A correlational study between the degree of digital eye strain and total screen time among medical students

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Abstract

Introduction The COVID-19 pandemic has significantly increased reliance on digital devices for education, leading to heightened concerns about digital eye strain (DES) among students. This study aimed to investigate the association between screen time and the degree of DES among first to third-year medical students at a private medical school from August to September 2023.

Methods An analytical cross-sectional design was employed, involving 194 participants who completed a self-administered questionnaire, including the Computer Vision Syndrome Questionnaire (CVS-Q). Data were analyzed using descriptive statistics and relative risk calculations.

Results The mean daily screen time was 6.94 hours, with 79.38% of participants reporting symptoms of digital eye strain. A significant association was found between screen time and DES, with a positive risk ratio of 1.304 for those spending 4-8 hours on screens compared to those with less than 4 hours.

Conclusion This study highlights the growing prevalence of DES among medical students during the pandemic, emphasizing the need for educational institutions to implement strategies that mitigate screen-related health risks. Recommendations include awareness programs, ergonomic guidelines and regular eye check-ups to promote ocular health.

Key words: Digital eye strain, total screen time, computer vision syndrome, medical students, online learning

Throughout the COVID-19 epidemic, online classes have emerged as a dominant method of education for students. The transition to digital schooling has led to children and young adults averaging at least eight hours daily in front of light-emitting diode (LED) screens. This duration pertains exclusively to online lessons, excluding additional hours spent on leisure activities or supplementary study. The blue light emitted from computer screens and mobile devices presents significant hazards, including discomfort and retinal damage, as high-energy wavelengths in the 380-500 nm spectrum penetrate the eyes.[1] As a result, digital eye strain has become more prevalent, particularly exacerbated during the epidemic. Reports revealed that persons suffering from digital eye strain exhibit several symptoms, including accommodation-related concerns like headaches, ocular discomfort, and blurred vision, alongside dryness-related

symptoms including foreign body sensation, excessive tearing, burning, itching and erythema.[2]

Prior to the pandemic, the prevalence of digital eye strain varied widely, with reports as low as 5%[3]. However, the emergence of COVID-19 has led to a staggering increase in digital eye strain among children, with estimates indicating a rise of 50-60%[3]. A recent study found that approximately 50.23% of students reported experiencing mild to severe digital eye strain during the COVID 19 pandemic.[4] Furthermore, other studies have documented a prevalence rate of 69% in adults and 50% in children.[1] These alarming statistics highlight digital eye strain as an emerging public health concern that necessitates further research, especially as online learning remains a primary educational option for many institutions.[5]

This study aimed to investigate the association between screen time and the degree of digital eye strain among first to third-year medical students from a private university from August to September 2023. Specifically, this research aimed to determine the average duration of screen time for online learning among these students; and to measure the degree of digital eye strain within this population using a self-administered questionnaire known as the "Computer Vision Syndrome Questionnaire" (CVS-Q).

Methods
This research has been approved by the Research Institute for Health Sciences Ethics Review Committee (RIHS ERC) under code: 1456/C/2023/028. The authors employed an analytical cross sectional research design to examine the relationship between total screen time and the presence of digital eye strain among participants.

The target population for this study consisted of first to third-year medical students who had access to the internet and were engaged in online learning. Those with current or previous diagnoses of eye problems, as well as those using devices equipped with anti-radiation screens, were excluded from participation.

Using an online sample size calculator for correlation the minimum sample size was 164 participants based on 95% confidence, 80% power and a proportion of 51.6% and 30% for those having DES for >8 hours and <5 hours, respectively, based from a previous study.[6]

Self-administered online questionnaire comprised of demographic Information Questionnaire, an 18-item screen-time questionnaire, and the Computer Vision Syndrome Questionnaire (CVS-Q) were distributed via Google Forms and various social media platforms.

The 18-item screen-time questionnaire categorized screen-based devices into five types: television, TV-connected devices, laptop/computer, smartphone, and tablet. Total screen time for each device was quantified in minutes and further analyzed based on average weekday, weeknight and weekend usage, as well as primary and background use. The CVS-Q comprises 16 symptoms related to digital eye strain and measures symptom frequency using a rating scale of 0-3 (never = 0; occasionally = 1; often/always = 2). Intensity is assessed on a scale of 1-2 (moderate = 1; intense = 2). This questionnaire has sensitivity and specificity rates of 75% and 70.2%, respectively. Rasch analysis confirmed that the 16 items adequately fit the rating scale model, with an internal consistency (Cronbach's alpha) of 0.78 and person separation reliability of 0.69.[7]

Descriptive statistics were employed to summarize the socio-demographic information of respondents. For the screen time questionnaire, both mean and median values were computed to determine total screen time. Responses from the CVS-Q were scored and summarized to measure symptoms of eye strain. To assess the association between total screen time and the degree of digital eye strain , prevalence relative risk calculations were performed.

Results
A total of 194 first to third-year medical students completed the survey. Among these participants, 108 (55.67%) were female, and 86 (44.33%) were male. The mean age of the participants was 23.54 years (SD = 2.41; range = 20-37 years) (Table 1).

The findings indicate that the mean daily screen time among participants averaged 6.94 hours, (sd 3.96 hours). Of the sample, 40 students (15.46%) did not exhibit digital eye strain, while a significant majority, comprising 154 students (79.38%), reported symptoms consistent with digital eye strain (Table 2).

Among the total participants, 44 individuals reported spending more than eight hours in front of a digital screen, while 27 individuals spent less than four hours in front of a digital screen. Furthermore, a majority of participants, specifically 123 individuals, spent between four and eight hours on digital screens (Table 2).

Table 1. Demographic characteristics of first to third – year medical students

Sex	N	Mean Age	Standard Deviation
Female	108	22.50	2.39
Male	86	23.00	2.98
Total	194	23.54	2.41

Table 2. Association between digital screen time and presence of digital strain

Screen Time	Presence of Digital Eye Strain	Absence of Digital Eye Strain	PRR (95% Confidence Interval)	p-value
≤ 4 hours	17	10	1.00 (Ref)	
4.01 - 8.00 hours	101	22	1.304 (1.023 - 1.871)	0.028
> 8 hours	36	08	1.299 (0.974 - 1.886)	0.076

The analysis revealed a statistically significant positive association between spending between four and eight hours in front of a digital screen and the development of digital eye strain (PRR 1.304; p 0.02). For those with more than 8 hours of screen time although there is a positive association, the results are not statistically significant. (Table 2)

Discussion

The increasing reliance on digital devices, particularly during online classes, has led to a significant rise in cases of digital eye strain (DES) among various populations, including children and young adults. Recent studies have highlighted the association between prolonged screen time and the prevalence of DES symptoms, emphasizing the need for awareness and intervention strategies.[2,4,6] Digital eye strain has emerged as a public health concern, particularly during the COVID-19 pandemic, when remote learning became the norm.[5]

Digital Eye Strain (DES) is characterized by a range of visual and ocular symptoms that arise from extended use of digital devices such as computers, tablets, and smartphones. Symptoms include dry eyes, blurred vision, headaches, and neck or shoulder pain. DES is specifically linked to the use of digital screens and encompasses issues like irritation, foreign body sensation and general discomfort associated with screen time.[3]

The mean daily screen time among participants in this study was recorded at 6.94 hours. This aligns with similar studies that reported average daily screen time among medical students ranging from 7 to 11 hours.[8-10]

A significant finding from this study was that 79.38% of participants reported symptoms consistent with digital eye strain. This prevalence is consistent with existing literature that documented rates of DES among medical students ranging from as low as 49% to as high as 92%.[11-13] The wide variability in reported prevalence may be attributed to differences in study methodologies, population demographics, and the specific definitions used for DES.

The findings revealed that those with 4 to 8 hours of screen time had a 1.3-fold elevated risk of developing DES symptoms compared to those with less than 4 hours of screen exposure. Likewise, individuals who spent over 8 hours on screens encountered a 1.29-fold higher risk. These findings align with earlier research that similarly indicated a positive association between elevated screen time and the incidence of DES symptoms.[11,14,15] The exacerbation of these symptoms can be attributed to continuous use of digital devices without breaks—a common practice among medical

students—along with inadequate use of lubricants or artificial tears to alleviate dryness.[16,17]

The ramifications of these findings are significant, highlighting the pressing necessity for educational institutions and healthcare providers to mitigate the risks linked to extended screen usage. Strategies including the implementation of regular breaks during screen usage, the promotion of suitable ergonomics and the encouragement of artificial tear application may alleviate the detrimental effects of digital eye strain.

This study underscores the increasing issue of digital eye strain among first to third-year medical students, especially during the COVID-19 epidemic when online learning has grown widespread. The study reveals a significant association between screen time and the onset of Digital Eye Strain (DES). Students who spent 4 to 8 hours in front of a digital screen were 1.304 times more likely to develop Digital Eye Strain (DES) than those who spent fewer than 4 hours. Although the association is evident, individual variability and other ergonomic interventions—such as keeping an adequate distance from screens and taking regular ocular breaks—may affect the severity of symptoms reported. As dependence on digital devices increases in educational environments, it is essential to create effective measures to protect ocular health and improve general well-being.

Educational institutions should enhance student understanding on the hazards of digital eye strain by offering advise on screen time regulation, ergonomic practices and ocular health. Regular ocular examinations should be advocated to identify and manage pre-existing visual problems that may deteriorate with extended screen exposure. Institutions should encourage ergonomic norms, including maintaining appropriate screen distance, minimizing glare, adhering to suggested eye break times, and providing advice on ideal screen configuration and posture. Finally, pupils ought to be urged to minimize screen time for non-essential activities and engage in offline pastimes to promote improved ocular health.

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