JOURNAL OF BASHIR INSTITUTE OF HEALTH SCIENCES

RESEARCH ARTICLE

OPEN ACCESS

ARTICLE INFO
*Date Received:*
*February 07, 2025*
*Date Revised:*
*March 01, 2025*
*Date Published Online*
*June 30, 2025*

# Prevalence of Computer Vision Syndrome among Staff Working at the Radiology Department in Healthcare Settings of Islamabad, Pakistan

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ABSTRACT

**Background:** Computer Vision Syndrome (CVS) is a severe occupational health issue in the field of radiology because of the widespread application of digital displays (e.g., PACS) to interpret images. Although the risks of CVS are well known globally due to their visual strain, headaches, and decreased productivity, little research has been conducted on radiology personnel in low-resource countries. This paper explored the prevalence of CVS, risk factors, and symptom profile in radiology workers in Islamabad, Pakistan, where the use of digital healthcare is rapidly growing without the corresponding protective strategies. **Methods:** A cross-sectional survey was done in 161 radiology employees (radiologists, technologists, nurses) of both government and privately owned hospitals in Islamabad. The participants were recruited through consecutive sampling and were evaluated with the help of the validated CVS-QT questionnaire that evaluated socio-demographics, screen exposure, ocular symptoms, and preventive practices. CVS was categorized as a symptom score of 6 or more, mild (6-19), moderate (10-14), or severe (15-18). The analysis of data was done in SPSS v 28, with descriptive statistics and chi-square tests used to determine risk-symptom relationships (significance: $p < 0.05$). **Results:** The prevalence of Computer Vision Syndrome among the radiology staff under investigation was 49.1%, with the severity of symptoms being mild (22.4%), moderate (15.5%), and severe (9.3%). The most common symptoms were headache, tearing eyes, and itching eyes, with 70.9%, 50.3%, and 47.9% of the participants reporting them, respectively. The top modifiable risk factors that were significantly linked to CVS were exposure to screen time all day long, more than five hours (45.3% of staff), poor workstation ergonomics where monitors are placed below eye level (47.2%), and lack of preventive measures (54.7%). It is worth noting that younger staff (20-29 years) and female workers had disproportionately increased rates of severe symptoms. There was a significant lack of protective measures, with only 31.7% taking regular breaks and only 5.0% using eye drops lubricating despite evidence-based recommendations. **Conclusion:** CVS is highly prevalent among Pakistani radiology staff, driven by modifiable occupational hazards: prolonged screen time, poor ergonomics, and inadequate eye protection. The disproportionate burden on younger professionals and women underscores the need for institutional interventions, including mandatory break protocols, ergonomic

workstation redesigns, and accessible ocular health resources. Prioritizing these measures is essential to safeguard workforce well-being and diagnostic efficiency in radiology.

**Keywords:** Computer Vision Syndrome, Image Interpretation, PACs, MRI, Radiologists

## INTRODUCTION

The rapid growth of digital devices has become an essential part of life, and millions of people of all ages are at risk of developing Computer Vision Syndrome (CVS) due to the rapid adoption, global utilization, and adoption of these devices [1]. The usage of digital devices has grown in underdeveloped nations, leading to a high burden of CVS caused by inadequate accessibility, low use of personal protective equipment, and little time for breaks while using digital devices [2]. With the introduction of information and communication technologies (ICT) and devices like computers, smartphones, and laptops with visual display terminals, transforming work, management, and organization, as well, human-computer interaction is causing advancement in human life [3]. Research concentrates on the interaction between humans and computers. In accordance with the Sixth European Working Condition Survey, managers, professionals, and technicians are the users of ICT who use it the most frequently in the healthcare industry [4]. Human-computer interaction still also has health hazards for workers, especially for electronic users who might experience visual and ocular problems. These problems include dry eyes, blurred vision, burning sensations, irritation, redness, and eyestrain [5]. These symptoms are called Computer vision syndrome (CVS) in medical terms, and prevalence rates range from less than 20% to more than 80%. Eye issues can also be caused by external variables like temperature, humidity, glare, screen brightness, lighting, and workstation structure [1, 6].

There is a lack of scientific study on the effects of Visual Display Terminal (VDT) exposure on the visual health of medical staff [7]. The CVS is the most prevalent workplace hazard of the twenty-first century, being on the rise; it is seen as a public health emergency that lowers workers' quality of life, job satisfaction, productivity, and their physical and physiological well-being [8]. The continued use of digital devices for more than two hours per day is a major cause of multiple vision-related problems, leading to 60 to 70 million CVS cases worldwide, including one million new cases being reported annually [3, 8]. The American Optometric Association also indicates that using digital devices constantly for two hours is a greater cause of digital eye strain [9]. Several media articles have been published since the beginning of the COVID-19 epidemic that covered the growth in CVS at that time [9]. Radiologists require prolonged use of monitor displays, like many other professions, which can impair their blinking reflex. Air conditioners in the workplace of Radiologists increase tear evaporation, putting radiologists at risk for dry eye [10]. Other risk factors, like using NightScope while working and being exposed to radiation during diagnosis, also decrease blinking rate, causing dry eye [10]. Radiologists are more prone to distinctive occupational health hazards than physicians working in other departments. In the past years, hazards to radiologists that are caused by too much exposure to ionize radiation have received much more attention [11].

However, over the last few decades, many changes related to information technology in the radiology department have been observed, i.e., changing from film-based to filmless imaging, which creates more challenges and workload for radiologists [11]. A vital component of the regular work of radiologists includes watching and sitting near -resolution display monitor with high brightness to investigate the reports and radiological images of patients; these high-resolution display monitors are called PACS (picture archiving and communication system) [12]. Virtual Desktops (VDTs) are being used because of the significant effect that digital technologies have on the eye health of healthcare workers. Few studies have examined how VDT exposure affects the eye health of healthcare workers. According to research, which was conducted in Canada, visual strain syndrome (VSS) affects radiologists at an average rate of 36% [13]. The most significant factors of Computer vision syndrome were gender, age, working longer hours and shifts, taking fewer breaks, and performing computed tomography screening [14]. Another study conducted in 2019 discovered that sitting for longer hours in front of computer displays made radiologists work exactly like computer specialists [15].

Radiologists are particularly vulnerable to CVS due to extensive screen use for image interpretation and administrative tasks, which is linked to sedentary behaviours and health concerns [16]. Differences in lighting and task variation between radiology rooms and typical offices do little to mitigate this risk [17]. CVS contributes to reduced productivity, ocular and musculoskeletal issues, and disrupted circadian rhythms, yet remains underrecognized, especially in low-resource countries [18]. However,

Limited research has examined its prevalence among radiologists; therefore, this study aims to investigate self-reported CVS prevalence and associated ocular symptoms, i.e., headaches, dry eyes, and eye strain, among radiology departments' healthcare workers in Pakistani healthcare facilities to provide preventive strategies like refractive correction, vergence management, and blink training.

## MATERIALS AND METHODS

The study was cross-sectional to determine the prevalence of Computer Vision Syndrome (CVS) among the healthcare professionals of the radiology department of the public and private hospitals in Islamabad, Pakistan. The medical professionals involved in the active process of image construction, interpretation, or machine handling (e.g., radiologists, technologists, nurses) were included in the study population, whereas non-medical staff (administrators, receptionists, sanitary workers) were excluded. A non-probability method called consecutive sampling was used to enrol participants who fit the inclusion criteria within a specified duration. The determination of sample size was done using OpenEpi software, and the result was 161 participants out of a target population of 275 (95% confidence level; 5% margin of error).

## DATA COLLECTION PROCEDURE

The validated CVS-QT questionnaire [19] was used to collect data which assessed four important domains: socio-demographics (age, gender, professional role, education level, and work experience), computer usage patterns (daily screen hours, years of computer use, and workstation ergonomics), CVS symptoms (frequency - never, occasionally, often, or always - and severity - moderate or intense - of 16 ocular symptoms such as headache and dry eyes), and preventive practices (use of regular breaks, anti-reflective glasses, and lubricating eye [19]. The participants were categorized as having CVS when their sum of symptoms was 6 or more points, and severity was rated as None (0-5), Mild (6-9), Moderate (10-14), or Severe (15-18). Before implementation, written consent of the original developers of the questionnaire was sought, institutional approvals were obtained in all the hospitals where the survey was to take place, anonymity of the participants was ensured by avoiding the use of personal identifiers, and written informed consent was obtained from all the participants before the administration of the survey.

## STATISTICAL ANALYSIS

The statistical analysis was conducted with the use of SPSS software (Version 28), where the descriptive statistics were used to determine frequencies and percentages of demographic variables and CVS symptom prevalence patterns. Chai-square analyses were performed to test the relationships between the important demographic variables (age groups, gender, professional roles) and CVS severity grades. The Chai-square analyses were also performed between the variables of risk exposure (daily screen time duration, use of preventive measures) and the levels of symptom severity. Ethical compliance was adhered to throughout the analytical process to ensure that all the data was used in research only, and confidentiality measures were taken to ensure that the identity of the participants remained anonymous.

## RESULTS

The participant's demographic details are shown in Table 1. The male was in higher proportion as compared to females. Males participated in the study were 52.8% and females were 47.2%. Those aged 20-29 years comprised many of the participants (57.1%). There were only 11 participants who were aged 50-59, with 6.8%. Aged 40-49 were about 13.0% and aged 30-39 were only 23.0%. Most of the participants were technologists, 52, with 32.3% because during data collection, author noted that technologists not only work with medical equipment like PACS but also use computers or smartphones for sending or receiving reports of the patients and entering patient data in private hospitals. Doctors were about 26.1% and Radiologists were about 14.3%. Nurses were about 17.4% and the least survey was filled by Residents of the Radiology Department with 9.9%. A total of 50.3% of the types of organization were public, and 49.7% were private. The distribution of work experience of staff in radiology department was as follows: 57.8% of staff had 1-5 years of work experience, 19.3% had 5-10 years of work experience, 14.3% had 11-15 years of work experience and 6.2% had 10-20 years of work experience in radiology department while 6.2 had greater than 20 years of work experience. In terms of educational level among staff working in the radiology department, most of the

radiology staff had bachelor's degrees, with 49.1%, 28.6% completed their master's degrees, and almost 22.4% were undergraduate. When asked about the eye disease other than near and farsightedness, the majority (81.4%) of the participants answered that they had no eye disease other than near or farsightedness, while 18.6% answered yes, meaning they had eye disease other than near or farsightedness.

**Table 1:** Socio Demographic Characteristics of the Study Participants (N=161)

| Variables | Categories | F | % |
|---|---|---|---|
| Age (Years) | 20-29 | 92 | 57.10 |
| | 30-39 | 37 | 23.00 |
| | 40-49 | 21 | 13.00 |
| | 50-59 | 11 | 6.80 |
| Gender | Male | 85 | 52.80 |
| | Female | 76 | 47.20 |
| Profession Rank | Doctors | 42 | 26.10 |
| | Technologists | 52 | 32.30 |
| | Nurses | 28 | 17.40 |
| | Radiologists | 23 | 14.30 |
| | Residents | 16 | 9.90 |
| Organization | Public | 81 | 50.30 |
| | Private | 80 | 49.70 |
| Work Experience | 1-5 Years | 93 | 57.80 |
| | 6 to 10 Years | 31 | 19.30 |
| | 11 to 15 Years | 23 | 14.30 |
| | 16 to 20 Years | 10 | 6.20 |
| | ≥ 21 Years | 4 | 2.50 |
| Education Level | Undergraduate | 36 | 22.40 |
| | Bachelor | 79 | 49.10 |
| | Master | 46 | 28.60 |
| Eye Disease History | Yes | 30 | 18.60 |
| | No | 131 | 81.40 |

The prevalence of Computer Vision Syndrome among healthcare workers working inside radiology departments of public and private hospitals in Islamabad was observed to be 79 (49.07%), as illustrated in Figure 1.

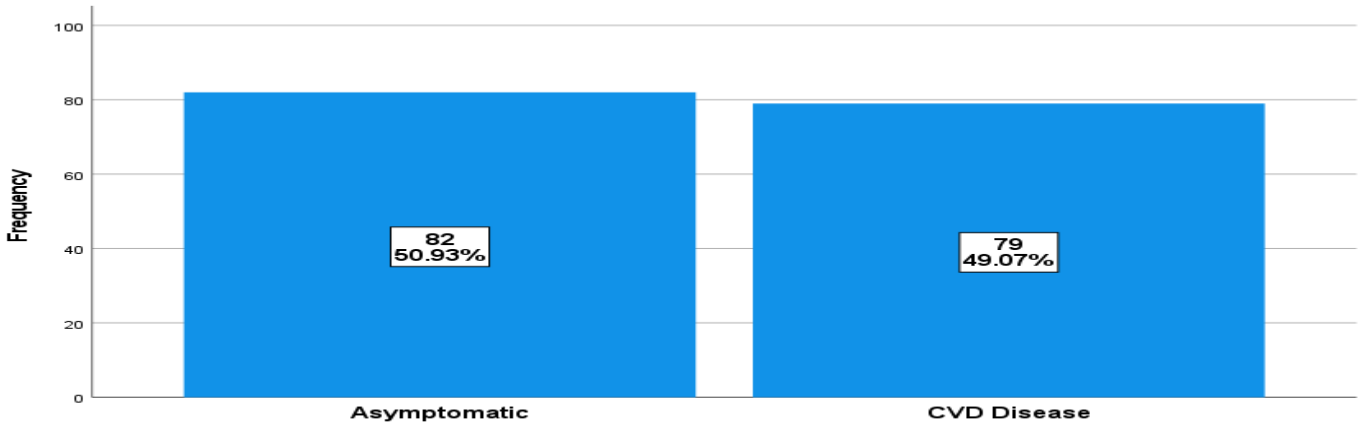

**Figure 1:** Prevalence of Computer Vision Syndrome among Healthcare Workers of Radiology Department

The study of risk factors in 161 radiology personnel identified critical trends in the development of Computer Vision Syndrome (CVS). Almost one-half (45.3%) were high screen exposure (>5 hours) daily, which is a statistically significant risk factor (p≤0.001). Computer experience was distributed almost equally (50.3% 7 years and less vs. 49.7% more than 7 years), but both groups had strong associations with CVS (p ≤0.001). Ergonomics of workstations became one of the main issues, with 47.2% of the respondents' locating monitors below eye level, a setup that is strongly associated with symptoms (p=0.001). Although most of the respondents (69.6%) did not wear protective eyewear, glass wearers (30.4%) were still highly susceptible (p≤0.001). Most importantly, 54.7 % did not take any preventive measures even though they had strong correlations of symptoms (p≤0.001). Regular breaks (31.7%), anti-reflective glasses (16.1%), and screen filters (9.9%) were the most common protections adopted. There was low use of lubricant eye drops, which are critical to ocular surface health (5.0%). All these findings establish the fact that long-term exposure to screens,

**Table 2:** Computer Vision Syndrome (CVS) Risk Factors and Preventive Practices (N=161)

| | | Computer Vision Syndrome | | |
|---|---|---|---|---|
| Variable | Category | Frequency (n) | Percentage (%) | P-Value |
| Daily Hours on Computer | 0–5 hours | 88 | 54.70 | ≤0.001 |
| | >5 hours | 73 | 45.30 | |
| Years of Computer Use | 0–7 years | 81 | 50.30 | ≤0.001 |
| | >7 years | 80 | 49.70 | |
| Computer Placement | At/Above Eye Level | 85 | 52.80 | ≤0.001 |
| | Below Eye Level | 76 | 47.20 | |
| Wearing Glasses | Yes | 49 | 30.40 | ≤0.001 |
| | No | 112 | 69.60 | |
| Use of Preventive Measures | Yes | 73 | 45.30 | ≤0.001 |
| | No | 88 | 54.70 | |
| | Regular breaks | 51 | 31.70 | |
| | Antireflective glasses | 26 | 16.10 | |
| Type of Measures Used | Lubricant eye drops | 8 | 5.00 | ≤0.001 |
| | Screen filters/guards | 16 | 9.90 | |
| | None | 60 | 37.30 | |

Table 3 shows the prevalence of different symptoms of CVS among participants. The symptoms that were most reported by participants include headache with 70.9%, itching eyes 47.9% and tearing eyes 50.3%. Other common symptoms were eye pain with 42.8%, sensitivity to light with 47.2% and blurred vision with 37.9%. Furthermore, excessive blinking and burning eyes were felt by 31.7% of participants. Whereas difficulty focusing on near vision was reported by 39.1% of the participants, and dry eyes were felt by 32.3% of the participants. Lastly, heavy eyelids with 26.1% and colored halos around objects (19.9%) were the least common symptoms reported by participants.

**Table 3:** Reported Symptoms of Computer Vision Syndrome among Healthcare Workers of Radiology Department (N:161)

| Symptom | Frequency (n) | Percentage (%) |
|---|---|---|
| Headache | 114 | 70.90 |
| Tearing eyes | 81 | 50.30 |
| Itching eyes | 77 | 47.90 |
| Photophobia (light sensitivity) | 76 | 47.20 |
| Eye pain | 69 | 42.80 |

| | | |
|---|---|---|
| Difficulty focusing | 63 | 39.10 |
| Blurred vision | 61 | 37.90 |
| Eye redness | 61 | 37.90 |
| Worsening vision | 53 | 32.90 |
| Dry eyes | 52 | 32.30 |
| Burning eyes | 51 | 31.70 |
| Excessive blinking | 51 | 31.70 |
| Feeling of foreign body | 49 | 30.50 |
| Double vision | 49 | 30.50 |
| Heavy eyelids | 42 | 26.10 |
| Colored halos | 32 | 19.90 |

The distribution of Computer Vision Syndrome severity among the 161-radiology staff revealed significant patterns across demographic and occupational factors. Overall, 50.9% (n=82) of participants were asymptomatic, while 22.4% (n=36) exhibited mild symptoms, 15.5% (n=25) moderate symptoms, and 9.3% (n=18) severe symptoms. Notable age disparities emerged, with the 20-29 years' cohort (n=92) showing the highest severe symptom prevalence (10.9%) and lowest asymptomatic rate (50.0%). Gender stratification revealed that female staff (n=76) experienced triple the severe symptom rate (17.1%) of their male counterparts (5.9%), despite comparable proportions in mild and moderate categories. Workplace setting differences were observed, with private hospital staff (n=80) demonstrating higher severe symptom prevalence (12.5%) than public hospital staff (9.9%). Experience-level trends indicated early-career personnel (1-5 years, n=93) had the lowest asymptomatic rate (44.1%) and highest moderate symptom prevalence (20.4%). Most strikingly, staff with pre-existing eye conditions (n=30) showed extreme vulnerability, with 93.3% (n=28) exhibiting symptoms (30.0% mild, 33.3% moderate, 30.0% severe). Both extended computer use (>7 years, n=80) and absence of protective measures (n=88) correlated with elevated symptom severity, with 51.2% and 47.7% of these groups, respectively, developing symptoms. All subgroup comparisons demonstrated statistically significant differences in symptom severity distribution.

**Table 4:** Severity of Computer Vision Syndrome (CVS) Across Participant Characteristics [N=161]

| Characteristic | Non-Diseased | CVS Diseased | | | P-value |
|---|---|---|---|---|---|
| | F (%) | Mild: F (%) | Moderate: F (%) | Severe :F (%) | |
| Total (N = 161) | 82 (50.9%) | 36 (22.4%) | 25 (15.5%) | 18 (9.3%) | ≤0.001 |
| Age 20–29 (n = 92) | 46 (50.0%) | 19 (20.7%) | 17 (18.5%) | 10 (10.9%) | ≤0.001 |
| Male (n = 85) | 47 (55.3%) | 19 (22.4%) | 14 (16.5%) | 5 (5.9%) | ≤0.001 |
| Female (n = 76) | 35 (46.1%) | 17 (22.4%) | 11 (14.5%) | 13 (17.1%) | ≤0.001 |
| Public (n = 81) | 44 (54.3%) | 18 (22.2%) | 11 (13.6%) | 8 (9.9%) | ≤0.001 |
| Private (n = 80) | 38 (47.5%) | 18 (22.5%) | 14 (17.5%) | 10 (12.5%) | ≤0.001 |
| Experience 1–5 yrs (n=93) | 41 (44.1%) | 22 (23.7%) | 19 (20.4%) | 11 (11.8%) | ≤0.001 |
| Eye disease (Yes = 30) | 2 (6.7%) | 9 (30.0%) | 10 (33.3%) | 9 (30.0%) | ≤0.001 |
| Computer Use > 7 yrs | 39 (48.8%) | 15 (18.8%) | 14 (17.5%) | 12 (15.0%) | ≤0.001 |
| No protective measures | 46 (52.3%) | 18 (20.5%) | 12 (13.6%) | 12 (13.6%) | ≤0.001 |

## DISCUSSION

Computer vision syndrome is also called digital eye strain (DES), which causes eye strain, fatigue, and blurred vision. Non-ocular symptoms, which include shoulder, neck, and headache serve as a sign of CVS symptoms [16]. Computer vision syndrome or digital eye strain is considerably more likely to occur when bright screens are utilized for longer than two hours [19], and in this study research almost 36 participants were those who had mild CVS symptoms and spent 0-5 and above 5 hours on computers.

With the replacement of outdated films with VDUs (computerized video displays) such as PACS, these recent advances in the radiology department make radiologists more prone to CVS as they spend more hours in front of the screen [20]. Multiple reasons contributed to CVS in staff working at the radiology department; the first is the nightscope, a common tool in most radiology departments that is used to assess films. Secondly, working in front of computer monitors for a longer period because every radiology machine has displays or computers to create film reports, all these circumstances result in a CVS prevalence, and it is also true for all medical professionals. Another factor that can cause dryness of the eyes is due to air conditioners that cause tears to evaporate [21].

The survey was completed by 161 participants, out of whom 52.8% were males and 47.2% were females. Most of the participants were from 20 to 29, with 57.1% and from 30-39, with 23.0%, this is conceded with another study research which was carried out in Saudi Arabia, where 56.1% were males and 43.9% were females and participants were from 30 to 39 and lower than 30 age [22]. Most of the participants (57.8%) in the study research had work experience of 1 to 5 years in the radiology field. This is in comparison to a study that was conducted in major cities of Pakistan, in which the work experience of most participants was less than five hours, with 57.9% [20, 22]. Most of the participants in this study were technologists (32.3%) and doctors (26.1%), and were nurses, radiologists, and residents. This study explored that there were many articles related to CVS among radiologists and radiology departments but did not consider technologists who were also working in radiology departments, so this study considered technologists. Technologists in the private sector use computers and mobile phones to enter patients' data and to deliver or send the patients' data to radiologists and doctors. However, the Chi-square test indicates that longer computer usage is linked with more severe cases of CVS symptoms [20, 22].

Most of the participants (31.7%) in the study research took regular breaks while using computers or VDUs. According to research conducted by Chawla et al. [20], one of the most effective ways to minimize digital eye strain in radiologists is to take regular breaks between work, no matter how long they last. Only a few participants, about 5.0%, were using lubricant eye drops, which is also in comparison to the study conducted by [23], in which 5.3% of the participants were using lubricant eye drops for any eye-related problems. The European Agency for Safety and Health at Work developed rules and regulations to reduce CVS prevalence, which provides that firms offer regular eye checkups and breaks when employees are at work [11]. The dry eye symptoms can be effectively minimized, and future worsening can be prevented with early examination and treatment [24].

In this study, the major symptoms of CVS reported by radiology staff were headache (70.9%), tearing eyes (50.3%), and itching eyes (47.9%), followed by sensitivity to light (47.2%), eye pain (42.8%), and blurred vision (37.9%). Less common symptoms included excessive blinking and burning eyes (31.7%), heavy eyelids (26.1%), and coloured halos around objects (19.9%). These findings are consistent with a study conducted in major cities of Pakistan, where headache (69.3%), blurred vision (46.2%), and itching eyes (54.3%) were most frequently reported [25], as well as studies in Saudi Arabia and India that reported headache, dryness, blurred vision, photophobia, burning, and tired eyes as common complaints [25]. Unlike previous research that often relied on unvalidated symptom reporting, this study used a validated CVS questionnaire developed by del Mar Seguí et al. to assess symptom frequency and intensity. The prevalence of CVS among radiology department staff in this study was 47.2%, which is lower than the 65.4% reported by Alhasan & Aalam [26] in a larger cohort of 416 participants and slightly lower than the 56.75% prevalence reported among nurses by Artime-Ríos et al. [16].

However, according to Anbesu & Lema, Pakistan shows one of the highest CVS prevalence rates, yet radiologists—who are at greater risk—remain underrepresented in research, highlighting the importance of this study, which included all radiology department staff, including doctors, residents, radiologists, and nurses [25]. There are several recommendations for preventive measures that can be taken for computers or other electronic devices, such as PACS. Such as taking regular breaks when using a computer and following the 20/20/20 rule that requires participants to examine 20 feet within 20 minutes for a minimum of 20 seconds. According to the study, which was conducted [27], people who take regular breaks had a minimized chance of acquiring CVS symptoms than people who did not. Also, the use of lubricant eye drops is important to enhance tear film stability. The use of lubricants to improve tear film stability is also crucial since it has been demonstrated to alleviate ocular pain in computer users. Similarly anti anti-reflective glasses can block blue light rays that can cause photophobia [28].

## LIMITATIONS AND RECOMMENDATIONS

This study's limitations include its reliance on self-reported symptoms without clinical verification, potential sampling bias from excluding non-medical radiology staff, and a cross-sectional design that precludes causal inference. Future research should incorporate longitudinal assessments with objective biometric measures (e.g., blink rate sensors), expand sampling to include administrators and receptionists, and evaluate targeted interventions like structured break protocols or ergonomic workstation redesigns in radiology settings.

## CONCLUSION

This study confirms Computer Vision Syndrome as a critical occupational hazard in radiology, driven primarily by modifiable workplace factors: prolonged screen exposure, suboptimal ergonomic setups, and inadequate protective practices. The disproportionate severity among younger professionals and female staff underscores systemic vulnerabilities, while the widespread underutilization of evidence-based interventions like regular breaks and ocular lubrication reveals urgent institutional gaps. These findings necessitate immediate workplace reforms—including mandatory ergonomic standards, structured break protocols, and accessible eye health resources—to mitigate a condition that fundamentally compromises both workforce well-being and diagnostic efficacy in radiology practice

## CONFLICT OF INTEREST

The authors declare that they have no competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## AUTHORS' CONTRIBUTIONS

MW conceived and designed the study, collected data, and prepared the initial draft of the manuscript. PA supervised the research process, critically revised the manuscript, and handled correspondence. AH performed data analysis, interpreted the findings, and contributed to drafting the results. MPN conducted the literature review, assisted with data entry, and supported manuscript preparation. SY provided statistical assistance, proofread the manuscript, and contributed to the final review for intellectual content. All authors read and approved of the final manuscript.

## ACKNOWLEDGEMENT

We acknowledge the research and academic support provided by Dr. Faiza Khan, which remains a key factor for the completion of this research study.

## FUNDING

No funding was obtained for this study.

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