DOI: https://doi.org/10.54393/pbmj.v9i8.1401

PAKISTAN BIOMEDICAL JOURNAL
https://www.pakistanbmj.com/journal/index.php/pbmj/index
ISSN (E): 2709-2798, (P): 2709-278X
Volume 9, Issue 08 (August 2026)

Original Article

OPEN ACCESS

Prevalence, Severity, and Associated Risk Factors of Computer Vision Syndrome among Undergraduate Medical Students in Peshawar: A Cross-Sectional Study Using the CVS-Q Questionnaire

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ARTICLE INFO

Keywords:
Computer Vision Syndrome, Digital Eye Strain, Medical Students, Screen Time, Ergonomics

How to Cite:
Hamza, M., Ahmed, D., Murad, H., Kakakhel, H., Khan, M. S., Arif, F., Yousafzai, S. K., Murad, S., Jahan, S., & Khan, Z. (2026). Prevalence, Severity, and Associated Risk Factors of Computer Vision Syndrome among Undergraduate Medical Students in Peshawar: A Cross-Sectional Study Using the CVS-Q Questionnaire: Prevalence, Severity, and Associated Risk Factors of Computer Vision Syndrome. Pakistan BioMedical Journal, 9(8), 11-17. https://doi.org/10.54393/pbmj.v9i8.1401

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Received Date: 13th May, 2026
1st Revision Received: 3rd June, 2026
2nd Revision Received:6th July, 2026
3rd Revision Received: 16th July, 2026
Acceptance Date: 5th August, 2026
Published Date: 31st August, 2026

ABSTRACT

Computer Vision Syndrome (CVS), also called Digital Eye Strain (DES), is one of the most common diseases and health concerns in the current digital age, particularly in individuals with prolonged screen time. **Objectives:** To assess the prevalence, severity, and risk factors of Computer Vision Syndrome among the undergraduate medical students of Peshawar by the CVS-Q Questionnaire. **Methods:** A cross-sectional analytical study was conducted among 227 undergraduate medical students from June 2025 to November 2025. Computer Vision Syndrome Questionnaire (CVS-Q) was used for data collection through a convenience sampling technique. Data were analyzed using SPSS version 27. **Results:** A total of 227 medical students participated (45.4% males, 54.6% females; mean age 21.3±1.8years). The prevalence of Computer Vision Syndrome (CVS) was 60.4%, with mild, moderate, and severe CVS being 41.4%, 15.0%, and 4.0%, respectively. CVS was significantly higher in students of public institutions (66.4% vs 48.7%, p=0.010) and continuous screen users (p=0.031). Anti-glare filter use was associated with lower CVS prevalence (p=0.007). Binary logistic regression identified institution type, continuous screen use, and anti-glare/blue-light filter use as independent factors associated with Computer Vision Syndrome. **Conclusions:** Prolonged, uninterrupted screen use and studying in public institutions were major contributors to CVS. Despite moderate awareness, gaps in preventive practices were also observed.

INTRODUCTION

Computer Vision Syndrome (CVS) or Digital Eye Strain (DES) is a considerable public health problem in this era of the technological revolution, especially among people using computer screens. Currently, 60 million people all around the globe suffer from Computer Vision Syndrome; also, one million new cases of CVS occur every year [1]. Students at

DOI: https://doi.org/10.54393/pbmj.v9i8.1401

universities, especially medical students, are seriously affected by the disease due to the extensive screen time required to complete their studies [2]. Previous research suggests that people using digital screens more than three hours daily become highly prone to CVS [3, 4]. Computer Vision Syndrome is a group of eye and vision-related problems caused by extended use of computers, tablets, e-readers, and cell phones, which places increased stress on near vision in particular [5]. Computer Vision Syndrome (CVS), also known as Digital Eye Strain (DES), is a range of ocular, musculoskeletal, and behavioral conditions caused by prolonged use of digital devices [6]. Its symptoms include dry and irritated eyes, eye strain and fatigue, blurred vision, red eyes, burning eyes, excessive tearing, double vision, headache, and light or glare sensitivity [4]. A high prevalence rate of Computer Vision Syndrome has been consistently reported among undergraduate and medical students across different countries. In Pakistan and Paraguay, the prevalence was reported as 70.4% and 82.5%, respectively. The most common symptoms found in studies include eye fatigue, eye dryness, blurred vision, headaches, and neck pain [7, 8]. Structured assessment tools such as CVS-Q were used for measuring the burden of symptoms and associated risk factors [8]. Similarly, in a cross-sectional study conducted in Oman, there was a 73.7% incidence rate of CVS in university students, where headache (52.4%) and eye strain/ fatigue (45.7%) were the predominant symptoms. Additionally, there was a significant association between CVS and poor ergonomic positioning as well as shorter viewing distance [9]. In Syria, a study involving 2,636 medical students reported that 47% of the subjects had CVS. However, it showed a very high frequency of use of digital gadgets such as smartphones (96%) among subjects and notably poor preventive practices, especially the low adherence to the 20-20-20 rule (7%) [10]. Furthermore, studies from Jordan and Iran reported prevalences of CVS among medical students from 56.3% to 76.9%. It was noted that female students had higher risks of contracting CVS than male students, as well as long hours of screen usage. Common symptoms observed among medical students with CVS included dry eyes, headache, irritation in their eyes, and watering of their eyes. The main risk factor for CVS among medical students included improper sleep before or after using screens. [11-13].

Although some reports published in various regions indicate a high prevalence rate of Computer Vision Syndrome (CVS) among medical students, there is no study available in Pakistan, specifically in Khyber Pakhtunkhwa, where the digital behavior patterns of the learners are varied. In addition to this, most of the studies previously carried out by local researchers in the area have used different approaches to measure the prevalence of CVS but have seldom made use of the CVS questionnaire. Therefore, this study aimed to determine the prevalence and severity of Computer Vision Syndrome and to evaluate its association with socio-demographic characteristics, digital device usage patterns, ergonomic factors, and preventive practices among undergraduate medical students in Peshawar, Pakistan, using the validated CVS-Q questionnaire.

METHODS

A cross-sectional analytical study was conducted among public and private undergraduate medical students from June 2025 to November 2025. Ethical approval was obtained from the Institutional Review Board & Ethical Committee (IRB&EC) of Northwest School of Medicine before data collection [Reference: IRB&EC/2025-GH/0246 dated 22 May 2025]. Data were collected from Northwest School of Medicine, Khyber Medical Colleges, Khyber Girls Medical Colleges, Rehman Medical College, Pak International Medical College, and Peshawar Medical College through a questionnaire using a convenience sampling technique. A total sample size of 227 participants was calculated using the Open Epi sample size calculator for proportions, applying the finite population correction factor where necessary, with the following values: expected proportion (p) of 82% (based on Coronel-Ocampos et al. [8]), 95% confidence interval (z = 1.96), margin of error (d) of 5% (0.05), and design effect = 1.Undergraduate medical students who used digital devices for educational or non-educational purposes and provided informed consent were included in the study. Undergraduate medical students who suffered from ocular diseases that can cause visual symptoms independently, such as glaucoma, cataracts, corneal disease, and retinal diseases, were excluded. The students who refused to give informed consent were also excluded from the study. The students who wore glasses and contact lenses were not excluded since there is a high prevalence of refractive error among the medical students. The Computer Vision Syndrome Questionnaire (CVS-Q) is a standardized assessment instrument used to diagnose the presence and severity of Computer Vision Syndrome (CVS), which is based on the 16 most commonly occurring symptoms. Ocular symptoms of computer vision syndrome may include eye fatigue, dry eye syndrome, eye burning, eye redness, blurriness, and tearing of the eyes. Non-ocular symptoms, which are assessed using the Computer Vision Syndrome Questionnaire, include headache, neck pain, and shoulder pain. Each of the symptoms is scored based on the frequency (never=0, occasionally=1, often/always=2) and intensity (moderate=1, severe=2). For each symptom, frequency is multiplied by intensity to calculate the score. A total score of 6 or higher is considered indicative of Computer Vision Syndrome. Based on the total score, CVS

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severity is classified using established cut-off values from the validated CVS-Q: no CVS (0–5), mild (6–12), moderate (13–18), and severe (≥19) [14]. The research questionnaire was carried out in the English language, with some verbal translation, so that participants could understand better and reduce the language barrier.

The collected data were analyzed using SPSS version 27.0. The prevalence rate of CVS was calculated according to the number of students who met the criteria score of ≥6. A chi-square test was applied to analyze differences between categorical data, and the Mann-Whitney U test was applied to analyze differences between continuous data. Binary logistic regression was performed using the presence of Computer Vision Syndrome as the dependent variable (0 = No CVS, 1 = CVS). Categorical predictors were entered using indicator coding with appropriate reference categories. Adjusted odds ratios (AORs) with 95% confidence intervals were reported.

RESULTS

The study was composed of a total of 227 participants, of whom 54.6% were females, whereas males constituted 45.4%. Participants in the current study were mostly from public institutions (65.6%), whereas private institutions had only 34.4% participation. When it comes to academic level, participants in 2nd year constituted 32.2%, followed by 1st year (28.2%), 3rd year (20.3%), 4th year (10.1%), and final year (9.3%). The mean age of participants was 21.30±1.80 years (Table 1).

Table 1: Socio-Demographic Characteristics, Digital Device Usage Patterns, Ergonomic Factors, and Study Habits of Participants

Variables	Category	n (%)
Socio-demographic Characteristics		
Gender	Male	103 (45.4%)
	Female	124 (54.6%)
Institute	Public	149 (65.6%)
	Private	78 (34.4%)
Year of Study	1st Year	64 (28.2%)
	2nd Year	73 (32.2%)
	3rd Year	46 (20.3%)
	4th Year	23 (10.1%)
	Final Year	21 (9.3%)
Age	Mean ± SD	21.30 ± 1.80 years
Digital Device Usage Pattern (n=227)		
University Screen Time (Computer/Laptop)	1-2 Hours	170 (74.9%)
	3-4 Hours	40 (17.6%)
	≥ 5 Hours	17 (7.5%)
Home/Hostel Screen Time (Computer/ Laptop)	1-2 Hours	117 (51.5%)
	3-4 Hours	71 (31.3%)
	≥ 5 Hours	39 (17.2%)
Handheld Devices Screen Time (Smartphone/Tablet)	1-2 Hours	44 (19.4%)
	3-4 Hours	73 (32.2%)
	5-6 Hours	60 (26.4%)
	≥ 7 Hours	50 (22.0%)
Most Screen Time	Day	105 (46.3%)
	Night	122 (53.7%)
Pattern of Screen Use	Continuous	79 (34.8%)
	Interrupted	146 (64.3%)
Main Purpose of Screen Time	Entertainment	93 (41.0%)
	Medicine/Science	73 (32.2%)
	Social Communication	53 (23.3%)
	Others	8 (3.5%)
Breaks During Device Use	Never	9 (4.0%)
	Rarely	62 (27.3%)
	Often	120 (52.9%)
	Always	36 (15.9%)
Ergonomic & Environmental Factors (n=227)		
Seating Posture	Upright with straight back	51 (22.5%)
	Bent back	68 (30.0%)
	Lying down	103 (45.4%)
	Other	5 (2.2%)
Distance From Eyes to Screen	<40 cm	99 (43.6%)
	40–70 cm	106 (46.7%)
	>70 cm	22 (9.7%)
Screen Brightness in Dark	10–30%	129 (56.8%)
	40–60%	82 (36.1%)
	≥70%	16 (7.0%)
Room Lighting	Overhead	85 (37.4%)
	Desk lamp	23 (10.1%)
	Natural light	51 (22.5%)
	Combination	68 (30.0%)
Screen Brightness Adjusted to Room	Yes	144 (63.4%)
	No	83 (36.6%)
Use of Anti-Glare / Blue-Light Filter	Yes	98 (43.2%)
	No	129 (56.8%)
Vision Correction & Study Habits (n=227)		
Wear Glasses	Yes	78 (34.4%)
	No	149 (65.6%)
Wear Contact Lenses	Yes	28 (12.3%)
	No	199 (87.7%)
Use Blue-Light Filtering Glasses	Yes	64 (28.2%)
	No	163 (71.8%)
View Reference Material While Using Screen	Yes	91 (40.1%)
	No	83 (36.6%)
Study Method	Both (Screen + Books)	186 (81.9%)
	Screens Alone	19 (8.4%)
	Books Alone	22 (9.7%)

The prevalence of Computer Vision Syndrome (CVS) was 60.4%, while 39.6% of students did not have CVS. Among the 60.4% of students who suffered from CVS, 41.4% of them suffered from mild CVS, 15% had moderate CVS, while 4% suffered from severe CVS. A significant association was observed between CVS severity and most symptoms,

DOI: https://doi.org/10.54393/pbmj.v9i8.1401

with greater severity associated with higher "always" responses and lower "never" responses. Ocular symptoms (itching, foreign body sensation, tearing, redness, eye pain, and dry eyes) increased significantly in both frequency and intensity ($p \leq 0.017$), while burning eyes increased in frequency only ($p<0.001$). Visual symptoms (blurred vision, double vision, difficulty focusing, and light sensitivity) and extraocular symptoms (headache and neck/shoulder pain) were strongly associated with higher CVS severity ($p<0.001$) (Table 2).

Table 2: Severity of CVS According to the CVS-Q Questionnaire

CVS Severity	n (%)	Total
No CVS	90 (39.6%)	39.6 %
Mild CVS	94 (41.4%)	60.4%
Moderate CVS	34 (15.0%)	
Severe CVS	9 (4.0%)	

CVS was significantly higher in public institutes (66.4% vs 48.7%), while gender showed no association ($p = 0.820$). There was a higher prevalence of CVS among those who used the screens continuously (69.6% vs 56.2%). Significant findings include awareness of CVS ($p=0.039$), recognition of symptoms by screen users ($p<0.001$), and eye examination ($p=0.029$), while others are not significant. Awareness rates about CVS were relatively low at 42.7%, with poor awareness concerning the 20-20-20 rule (25.6%) and ergonomics (34.8%). However, awareness regarding the role of electronic devices (63.9%) and their effects on eye health (78.4%) and decreasing the usage of digital devices (74.4%) was relatively high. Relief was mostly provided by taking breaks, whereas adjusting screens (52.4%), blinking (39.2%), using artificial tears (33.0%), and closing eyes (26.0%) were relatively infrequent methods for relieving CVS. The most common preventive measures included taking regular breaks (76.7%), proper posture (67.4%), and suitable screen distance (68.7%) (Table 3).

Table 3: Association of Socio-Demographic, Behavioral, and Preventive Factors with CVS (n=227)

Variables	Category	CVS, n (%)	No, CVS n (%)	χ^2	p-value
Gender	Male	63 (61.2%)	40 (38.8%)	0.052	0.820
	Female	74 (59.7%)	50 (40.3%)		
	Total	137 (60.4%)	90 (39.6%)		
Institute	Private	38 (48.7%)	40 (51.3%)	6.722	0.010
	Public	99 (66.4%)	50 (33.6%)		
Year of Study	First Year	39 (60.9%)	25 (39.1%)	4.666	0.323
	Second Year	43 (58.9%)	30 (41.1%)		
	Third Year	29 (63.0%)	17 (37.0%)		
	Fourth Year	17 (73.9%)	6 (26.1%)		
	Final Year	9 (42.9%)	12 (57.1%)		
Screen Usage Pattern	Continuous	55 (69.6%)	24 (30.4%)	6.950	0.031
	Interrupted	82 (56.2%)	64 (43.8%)		
Main Purpose	Medicine/Science	27 (37.0%)	46 (63.0%)	0.543	0.909
	Social Communication	23 (43.4%)	30 (56.6%)		
	Entertainment	37 (39.8%)	56 (60.2%)		
	Others	3 (37.5%)	5 (62.5%)		
Most Screen Time	Night	52 (42.6%)	70 (57.4%)	0.976	0.323
	Day	38 (36.2%)	67 (63.8%)		
Anti-glare / Blue-light Filter	Yes	29 (29.6%)	69 (70.4%)	7.288	0.007
	No	61 (47.3%)	68 (52.7%)		
Awareness, Perception and Practices	Awareness of CVS	51 (52.6%)	46 (47.4%)	4.279	0.039
	20–20–20 Rule Awareness	33 (56.9%)	25 (43.1%)	0.389	0.533
	Ergonomic Practice	49 (62.0%)	30 (38.0%)	0.142	0.707
	Device Cause Belief	104 (71.7%)	41 (28.3%)	21.693	<0.001
	Screen Lifestyle Belief	113 (63.5%)	65 (36.5%)	3.378	0.066
	Reduce Screen Time	107 (63.3%)	62 (36.7%)	2.424	0.120
Relief Measure	Take Breaks	105 (60.7%)	68 (39.3%)	0.035	0.851
	Blink Frequently	54 (60.7%)	35 (39.3%)	0.006	0.937
	Artificial Tear Drops	36 (48.0%)	39 (52.0%)	7.142	0.008
	Close Eyes Briefly	29 (49.2%)	30 (50.8%)	4.179	0.041
	Screen Brightness/Antiglare	65 (54.6%)	54 (45.4%)	3.433	0.064

DOI: https://doi.org/10.54393/pbmj.v9i8.1401

Preventive Measures Considered Important	20–20–20 Practice	106 (60.9%)	68 (39.1%)	0.100	0.752
	Posture Maintenance	89 (58.2%)	64 (41.8%)	0.934	0.334
	Screen Distance	96 (61.5%)	60 (38.5%)	0.293	0.588
	Blue Light Filter	80 (62.0%)	49 (38.0%)	0.345	0.557
	Regular Eye Checkups	50 (52.1%)	46 (47.9%)	4.754	0.029
	Blinking Frequency	50 (60.2%)	33 (39.8%)	0.001	0.979
	Room Lighting Adjustment	83 (59.3%)	57 (40.7%)	0.174	0.677

The Multivariate binary logistic regression analysis showed that the result was statistically significant (χ^2 = 20.999, p=0.007). Goodness of fit of the model was satisfactory (Hosmer-Lemeshow χ^2 = 7.426, p=0.386; Cox & Snell R^2 = 0.088, Nagelkerke R^2 = 0.120). The finding showed that the odds ratio of Computer Vision Syndrome (CVS) among the students enrolled in private colleges was statistically significantly lower than that of the students enrolled in public colleges (AOR = 0.534, 95% CI: 0.297-0.960; p=0.036). In contrast, it was seen that the continuous screen usage (AOR = 2.064, 95% CI: 1.100-3.874; p = 0.024) and the use of anti-glare/blue-light filters (AOR = 2.175, 95% CI: 1.213–3.901; p=0.009) were independently associated with higher odds of CVS, whereas gender, daily screen time, and break frequency were not significantly associated with the outcome (p>0.050). However, individuals who engaged in continuous screen viewing had higher CVS-Q scores than individuals who engaged in intermittent screen viewing (Mean Ranks: 124.75 and 106.64; U = 4838.500, Z = –1.996, p=0.046). However, there was no significant association of CVS-Q scores with gender, institute type, use of anti-glare or blue light filter, and breaks per day (p>0.005) (Table 4).

Table 4: Binary Logistic Regression Analysis for Factors Associated with Computer Vision Syndrome (CVS)

Variables	B	SE	Adjusted OR (95% CI)	p-value
Gender (Male vs Female)	-0.084	0.292	0.919 (0.518–1.631)	0.774
Institution (Private vs Public)	-0.628	0.300	0.534 (0.297–0.960)	0.036
Screen time (>6 h/day vs ≤6 h/day)	0.169	0.292	1.185 (0.668–2.099)	0.562
Screen usage pattern (Continuous vs Interrupted)	0.725	0.321	2.064 (1.100–3.874)	0.024
Anti-glare/blue-light filter (Yes, vs No)	0.777	0.298	2.175 (1.213–3.901)	0.009

*Computer Vision Syndrome (0 = No CVS, 1 = CVS). Reference categories: Female, Public institution, ≤6 hours/day screen time, interrupted screen use, and no anti-glare/blue-light filter

DISCUSSION

According to this study, the prevalence rate of CVS among medical students in Peshawar was 60.4%. The most affected students had mild computer vision syndrome (41.4%), followed by moderate (15.0%) and severe (4.0%). This prevalence rate was lower than the 95% prevalence rate observed in Saudi health sciences students [15], but it was consistent with the global meta-analysis by Dimitrijević *et al.* [3]. In the present study, CVS was assessed using the validated CVS-Q questionnaire, which incorporates both symptom frequency and intensity for diagnosis and severity classification [14]. Among the most prevalent symptoms are Ocular itching (61.7%), tears (55.5%), and eye burning (54.6%), whereas headache (49.3%) and neck/shoulder pain (48.0%) are among the least common. Headache was the most common complaint among Ethiopian bank employees (50.7%) [16], while tired eyes (76.6%) and headache (57.2%) were the most commonly reported symptoms among undergraduate students in the Kathmandu Valley, Nepal [17], consistent with the worldwide meta-analysis by Dimitrijević *et al.* [3]. The prevalence of Computer Vision Syndrome was substantially greater in students who used screens continuously (69.6%) compared to those who used them intermittently (56.2%) (p=0.031) and in public institutions (66.4%) compared to private institutions (48.7%) (p=0.010). Multivariable logistic regression showed that students from private institutions had significantly lower odds of CVS than those from public institutions (AOR = 0.534, p=0.036), whereas continuous screen use (AOR = 2.064, p=0.024) and anti-glare/blue-light filter use (AOR = 2.175, p=0.009) were independently associated with higher odds of CVS. The latter finding may reflect reverse causality; whereby symptomatic students are more likely to use protective filters. Although anti-glare/blue-light filter use appeared protective in the unadjusted analysis, the adjusted logistic regression showed higher odds of CVS, suggesting confounding and possible reverse causality, whereby students with symptoms were more likely to adopt these protective measures. For Ethiopian bank employees who worked more than eight hours a day, the AOR for developing CVS was 2.11 [16], which is in line with results published by Bajracharya *et al.* [18]. Although students using anti-glare/blue-light filters had higher odds of CVS in our study, this association may reflect reverse causality or residual confounding rather than a harmful effect of the filters. Current evidence regarding the effectiveness of blue-light filtering lenses in reducing digital eye strain and visual fatigue remains inconclusive [19, 20]. Despite 78.4%

DOI: https://doi.org/10.54393/pbmj.v9i8.1401

of respondents acknowledging that screens damaged their vision and 74.4% being willing to cut back on screen time, only 42.7% of respondents were aware of CVS, and only 25.6% were aware of the 20-20-20 rule. 45.4% of students studied while lying down, and 43.6% had screens positioned less than 40 cm away, indicating poor ergonomic practices. The significance of awareness campaigns inside institutions is shown by this knowledge-practice gap [17]. In contrast to other meta-analyses, there was no correlation between age or gender and CVS (p=0.798 and 0.820, respectively), in contrast to the global meta-analysis that revealed that females were more likely to develop CVS (OR = 1.74) [3].

There are several limitations in this study. First, its cross-sectional design makes it impossible to prove a link between screen time, ergonomics, and CVS. Second, use of subjective measures may have resulted in issues of social desirability and recall bias. Third, as the data were collected from six different medical colleges in Peshawar, results are unlikely to generalize to any other region in Pakistan or any other field apart from medical science students. The diagnosis was made exclusively using the CVS-Q, without a clinical ocular examination, which might have led to some misclassification. Future research should adopt a longitudinal and multicenter design in Pakistan, including clinical ocular exams, and evaluate the effectiveness of awareness and ergonomics interventions.

CONCLUSIONS

Computer Vision Syndrome (CVS) is highly prevalent among medical students in Peshawar, affecting more than half of the participants, with most cases being mild in severity. It is significantly associated with students who study in public institutions and prolonged screen use. Although anti-glare/blue-light filter use was independently associated with higher odds of CVS, this finding likely reflects reverse causality, whereby symptomatic students were more likely to adopt these protective measures. The symptoms that are usually experienced include itching of the eyes, watering of the eyes, a burning sensation, and headaches. Despite awareness of screen-related harm, knowledge of preventive measures and ergonomic practices remains limited. These findings highlight the need for targeted awareness programs, promotion of healthy screen habits, and ergonomic interventions to reduce CVS burden and improve student well-being.

Authors' Contribution

Conceptualization: MH, DA, HK
Methodology: MH, DA, HM, HK, MSM, FA, SKY, SM, SJ, K
Formal analysis: MH, DA, HK
Writing and Drafting: MH, DA, HM, HK, MSM, FA, SKY, SM, SJ, ZK
Review and Editing: MH, DA, HM, HK, MSM, FA, SKY, SM, SJ, ZK

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article.

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