARE WORKERS: A CROSS-SECTIONAL ONLINE SURVEY

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## ABSTRACT

**Background and Objectives:** Computer Vision Syndrome (CVS) refers to the constellation of ocular and musculoskeletal symptoms that develop from prolonged digital screen exposure. To assess CVS awareness, characterise digital device usage patterns, determine the prevalence of CVS-related symptoms, and evaluate associations between screen time, demographic variables, and probable CVS.

**Methods:** A quantitative, cross-sectional, questionnaire-based study was conducted among students and healthcare workers. A sample of 385 participants was determined using standard formula (Z = 1.96, p = 0.5, d = 0.05). Awareness, screen time, device usage, and seven CVS-related symptoms were assessed. Probable CVS was defined as at least one eye-related symptom combined with reported symptom aggravation on prolonged screen use. Descriptive statistics, chi-square tests, and binary logistic regression were applied; statistical significance was set at $p < 0.05$.

**Results:** A total of 385 participants (mean age 24.8 ± 7.7 years; 50.6% male) were analyzed, comprising predominantly students and healthcare workers. CVS awareness was low at 17.9%. Most participants (68.9%) reported at least four hours of daily screen time. Eye strain (60.3%), headache and blurred vision (both 50.4%) were common. Probable CVS was identified in 58.4% of participants. Higher screen time was significantly associated with symptoms. Male sex (adjusted OR ≈ 1.6, p ≈ 0.045) and healthcare worker occupation (adjusted OR ≈ 3.6 vs. students, p ≈ 0.001) were independently associated with probable CVS.

**Interpretation and Conclusion:** CVS awareness is critically low despite a substantial symptom burden.

**Keywords:** Computer Vision Syndrome, Digital Device Usage, Screen Time, Awareness, Students, Healthcare Workers.

## INTRODUCTION

The proliferation of digital technology over the past two decades has fundamentally reshaped the way individuals learn, work, and communicate. Laptops, smartphones, tablets, and desktop computers are now indispensable across virtually every professional and academic domain, and their adoption has accelerated sharply in the post-pandemic era[1]. While this digital integration has yielded substantial gains in productivity and access to information, it has simultaneously placed unprecedented demands on the human visual system—demands that have given rise to a clinical entity widely recognised as Computer Vision Syndrome (CVS), or digital eye strain.

*www.ajmrhs.com*
eISSN: 2583-7761

Date of Received: 13-04-2026
Date Acceptance: 20-04-2026
Date of Publication: 16-05-2026

The American Optometric Association (2023) defines CVS as a cluster of eye and vision-related problems arising from sustained digital screen use. Clinically, it presents as a heterogeneous mix of ocular symptoms eye strain, burning sensation, redness, dry eyes, and blurred vision alongside systemic complaints such as headache and neck or shoulder pain[2]. These manifestations stem from a convergence of factors: sustained near-focus effort that fatigues the ciliary and extraocular muscles, a well-documented reduction in blink frequency during screen use that accelerates tear evaporation, uncorrected or under-corrected refractive errors, and suboptimal display ergonomics including inappropriate viewing distances, glare, and poor ambient lighting[3,4]. Although individual symptoms are seldom incapacitating, their cumulative effect on visual comfort, cognitive performance, and occupational productivity is considerable[5].

Cross-sectional surveys have reported CVS symptom prevalence ranging from roughly 50% to more than 90% across diverse populations, with the estimates varying markedly based on symptom definitions, screen-time thresholds, and measurement instruments[3,5]. Students and healthcare workers are consistently identified as two of the most heavily exposed groups: the former on account of prolonged engagement with digital learning platforms and social media, and the latter because of their increasing reliance on electronic health record (EHR) systems, diagnostic imaging, and telemedicine tools as routine elements of clinical work[6,7].

Efforts to standardise CVS measurement have produced validated self-report instruments. The Computer Vision Syndrome Questionnaire (CVS-Q), developed and psychometrically evaluated by Seguí and colleagues (2015)[8], and the 17-item Computer Vision Symptom Scale (CVSS17), initially developed and validated by González-Pérez et al. (2014)[9] and subsequently adapted into English and other languages[10] enable the systematic quantification of symptom frequency, intensity, and associated discomfort.

A perhaps more troubling issue than symptom prevalence, however, is the persistent finding that awareness of CVS as a recognised clinical entity remains low—including among populations with the greatest digital exposure. In India, where the pace of digitalization in academic and healthcare settings has intensified dramatically—a process further accelerated by the COVID-19 pandemic's rapid expansion of remote learning and telehealth[1]—baseline data on CVS awareness remain sparse.

The present study was therefore undertaken to address four objectives: (i) to estimate the prevalence of CVS awareness among students and healthcare workers; (ii) to describe digital device usage patterns including daily screen duration and primary device type; (iii) to determine the prevalence of seven established CVS-related symptoms; and (iv) to evaluate associations between daily screen time, demographic factors, and the occurrence of probable CVS. Throughout, the study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement[11,12] and the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)[13], reflecting the cross-sectional, web-based nature of the investigation.

## MATERIALS & METHODS

### Study Design and Setting

This investigation employed a quantitative, cross-sectional, questionnaire-based design administered through an online Google Form platform. Cross-sectional surveys are well suited to simultaneously estimating the prevalence of an exposure (digital screen use), an outcome (CVS-related symptoms), and awareness of a clinical condition, and they have been the predominant design in the CVS epidemiology literature[5,6]. The study was designed and reported in adherence to the STROBE statement for observational research[11] and the CHERRIES guidelines for internet-based surveys[13,14].

### Study Population and Eligibility

The target population comprised two groups whose heavy dependence on digital screens has been consistently documented in the literature[6,7]: (i) students using digital devices for academic purposes, and (ii) healthcare workers who routinely rely on screens for clinical or administrative tasks at Great Eastern Medical School & Hospital (GEMS&H). Participants were eligible if they were aged 18 years or older, currently enrolled or employed in the respective category, and used digital screens for a minimum of one hour per day on average. Individuals were excluded if they self-reported a pre-existing ocular pathology (such as advanced glaucoma or retinal disease) or recent ocular surgery that could confound symptom assessment, consistent with exclusion criteria applied in comparable CVS surveys[7]. Incomplete questionnaires—those with missing data on key variables—were similarly excluded and documented in the participant flow, as recommended by the CHERRIES framework[13].

### Sample Sise Determination

The minimum required sample sise was calculated using the standard single-proportion estimation formula: $n = Z^2 \times p(1 - p) / d^2$, where $Z = 1.96$ (corresponding to a 95% confidence level), $p = 0.50$ (an assumed proportion that, in the absence of reliable prior local estimates, maximises the sample sise requirement), and $d = 0.05$ (an acceptable margin of error of 5%). This yielded $n = 384.16$, rounded to 385 participants—a sample-sise calculation consistent with methodological guidance in CVS survey literature[6,7]. To accommodate anticipated non-response and incomplete submissions, the recruitment target was inflated to approximately 425–480 invitations, with a minimum of 385 complete and eligible responses required for final analysis.

### Survey Instrument and Variables

The structured self-administered questionnaire was hosted on Google Forms and organised into four domains. The first captured sociodemographic data: age, sex (male/female), and occupation (student, healthcare worker, or other). The second domain assessed digital device usage, recording daily screen time in five pre-specified categories (<2 hours, 2–4 hours, 4–6 hours, 6–8 hours, or >8 hours) and primary device type (mobile, laptop, tablet/iPad, or combination)[3,7].

The third domain assessed CVS awareness through a single item—"Are you aware of Computer Vision Syndrome (CVS)?"—with response options of Yes, No, or Maybe[6]. The fourth domain addressed CVS-related symptoms via seven binary (Yes/No) items: eye strain, headache during or after screen use, burning sensation in the eyes, redness of the eyes, dry eyes, blurred vision, and neck and shoulder pain—symptom domains aligned with those established in the CVS literature[2,5]. A final item asked participants whether their symptoms increase with prolonged screen use (Yes/No).

**Operational Definitions of CVS**

Because the survey did not incorporate a validated CVS scale, two complementary operational definitions were prespecified in the study protocol—an approach consistent with epidemiological practice for surveys that rely on non-validated binary symptom items[6,8].

**Self-perceived CVS** was defined as a "Yes" response to the question on symptom aggravation with prolonged screen use.

**Probable CVS** required the co-presence of at least one eye-related symptom (eye strain, burning sensation, redness, dry eyes, or blurred vision) and self-reported symptom worsening with screen use—a composite criterion conceptually analogous to the symptom-plus-aggravation structure of validated instruments such as the CVS-Q and CVSS17[9.]

**Data Collection Procedures**

The survey link was disseminated through institutional email groups, messaging applications and electronic notice boards over a pre-defined data-collection window. These recruitment channels are consistent with those employed in comparable online CVS surveys[7,14]. The opening page of the Google Form contained a participant information sheet—specifying the study purpose, voluntary nature of participation, estimated completion time, absence of direct risks or personal benefits, anonymity assurances, and investigator contact details—followed by a mandatory consent checkbox, as recommended by the CHERRIES guidelines[13] and the Declaration of Helsinki[15].

**Statistical Analysis**

Exported data were transferred to statistical software for cleaning and analysis. Descriptive statistics were presented as means ± standard deviations for continuous normally distributed variables and as frequencies with percentages for categorical variables. Chi-square tests (or Fisher's exact test where expected cell counts were below five) were used to evaluate associations between daily screen-time category and each of the seven symptom outcomes, as well as the composite probable CVS variable—an analytic approach routinely applied in CVS epidemiological research [5,6]. The associations of sex and CVS awareness with probable CVS were examined in the same fashion. A binary logistic regression model was subsequently fitted, specifying probable CVS (Yes/No) as the dependent variable and incorporating screen-time category, age (continuous), sex, and occupation as covariates. Results were expressed as adjusted odds ratios (ORs) with 95% confidence intervals. A two-sided significance threshold of $p < 0.05$ was maintained throughout.

**Ethical Considerations**

Given the survey-based, observational design and the absence of any direct intervention or collection of biologically identifiable material, the study was categorised as minimal-risk research. Participation was entirely voluntary, and no incentives were offered. Anonymity was ensured by the non-collection of personally identifiable information, and all data were handled in compliance with applicable data protection regulations.

## RESULTS

A total of 385 participants met the inclusion criteria and were included in the final analysis. The mean age was 24.8 ± 7.7 years, and the sample was approximately equally distributed by sex (195 males, 50.6%; 190 females, 49.4%). Students constituted the largest occupational subgroup (n = 278; 72.2%), followed by healthcare workers (n = 71; 18.4%); the remaining 9.4% comprised other occupations. Overall CVS awareness was markedly low. Table I presents the full distribution of awareness responses.

Table I. Awareness of Computer Vision Syndrome by Occupational Group

| Awareness Category | Overall (N=385) | Students (n=278) | Healthcare Workers (n=71) |
|---|---|---|---|
| Aware (Yes) | 69 (17.9%) | 48 (17.3%) | 14 (19.7%) |
| Not Aware (No) | 278 (72.2%) | 201 (72.3%) | 54 (76.1%) |
| Uncertain (Maybe) | 38 (9.9%) | 29 (10.4%) | 3 (4.2%) |

Extended daily screen use was common across the cohort: 68.9% of participants reported four or more hours of daily screen exposure, while only 10.9% reported less than two hours. Mobile phones were the primary or sole device for 210 participants (54.5%), consistent with national and global trends in smartphone adoption reported in the literature[1]. Combined mobile and laptop use was the second most frequent pattern (n = 114; 29.6%), followed by laptop-only use (n = 26; 6.8%). Tablet use, either alone or in combination with other devices, was comparatively rare. Symptom prevalences are summarised in Table II.

Table II. Prevalence of CVS-Related Symptoms among Study Participants (N = 385)

| Symptom | n Reporting | Prevalence (%) |
|---|---|---|
| Eye strain | 232 | 60.3% |
| Headache during or after screen use | 194 | 50.4% |
| Blurred vision | 194 | 50.4% |
| Neck and shoulder pain | 182 | 47.3% |
| Burning sensation in the eyes | 179 | 46.5% |
| Dry eyes | 145 | 37.7% |
| Redness of the eyes | 116 | 30.1% |
| Self-perceived CVS (symptom aggravation with screen use) | 254 | 66.0% |
| Probable CVS (≥1 eye symptom + symptom aggravation) | 225 | 58.4% |

Chi-square analyzes revealed statistically significant associations between daily screen-time category and three individual symptoms (Table III).

Table III. Association between Daily Screen-Time Category and CVS Symptoms (Chi-Square Analysis)

| Symptom / Outcome | $\chi^2$ | df | p-value | Significance |
|---|---|---|---|---|
| Eye strain | 16.73 | 4 | 0.002 | Significant |
| Headache | 12.36 | 4 | 0.015 | Significant |
| Burning sensation | 17.85 | 4 | 0.001 | Significant |
| Blurred vision | 9.09 | 4 | 0.059 | Borderline |
| Redness of eyes | 6.97 | 4 | 0.140 | Not significant |
| Dry eyes | 1.18 | 4 | 0.880 | Not significant |
| Neck and shoulder pain | 2.43 | 4 | 0.660 | Not significant |
| Probable CVS (composite) | 4.85 | 4 | 0.300 | Not significant |

*Statistical significance threshold: $p < 0.05$. df, degrees of freedom.*

Probable CVS prevalence differed significantly by sex: 64.6% of males (126/195) versus 52.1% of females (99/190) met the composite definition ($\chi^2$ test, $p \approx 0.017$). The association between CVS awareness (dichotomised as aware vs. not aware/uncertain) and probable CVS was not statistically significant ($p \approx 0.75$).

In the binary logistic regression model, none of the screen-time categories were significantly associated with probable CVS relative to the reference category of less than two hours daily ($p > 0.19$ for all levels), corroborating the null bivariate result for the composite outcome. Male sex was associated with approximately 1.6-fold higher adjusted odds of probable CVS compared with females (OR ≈ 1.6, $p \approx 0.045$). Most notably, healthcare worker occupation was associated with substantially elevated adjusted odds relative to students (OR ≈ 3.6, $p \approx 0.001$). Age was not a significant predictor ($p \approx 0.37$).

## DISCUSSION

Three findings from this cross-sectional survey deserve particular emphasis. First, CVS awareness was strikingly low, with fewer than one in five participants (17.9%) familiar with the condition. Second, the symptom burden was substantial—58.4% met the operational criteria for probable CVS, and 66.0% reported that symptoms worsen with prolonged screen use. Third, while elevated daily screen time was significantly associated with specific ocular symptoms (eye strain, headache, burning sensation), male sex and healthcare worker occupation emerged as the strongest independent predictors of probable CVS in the multivariable model.

The awareness figure of 17.9% is consistent with—and in some instances lower than—proportions documented in comparable Indian surveys, where CVS awareness among students and health trainees has typically ranged from approximately 15% to 35%[6,7]. That awareness was equally low among healthcare workers (19.7%) as among students (17.3%) is arguably the more consequential observation: clinicians and allied health professionals might reasonably be expected to encounter information about screen-related visual morbidity through their professional training.

The null association between CVS awareness and probable CVS ($p \approx 0.75$) warrants careful interpretation. It is possible that the relatively small number of self-identified aware participants (n = 69) limited statistical power for this specific comparison. More conceptually, it is recognised that awareness alone—without accompanying behavioural change—is an insufficient mechanism for symptom reduction; attitude–behaviour gaps are well documented in preventive health contexts.

The finding that nearly 70% of participants reported four or more hours of daily screen exposure reflects the deep integration of digital technology into academic and professional life—a trend dramatically intensified by the COVID-19 pandemic and the resultant expansion of remote learning and telehealth[1]. Mobile phones were the dominant device (54.5%), a pattern with important ergonomic implications. Smartphone use typically occurs at suboptimal viewing angles and distances, in variable and often inadequate lighting, and is associated with substantially reduced blink rates compared with desktop workstation use[3,4]. These ergonomic disadvantages may contribute independently to ocular symptom burden over and above total daily screen duration, underscoring the need for ergonomic guidance that addresses mobile device use specifically.

Prior reviews have highlighted the musculoskeletal co-morbidities—particularly cervical and shoulder pain—are intrinsic to the syndrome rather than incidental[2,3], a pattern that may reflect unfavorable screen placement and sustained postural loading during prolonged device use.

The positive and statistically significant associations between higher screen time and eye strain (p = 0.002), headache (p = 0.015), and burning sensation (p = 0.001) are biologically coherent. Extended near-focus tasks reduce blink completeness and frequency, accelerating tear-film evaporation and destabilizing the ocular surface, which manifests as burning, photophobia, and blurred vision[3,4]. Sustained convergence and accommodation simultaneously generate ciliary muscle fatigue that propagates into reflex headache—a mechanism well described in the asthenopia literature[16].

The absence of a significant association between screen-time category and composite probable CVS (p = 0.30) should not be interpreted as evidence that screen time is unimportant. Composite outcomes aggregate symptoms with heterogeneous etiological relationships to screen exposure, which can dilute associations present for individual items[17].

The markedly elevated adjusted odds of probable CVS in healthcare workers compared with students (OR ≈ 3.6, p ≈ 0.001) is perhaps the most clinically actionable finding in this study. Sawsan et al. (2016)[18] similarly reported high CVS symptom prevalence among healthcare professionals in Saudi Arabia, and Gandhi et al.'s (2023)[6] systematic review identified occupational screen intensity as a key determinant of CVS severity beyond total duration.

The collective findings of this study support a tiered, multi-level response. At the individual level, increasing awareness of CVS and promoting evidence-based preventive behaviours including the 20-20-20 rule, maintenance of a screen-to-eye distance of at least 50–70 cm, screen placement at or slightly below eye level, and adequate ambient and task lighting represents a low-cost, scalable entry point[4,17].

The strengths of this study include a prospectively powered sample (n = 385, calculated a priori), transparent pre-specification of operational CVS definitions, adherence to STROBE and CHERRIES reporting standards, and the use of multivariable logistic regression to control for key demographic confounders. The simultaneous examination of both a primary awareness objective and symptom-level associations provide a richer characterization of the CVS landscape in this population than single-outcome surveys typically afford.

Several limitations must be acknowledged. All data—including symptom presence, screen time, and ocular history were self-reported and unverifiable, introducing information bias and precluding differentiation of CVS from other ophthalmological conditions. The absence of a validated CVS instrument (such as the CVS-Q or CVSS17) limits direct comparability with studies employing standardised metrics and precludes graded severity classification. As with all cross-sectional designs, causal inference is not possible. The duration of continuous uninterrupted screen use arguably a more mechanistically relevant exposure was not assessed.

## CONCLUSION

This cross-sectional online survey documents a troubling paradox among Indian students and healthcare workers: high digital screen exposure and a substantial burden of CVS-related symptoms coexist with critically low awareness of the syndrome itself. Fewer than one in five participants had heard of CVS, yet nearly three in five met the operational criteria for probable CVS a discordance that has direct implications for how institutions communicate occupational visual health to their members. Higher daily screen time was meaningfully associated with individual ocular symptoms, while male sex and healthcare worker occupation emerged as the strongest independent predictors of probable CVS in multivariable analysis. Together, these findings call for targeted educational campaigns, workstation ergonomic programs, and institutional policies that embed visual rest and eye care promotion into the everyday structures of academic and clinical environments. Future work should deploy validated CVS instruments such as the CVS-Q or the CVSS17 alongside objective clinical measures and prospective designs, to advance causal understanding and evaluate the real-world efficacy of preventive strategies.

**Acknowledgements**

The authors are grateful to all participants who generously volunteered their time to complete this survey, and to the institutional departments and healthcare facilities whose cooperation facilitated participant recruitment.

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**How to cite this article:** Ashwini Vilekar, Shaik Sadik, Divya Juttu, Bura Hima Bindu, AWARENESS OF COMPUTER VISION SYNDROME AND DIGITAL SCREEN USE PATTERNS AMONG STUDENTS AND HEALTHCARE WORKERS: A CROSS-SECTIONAL ONLINE SURVEY, Asian J. Med. Res. Health Sci., 2026; 4 (2):-286-291.

**Source of Support:** Nil, Conflicts of Interest: None declared.