PACIFIC JOURNAL OF MEDICAL SCIENCES
{Formerly: Medical Sciences Bulletin}
ISSN: 2072 – 1625

Pac. J. Med. Sci. (PJMS)
www.pacjmedsci1625.com. Email: managingeditorpjms1625@gmail.com.

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Submitted: November 2024; Accepted: December 2024

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ABSTRACT:
The use of computers, smartphones, mobile phones, and similar digital devices is among the daily routine of students worldwide. However, frequent use of these devices can lead to a complex set of ocular and non-ocular symptoms collectively known as Computer Vision Syndrome (CVS) or Digital Eye Strain (DES). Prolonged use, along with factors such as improper sitting positions, incorrect viewing distances, and a lack of protective practices, are associated with CVS, which can vary in frequency and intensity. Currently, there is a lack of published data on the awareness and prevalence of CVS-associated risk factors among students at the University of Papua New Guinea (UPNG). The objectives of this study were to assess the level of awareness and prevalence of CVS among undergraduate students at UPNG. This institution-based, non-clinical, cross-sectional quantitative study was conducted at the Taurama and Waigani campuses of UPNG. The study population included registered students for the 2024 academic session at both campuses. Simple random sampling was used to select participants. Data were collected using a modified and validated version of the "Computer Vision Syndrome Questionnaire" (CVS-Q). Statistical analysis was performed using Excel MS Data Pack software. In Taurama campus, 55.1% of participating students were CVS positive, compared to 82.0% in the Waigani campus. Gender distribution showed that 51.2% of male students in Taurama were CVS positive, compared to 77.8% in Waigani campus. Among female students, 77.8% in Taurama and 87.0% in Waigani were CVS positive. It is possible that the female students are using their digital screen devices, such as, mobile phones and computers more frequently that the male students. In conclusion, Computer Vision Syndrome is present among the male and female students on both campuses. It is a growing problem that requires attention and action. Students should be encouraged to take frequent breaks, ensure proper lighting in the surroundings, using the correct posture and correct viewing angles to reduce the possibility of developing CVS.

Keywords: Computer, Digital devices, Vision, Students, Eyes, Awareness, Prevalence

INTRODUCTION:

Digital devices are among the technological advances readily available to people of all ages, both in developed and resource-limited countries. This is evident in the widespread use of devices equipped with Video Display Terminals (VDT), which include tabletop computers, laptops, tablets, smartphones, e-readers, and others [1, 2]. These devices are integral to daily life at work, home, schools, and universities. Over the past decades, the frequent use of these devices has led to a set of symptoms collectively referred to as Computer Vision Syndrome (CVS), also known as Digital Eye Strain (DES) [1, 2, 3]. CVS describes a range of eye- and vision-related problems resulting from prolonged use of VDTs. Given that students often engage in extensive screen time for academic, social, and recreational activities, they are at increased risk for developing CVS symptoms, which encompasses a variety of ocular, musculoskeletal, and behavioral conditions. Some common causes of CVS also include poor lighting, glare from screens, improper viewing distance, inadequate sitting posture, uncorrected vision problems, and a combination of these factors [3, 4, 5]. Symptoms associated with CVS can be categorized as [3, 6, 7]:

Visual symptoms: *slowness of focus change, double vision, blurred vision*.

Ocular surface-related symptoms: *irritated eyes, watery eyes, dry eyes, and contact lens discomfort*.

Asthenopia symptoms: *eye strain, tired eyes, glare sensitivity, and sore eyes*.

Extra-ocular symptoms: *headaches, neck pain, shoulder pain*.

CVS can be diagnosed through clinical and non-clinical methods. A clinical diagnosis involves a comprehensive eye examination conducted by a qualified medical professional, specifically an optometrist [6, 7, 8]. This process typically includes taking the individual's medical history and assessing their general health, drug use, and environmental factors to ensure symptoms are attributable to VDT usage [6, 7]. Visual acuity measurements, as well as evaluations for refractive errors such as myopia, hypermetropia, or astigmatism, may also be performed. More detailed examinations can assess eye focus and movement to identify issues affecting visual performance, allowing clinicians to rule out more serious eye conditions that mimic CVS [6, 7, 8].

In non-clinical settings, CVS has been diagnosed by various researchers using a modified version of the "Computer Vision Syndrome Questionnaire" (CVS-Q), developed and validated by Seguí et al. [9]. This questionnaire assesses the frequency and intensity of 16 symptoms experienced by VDT

users, including burning eyes, tearing, redness, and headaches.

Symptoms are quantified based on Frequency (Never = 0; Occasionally = 1; Often/Always = 2) and Intensity (Moderate = 1; Intense/Severe = 2).
Severity scores are calculated from these metrics, with individuals scoring 6 or higher considered to have CVS [4, 6 – 9].

A recent study in 2021 found that approximately 90% of computer users who spent over three hours per day in front of screens suffered from CVS [10]. Recommendations suggest positioning digital screens 50 to 100 cm from the eyes, indicating that smartphone use can negatively impact eye health more than computer use. Research shows smartphone usage is significantly linked to increased intraocular pressure (IOP), particularly under low-light conditions [11].

Further studies have indicated that excessive smartphone use among college students correlates with reduced physical activity, a sedentary lifestyle, mood disturbances, and poor sleep quality [12]. Additionally, participants using VDTs for more than four hours a day are at greater risk for dry eye syndrome [3, 13]. Factors such as poor screen resolution, inadequate brightness, and glare from older screens exacerbate CVS symptoms. Findings indicate that the highest severity of CVS is associated with inappropriate smartphone use, while desktop computers yield lower severity scores [3, 14].

One of the key risk factors for dry eyes includes using VDTs for over eight hours daily. Implementing work-rest schedules—taking breaks every 15 minutes or micro-breaks every 30 minutes—can significantly enhance work efficiency while reducing eye and musculoskeletal discomfort [3, 11]. Research has also shown that lighting conditions, such as overhead sources, can diminish text contrast on VDTs, leading to visual fatigue [11]. Benefits to visual comfort and posture have been noted when using adjustable lighting [12].

Prolonged screen time leads to excessive tear film evaporation, which results in ocular discomfort [15, 16]. To alleviate visual fatigue, individuals may blink more frequently, but this can lead to increased dryness if not managed properly.
One study reported that evaporative dry eye disease (DED) can result from long-term computer use [17]. Preventive measures for DED among digital device users include, short rest periods for the eyes, conscious blinking techniques, and environmental adjustments. The "20-20-20 rule" is a widely recommended strategy, encouraging users to take a break every 20 minutes to look at an object 20 feet away for at least 20 seconds [3, 5]. Headaches are particularly common when devices are used

at distances less than 50 cm from the eyes, especially with smartphones [3, 8].

Over 50% of participants in recent studies reported frequent shoulder, neck, and back pain as musculoskeletal symptoms [18, 19]. Factors contributing to back pain include screen and keyboard positioning as well as desk design [20]. Poor screen placement can lead to abnormal postures and back pain [20]. Excessive VDT usage also affects wrists, arms, and hands, leading to conditions such as carpal tunnel syndrome, characterized by numbness, pain, and tingling due to median nerve compression in the wrist [21].

A recent study highlighted the pervasive use of computers and smartphones among university students for both academic and non-academic activities, leading to significant concerns regarding Computer Vision Syndrome (CVS) [8]. Notably, the study found that 75% of medical students experienced CVS, with symptoms such as headaches (81.5%) and eye pain (63.8%) being most common. The prevalence was higher among female students (78.7%) compared to males (71%), and those wearing contact lenses (92.9%) experienced more symptoms than non-users (72.8%) [8].

A systematic review and meta-analysis sought to address inconsistencies in CVS findings across various studies [22]. It included 49 out of 725 studies, revealing a pooled CVS prevalence of 66% (95% Confidence Interval: 59, 74). Factors associated with increased CVS risk included being female (Odds Ratio = 1.74), improper body posture (Odds Ratio = 2.65), using devices outside work hours (Odds Ratio = 1.66), not taking breaks (Odds Ratio = 2.24), prolonged VDT use (Odds Ratio = 2.02), short distance from the screen (Odds Ratio = 4.24), and poor ergonomic practices (Odds Ratio = 3.87). Conversely, good knowledge about CVS was linked to decreased odds of developing the syndrome (Odds Ratio = 4.04) [22]. These findings underscore the importance of preventive measures to reduce CVS prevalence among students, particularly in resource-limited countries. In addition, the increasing number of publications about the impact of CVS on different population groups in various countries indicates that it is becoming one of the major public health problems.

In Papua New Guinea (PNG), the use of digital devices has surged over the past decade across all age groups for educational, business, and recreational purposes. The use of laptops, smartphones, tablets, and other digital devices increased significantly among university students especially during the COVID-19 pandemic.

A review of available literature reveals several studies on eye health in PNG [23 -30]. However, there is a significant lack of published data concerning the awareness and prevalence of

CVS among students at the University of Papua New Guinea (UPNG). Most students are known to utilize computers and smartphones for academic assignments and related activities, often spending excessive hours online for leisure activities such as chatting, streaming, and gaming.

Many students are unaware of the connections between incorrect posture and the resulting musculoskeletal discomfort or visual abnormalities they may experience. Good knowledge and awareness of healthy habits are always associated with satisfactory behaviors and good health outcomes. Thus, the need to assess the awareness and prevalence of CVS among students cannot be overemphasized.

This study was motivated by the apparent absence of published data regarding the effects of frequent use of VDTs among students in the UPNG.

The major objectives of this study were to assess the level of awareness and prevalence of CVS among undergraduate students in the UPNG.

METHODOLOGY:

Study sites and subjects:

This study was carried out in both Waigani and Taurama campuses of the University of Papua New Guinea (UPNG), located in Port Moresby, the Capital city of Papua New Guinea (PNG).

The UPNG is made up of five schools. Four of the schools are situated at the Waigani Campus. The School of Medicine and Health Sciences (SMHS) is located at the Taurama Campus, adjacent to Port Moresby General Hospital (PMGH). Students on Taurama campus completed their foundation year at Waigani campus UPNG before moving over to Taurama to pursue their degrees in medicine, dentistry or the health sciences. Post-basic nurses from various hospitals around the country are also enrolled in the Taurama campus to complete their nursing degrees.

The study subjects include students that were registered in the SMHS in Taurama campus and the four Schools in the Waigani campus for the 2024 academic session.

Study design and sampling:

This was an institution-based non-clinical, cross-sectional quantitative study. The targeted population consisted of registered students, both residential and non-residential, in the UPNG. All registered students were eligible to participate in the study. Simple random sampling was used in the selection of participants.

Calculation of Sample Size:

Calculation of sample size was based on a design effect of one, a relative precision of 10% and a confidence level (CL) of 95%. As there was no available information on the likely

prevalence rate CVS in UPNG, an assumed prevalence rate of 25% and a predicted non-response rate of 20% was used. The calculated sample size of about 200 participants in each of the campuses was obtained. This was considered appropriate for a study with limited resources. The questionnaires were distributed randomly to students on both campuses.

Data collection using a questionnaire and assessment criteria:

Data for this non-clinical study was collected using a modified version of the "Computer Vision Syndrome Questionnaire" (CVS-Q), developed and validated by Seguí et al. [9]. The modified questionnaire contained three sections (A, B, C) and a total of 49 questions, both open and closed-ended questions.

Section-A:

contained eight questions (Q 1 to Q 8) to probe the respondents' socio-demographic profile.

Section-B:

contained 25 questions (Q 9 to Q 33). The questions in this section seek to elicit information about the respondent's daily practices when using a computer, smart phone, mobile phones, or similar devices. The response options were either "Yes", "No", or "Don't know". For assessment, each correct answer was given a score of "1", each incorrect answer or "don't know" was given zero.

Section-C the CVS-Q questionnaire:

This section consisted of two parts: 1. Frequency and 2. Intensity. Respondents were required to indicate if they ever felt any of the symptoms when using the computer / cell phone or other digital devices. The CVS-Q assessed the "Frequency" and "Intensity" of the **16 Symptoms** (Q 34 to Q 49) which may be experienced by individuals using VDTs. The symptoms are, *burning eyes, itching, foreign body sensation, tearing, excessive blinking, eye redness, eye pain, eyelid heaviness, dry eye, blurred vision, double vision, difficulty focusing on near vision, increased sensitivity to light, colored halos around objects, feelings of worsening eyesight and headache* [9].

Study variables and Data analysis:

The dependent variable of this study was the presence of CVS (dichotomous). The independent variables included age (continuous), gender (dichotomous), duration of computer use (categorical), frequent blinking of eyelids (dichotomous), viewing distance of the screen (dichotomous), level of top of the computer screen (ordinal), sitting position (dichotomous), glare on the computer screen (dichotomous), brightness of the surroundings (categorical), CVS awareness (dichotomous), taking breaks (categorical), wearing eyeglasses (dichotomous), screen brightness adjustment (dichotomous).

Excel MS data pack software and the Statistical Package for Social Sciences (SPSS) version 20 were used for statistical analysis of the data.

Exclusion criteria:
Students that did not give consent were excluded from the study.

Ethical Clearance**:**
Ethical clearance and approval for this project were obtained from the Ethical and Research Grant Committee of the SMHS UPNG, and informed consent was obtained from each of the participants.

RESULTS:
This non-clinical questionnaire-based study with three major sections (A, B, C) was carried out between June and September 2024. Of the 200 questionnaires distributed to students on the Taurama campus only 138 were completed and found suitable for analysis. The response rate was 69.0%. For the Waigani campus, only 50 of the 200 questionnaires were completed and found suitable for analysis. The response rate was 25.0%. The low response rates obtained in the present study have been reported by other researchers involved in medical related research projects in the UPNG [31].

SECTION A:
Sociodemographic and use of digital devices:
A total of 188 students in both campuses participated in the study. Of these 138 (73.4%) were in Taurama campus and 50 (26.6%) were in Waigani campus. The mean age of the 188 students was 23.9 ± 4.6 years.

Gender distribution of the 138 students in Taurama campus shows that 59.4% (82/138) were males and 40.6% (56/138) were females. For students in the Waigani campus 54.0% (27/50) were males and 46.0% (23/50) were females.

The mean age of the students in Taurama campus was 25.4 ± 5.6 years. The mean age for the male students was 23.6 ± 2.2 years, mean age for female students was 28.1 ± 7.7 years. For students in Waigani campus the mean age was 22.3 ± 3.6 years. Mean age for male students was 21.9 ±1.76 years; mean age for female students was 22.9 ± 5.1 years.

Of the 138 students on Taurama campus, 80.4% (111/138) were single, 19.6% (27/138) were married. For the 50 students on the Waigani campus, 98.0% (49/50) were single and 2.0% (1/50) were married.
The students on both campuses were not separated into gender and marital status for further analysis of the data.

Table 1 shows the responses to general questions regarding the use of digital devices.
In response to question No 5 (Q 5) "*Do you use a laptop computer regularly?*" A total of 91.3% of the students in Taurama campus said "Yes"

compared to 82.0% in Waigani campus. The follow up question, Q 6, was, "*Do you use a Tabletop computer regularly?*" 87.7% of the students in Taurama campus answered in the negative compared to 84.0% of students in Waigani campus with a similar answer. The next question Q 7, was, "*Do you use a smart / mobile phone?*" Most of the students in Taurama (95.7%) and Waigani (94.0%) answered in affirmative. When the students were asked Q 8 "*Do you know about the condition called computer vision syndrome (CVS) also called digital eye strain (DES)*? Only 15.9% of the students in Taurama said Yes, compared to 20.0% of the students in Waigani campus.

Table 1: General questions on use of digital devices

			TAURAMA	WAIGANI
Q 5	Do you use a laptop computer regularly?	Yes	91.3%	82.0%
		No	8.0%	18.0%
		Don't know	0.7%	0
Q 6	Do you use a Tabletop computer regularly?	Yes	10.1 %	14.0%
		No	87.7%	84.0%
		Don't know	2.2%	2.0%
Q 7	Do you use a smart / mobile phone regularly?	Yes	95.7 %	94.0%
		No	4.3%	6.0%
		Don't know	0	0
Q 8	Do you know about the condition called computer vision syndrome (CVS) also called digital eye strain (DES)?	Yes	15.9 %	20.0%
		No	83.3%	60.0%
		Don't know	0.7%	20.0%

SECTION B:

The questions (Q 9 to Q 33) in this section were to assess the daily practice of students while using a computer, smart phone, mobile phones, or other similar devices. This section also assessed the knowledge and awareness of students about the sitting position, screen distance and device-related factors and the associated problems. The questions and responses are presented in Table 2.

To assess the awareness about their sitting position when using a tabletop computer, the students were asked Q 9 "What is your sitting position while you are using a tabletop computer?" In response, 53.6% of students in Taurama compared to 34.0% in Waigani stated

that "my face is just at the level of the computer screen". In Taurama, 24.6% of students compared to 48.0% said that "my face is not at the level of the computer screen". The follow up question, Q 10 was about the sitting position when using a laptop computer. Most of the students in Taurama (65.9%) and in Waigani (52.0%) said that their face is just at the level of the computer screen.

When asked about the distance from the computer screen (Q 11), almost equal percent of students in Taurama (52.2%) and Waigani (50.0%) reported the length of the forearm.

In response to Q 12, about the top of the computer screen, 52.2% of students in Taurama and 38.0% in Waigani responded correctly – "at the level of your eyes".

Q 13 was to determine the type of electronic devices with screen commonly used by the students. The results are presented in Figure 1.

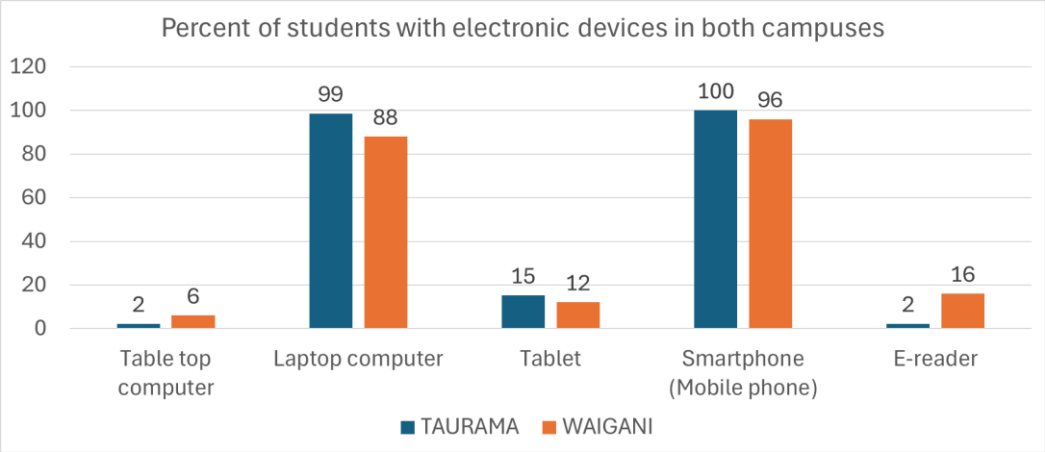

Figure 1: Response to Q 13: % of students with electronic devices with screen

In response to Q 14, 52.2% of students in Taurama campus compared to 70.0% in the Waigani campus reported the presence of bright lights that disturbs their vision when using their computer. Majority of the students in Taurama (60.2%) and Waigani (66.0%) responded yes to Q 15 that computer vision syndrome (CVS) causes eye problems. However, 36.2% of students in Taurama compared to 44.0% in Waigani campus, in response to Q 16 spent more than 8 hours a day using electronic devices. These answers agreed with the responses to Q 17 by students in both campuses. In addition, in response to Q 18, only a limited percent of students in Taurama (12.3%) and Waigani (20.0%) campuses are

aware of the "20-20-20 Rule". When asked Q 19, "*Do you use eyeglasses?*", most of the students in Taurama (92.0%) and Waigani (88.0%) campuses do not use eyeglasses. The students were asked Q 22, "*Do you use contact lenses?*" only 2.2% and 4.0% of students in Taurama and Waigani campus respectively answered in the affirmative.

In response to Q 24, "*Have you had eye surgery in the past"*? The majority of the students in both campuses answered in the negative. The follow up question Q 25, "*Do you have a habit of frequent voluntary blinking*"? Among the students in Taurama campus 20.3% answered in the affirmative compared to 34.0% of the students in the Waigani campus.

When asked Q 26, about the lighting conditions when using the computer, 58.7% of students in Taurama and 54.0% in Waigani said bright light. In response to Q 27, most of the students in Taurama (78.3%) and Waigani (72.0%) usually adjusted the contract of their computer with the surrounding brightness. Only a few of the students, 19.6% in Taurama and 18.0% in Waigani campuses use anti-glare filter on their computer. When asked Q 29, if they have ever used lubricant eye drops after working on the computer, 5.0% in Taurama and 18.0% in Waigani campuses answered in the affirmative.

In Q 30, students were asked if they sometimes have neck pain because of working on the computer, 73.9% of students in Taurama compared to 4.0% in Waigani said Yes. The next question was, Q 31, if they sometimes have shoulder pain because of working on the computer, 67.4% of students in Taurama and 90.0% of students in Waigani said Yes. In response to Q 32 about back pain when working on the computer, 80.4% of students in Taurama and 82.0% in Waigani answered Yes. When asked Q 33, if they sometimes feel numbness in the hands or fingers, 61.6% of students in Taurama and 92.0% in Waigani said Yes. All the results for section B are presented in Table 2.

Table 2: Sitting position, Screen distance, and Device-related factors

Q 9	**What is your sitting position while you are using a tabletop computer?**			**TAURAMA**	**WAIGANI**
	(i)	My face is just at the level of the computer screen	Yes	53.6%	34.0%
			No	31.2%	50.0%
			Don't know	15.2%	16.0%
	(ii)	My face is not at the level of the computer screen	YES	24.6%	48.0%
			No	59.4%	36.0%
			Don't know	15.9%	16.0%

				TAURAMA	WAIGANI
Q 10	**What is your sitting position while you are using a laptop computer?**				
	(i)	My face is just at the level of the computer screen	Yes	65.9%	52.0%
			No	31.2%	46.0%
			Don't know	2.9%	2.0%
	(ii)	My face is not at the level of the computer screen	Yes	30.4%	44.0%
			No	65.9%	54.0%
			Don't know	3.6%	2.0%
Q 11	**What is your distance from the screen when using the computer?**			**TAURAMA**	**WAIGANI**
	(i)	Longer than my forearm + wrist (> 75 cm)	Yes	26.8%	32.0%
			No	68.4%	68.0%
			Don't know	4.4%	0
	(ii)	About the length of your forearm (about 40 cm -75 cm)	Yes	52.2%	50.0%
			No	46.4%	50.0%
			Don't know	1.4%	0
	(iii)	Shorter than my forearm (< 40 cm)	Yes	26.1%	24.0%
			No	70.3%	76.0%
			Don't know	3.6%	0
Q 12	**Where is the top of your computer screen?**			**TAURAMA**	**WAIGANI**
	(i)	Above the level of your eyes	Yes	17.4%	22.0%
			No	81.2%	78.0%
			Don't know	1.4%	0
	(ii)	At the level of your eyes	Yes	52.2%	38.0%
			No	45.7%	62.0%
			Don't know	2.2%	0
	(iii)	Below the level of your eyes	Yes	34.8%	44.0%
			No	62.3%	56.0%
			Don't know	2.9%	0
Q 13	**What type of electronic devices with screen do you have? (Tick all that apply)**			**TAURAMA**	**WAIGANI**
	(i)	Tabletop computer	Yes	2.2%	6%
			No	97.8%	94%
			Don't know	0	0
	(ii)	Laptop computer	Yes	98.6%	88.0%
			No	1.4%	12.0%
			Don't know	0	0
	(iii)	Tablet	Yes	15.2%	12.0%
			No	84.8%	88.0%
			Don't know	0	0
	(iv)	Smartphone (Mobile phone)	Yes	100%	96.0%
			No	0	4.0%
			Don't know	0	0
	(v)	E-reader	Yes	2.2%	16.0%
			No	97.8%	84.0%
			Don't know	0	0
Q 14	**Is there any glare** ("presence of bright light that disturbs the vision due to direct or reflected sunlight or overhead lamps") **on the computer screen?**		Yes	52.2%	70.0%
			No	29.7%	16.0%
			Don't know	18.1%	14.0%
Q 15	Can Computer Vision Syndrome (CVS) causes eye problems?		Yes	60.2%	66.0%
			No	4.3%	2.0

			Don't know	35.5%	32.0%
Q 16	**How many hours a day do you spend using electronic devices? (Choose only one option)**			**TAURAMA**	**WAIGANI**
	(i)	Less than 2 hours	Yes	2.2%	0
			No		
			Don't know	0	0
	(ii)	Between 2 to 4 hours	Yes	15.9%	10.0%
			No		
			Don't know		
	(iii)	Between 4 to 6 hours	Yes	22.5%	24.0%
			No		
			Don't know		
	(iv)	Between 6 to 8 hours	Yes	23.2%	24.0
			No		
			Don't know		
	(v)	More than 8 hours	Yes	36.2%	42.0
			No		
			Don't know		
Q 17	**How often do you take a break while using the computer? (Choose only one option)**			**TAURAMA**	**WAIGANI**
	(i)	Every 20 minutes of work	Yes	24.6%	32.0%
			No		
	(ii)	Every 60 minutes of work	Yes	36.2%	22.0%
			No		
	(iii)	Every 2 hours of work	Yes	15.9%	12.0%
			No		
	(iv)	More than every 2 hours	Yes	23.3%	34.0%
			No		
Q 18	**Do you know about the 20-20-20 Rule** (*Take a 20-second break every 20 minutes and focus your gaze on an object 20 feet away*)**?**		Yes	12.3%	20.0%
			No	67.4%	62.0%
			Don't know	20.3%	18.0%
Q 19	**Do you use eyeglasses?** (If you answer **No**, jump to **Q 22**)		Yes	8.0%	12.0%
			No	92.0%	88.0%
			Don't know	0	0
Q 20	**If you answer YES to Q 19; Do you know the purpose of your eyeglasses?**			**TAURAMA**	**WAIGANI**
	(i)	For computer use only	Yes	0	16.7
			No	100.0	0
			Don't know	0	0
	(ii)	For vision use only	Yes	36.4	83.3
			No	0	0
			Don't know	0	0
	(iii)	For both computer and vision use	Yes	63.6	100
			No	0	0
			Don't know	0	0
Q 21	**If you answer YES to Q 19; Do your eyeglasses have anti-reflecting and/or blue light filter coating?**		Yes	72.7%	83.3%
			No	18.2%	16.7%
			Don't know	9.1%	0
Q 22	**Do you use contact lenses?** (If you answer **No**, jump to **Q 23**)		Yes	2.2%	4.0%
			No	97.8%	96.0%
			Don't know	0	0

				TAURAMA	WAIGANI
Q 23	**If you answer YES to Q 22; Do you know the purpose of your contact lenses?** (Choose only one of the options)				
	(i)	For computer use only	Yes	0	50%
			No	100	0
	(ii)	For vision use only	Yes	0	50%
			No	100	0
	(iii)	For both computer and vision use	Yes	100.0	0
			No	0	0
Q 24	**Have you had eye surgery in the past?**		Yes	1.4%	2.0%
			No	98.6%	98.0%
			Don't know	0	0
Q 25	**Do you have a habit of frequent voluntary blinking?**		Yes	20.3%	34.0%
			No	64.5%	58.0%
			Don't know	15.2%	8.0%
Q 26	**What are the usual lighting conditions when you are using the computer?** (Choose only one of the options)			TAURAMA	WAIGANI
	(i)	Very bright	Yes	5.8%	6.0%
			No	0	0
			Don't know	0	0
	(ii)	Bright	Yes	58.7%	54.0%
			No	0	0
			Don't know	0	0
	(iii)	Dark	Yes	17.4%	20.0%
			No	0	0
			Don't know	0	0
	(iv)	Dull	Yes	18.1%	20.0%
			No	0	0
			Don't know	0	0
Q 27	**Do you usually adjust the contrast of your computer with the surrounding brightness?**		Yes	78.3%	72.0%
			No	20.3%	28.0%
			Don't know	1.4%	0
Q 28	**Do you usually use an anti-glare /filter / blue light filter for your computer screen?**		Yes	19.6%	18.0%
			No	73.2%	82.0%
			Don't know	7.2%	0
Q 29	**Have you ever used lubricant eye drops after working on the computer?**		Yes	5.0%	18.0%
			No	92.8%	74.0%
			Don't Know	2.2%	8.0%
Q 30	**Do you sometimes have neck pain because of working on the computer?**		Yes	73.9%	4.0%
			No	22.5%	96.0%
			Don't know	3.6%	0
Q 31	**Do you sometimes have shoulder pain because of working on the computer?**		Yes	67.4%	90.0%
			No	27.5%	10.0%
			Don't know	5.1%	0
Q 32	**Do you sometimes have back pain because of working on the computer?**		Yes	80.4%	82.0%
			No	16.7%	12.0%
			Don't know	2.9%	6.0%
Q 33	**Do you sometimes feel numbness in your hands or fingers?**		Yes	61.6%	92.0%
			No	32.6%	8.0%
			Don't know	5.8%	0

SECTION C: COMPUTER VISION SYNDROME (CVS):

This section focuses on the non-clinical method for the diagnosis of CVS, which has been made by several authors using the modified versions of the "Computer Vision Syndrome Questionnaire" (CVS-Q), developed and validated by Seguí et al. [9].

The CVS-Q assesses the frequency and intensity of 16 symptoms which are experienced by individuals using VDT [9]. The results obtained in this study using the 16 symptoms (Q 34 to Q 49) are presented in **Table 3** for students in the Taurama campus and **Table 4** for students in the Waigani campus.

The percentage frequency of the symptoms that occur occasionally were higher among students in Waigani compared to those in Taurama campus. The intensity of the symptoms was also higher among students in Waigani compared to those in Taurama.

To assess the prevalence of CVS the guidelines proposed by Segui et al [9] was used.

According to the guidelines, the frequency was quantified as: Never = 0; Occasionally = 1; Often or always = 2.

The Intensity of the symptoms was rated as: Moderate = 1; Intense (severe) = 2.

The Severity was determined by the Product of Frequency and Intensity.

Later, the Product was recorded as 0 = 0; 1 or 2 = 1; and 4 = 2.

For the final score of the CVS, the Sum of the Recorded Severity Scores was used.

Individuals with Scores of 6 or higher were considered to have CVS [4, 6, 7, 8, 9].

Table 3:
SECTION C: COMPUTER VISION SYNDROME AMONG STUDENTS IN TAURAMA CAMPUS UPNG

		FREQUENCY			INTENSITY	
Symptoms of CVS		**Never**	**Occasionally**	**Often /Always**	**Moderate**	**Severe**
34	Tearing eyes	47.1 %	45.7 %	7.2 %	90.4 %	9.6 %
35	Eye redness	45.7 %	44.9 %	9.4 %	88 %	12 %
36	Eye pain (ocular pain)	46.4 %	44. 9 %	8.7 %	91.9 %	8.1 %
37	Burning sensation in eyes	65.2 %	31.2 %	3.6 %	91.7 %	9.1 %
38	Dryness in eyes (dry eyes)	78.3%	19.6 %	2.2 %	96.7 %	3.3 %
39	Itching eyes	50.0 %	46.4 %	3.6 %	92.8 %	7.2 %
40	Feeling of foreign body in the eyes	68.1%	29.0 %	2.9 %	86.4 %	13.6 %
41	Blurred vision	55.1 %	36.2 %	8.7 %	90.3 %	9.7 %

42	Increased sensitivity to light	43.5 %	41.3 %	15.2 %	76.9 %	23.1%
43	Double vision	78.3 %	15.9 %	5.8 %	83.3 %	16.7 %
44	Excessive blinking	79.0 %	15.2 %	5.8 %	72.4 %	27.6 %
45	Heavy eyelids	66.7 %	29.7 %	3.6 %	87.0 %	13 %
46	Difficulty focusing for near vision	73.%	17.4 %	18.7 %	75 %	25 %
47	Color halos around objects	80.4 %	17. 4%	2.2 %	92. 6 %	7.4 %
48	Feeling that sight is worsening	5.4 %	21 %	3.6 %	88.2 %	11.8 %
49	Headache	35.5 %	54.3 %	10.1 %	86.5 %	13.5 %

Table 4:
SECTION C: COMPUTER VISION SYNDROME AMONG STUDENTS IN WAIGANI CAMPUS UPNG

		FREQUENCY			INTENSITY	
Symptoms of CVS		**Never**	**Occasionally**	**Often /Always**	**Moderate**	**Severe**
34	Tearing eyes	38 %	58 %	4 %	93.5 %	6.5 %
35	Eye redness	30 %	60 %	10 %	94.3%	5.7 %
36	Eye pain (ocular pain)	32 %	54 %	14 %	73.5 %	8.8 %
37	Burning sensation in eyes	44 %	50 %	6 %	89.3 %	10.7 %
38	Dryness in eyes (dry eyes)	64 %	36 %	0	100 %	0
39	Itching eyes	28 %	64 %	8 %	88.9 %	11.1 %
40	Feeling of foreign body in the eyes	74 %	20 %	6 %	76.9 %	23.1 %
41	Blurred vision	36 %	48 %	16%	87.5%	12.5 %
42	Increased sensitivity to light	28 %	54 %	18 %	80.6 %	19.4 %
43	Double vision	66%	32 %	2 %	100 %	0
44	Excessive blinking	52 %	36 %	8 %	81.8 %	18.2 %
45	Heavy eyelids	56 %	52 %	12 %	87.5 %	12.5 %
46	Difficulty focusing for near vision	64 %	28 %	8 %	8.9 %	11. 1 %
47	Color halos around objects	72 %	24 %	4 %	92.9 %	7.1 %
48	Feeling that sight is worsening	64 %	32 %	4 %	88.9 %	11.1 %
49	Headache	14 %	68 %	18 %	81.4 %	18.6 %

Results of the analysis are presented in Table 5. In Taurama campus 55.1% of the students that participated in this study were CVS positive compared to 82.0% of the students in the Waigani campus. Gender distribution of the results show that 51.2% of the students in

Taurama compared to 77.8% of the students in Waigani were CVS positive. Among the female students 77.8% in Taurama and 87.0% in Waigani were CVS negative.

This seems to indicate that in both campuses the female students are more vulnerable to developing digital eye injury later. It is possible that the female students are using their digital screen devices like mobile phones and computers more frequently that the male students.

Table 5: Prevalence of CVS among students in Taurama and Waigani campuses

	Taurama campus	Waigani campus
CVS negative (Product < 6)	44.9% (63/138)	18.0% (9/50)
CVS positive	55.1% (76/138)	82.0% (41/50)
Highest CVS Score	24	23
Males (CVS positive)	51.2% (42/82)	77.8% (21/27)
Females (CVS positive)	60.7% (34/56)	87.0% (20/23)

DISCUSSION:

The findings in Section A show that laptop computers, mobile and smartphones are very popular among students on both campuses compared to tabletop computers. These findings are consistent with report by other authors [8, 32], that the use of these digital devices is popular among university students worldwide. The lack of knowledge of students about the CVS also called DES has been reported by other researchers in different countries worldwide [8, 32]. To the best of our knowledge this is the first study among students in the university of Papua New Guinea (UPNG). The recommended sitting position in from of the computer is for the face to be at the level of the tabletop computer screen as reported by 53.6% of students in Taurama and 34.0% in Waigani. The correct answer was given by most of the students in Taurama campus. The distance from the computer screen was similar among about half of the students in both Taurama and Waigani. The results indicated that the students in Taurama campus are more aware of the sitting position and

distance of the computer from the user compared to those in the Waigani campus. The difference in knowledge, however, was not statistically significant ($p > 0.5$). Laptop computers and Smartphones (Mobile phones) were the most popular digital devices with screens among the students in both campuses. These findings are similar to those reported by other researchers in different universities around the world [8, 32].

The responses of students to Q 16 seem to indicate that they have some knowledge about the negative impact of computers on their vision. However, their responses to Q 17 and Q 18 show very limited knowledge about the basic concepts to protect the eyes from damage using digital devices with screens. Most of the students in the present study do not use eyeglasses or contact lenses. One of the major reasons is because the age range of the students in the present study was 18 to 30 years, which is the age range of youths and young adults with relatively good eyesight compared to older adults.

Most of the students on both campuses correctly adjusted the contrast of their computers with the surrounding brightness. The use of anti-glare filter was not popular among the students in both campuses. The use of lubricant eye drops after working on their computers was also not popular among the students in both campuses. Neck pain was common among students in Taurama campus compared to their colleagues in Waigani. One of the reasons might be because of the posture and sitting position of the students. Although shoulder pain was common among both groups of students, it was significantly higher among students in Waigani campus. Back pain was a common occurrence among students in both campuses. This may be due to improper posture when working on their laptop computers. Although students in both campuses reported having numbness of hands and fingers, the conditions were more common among students in Waigani campus.

The findings of the present study show that the CVS scores for students in Taurama ranges from 0 to 24 compared to those in Waigani with a maximum range of 23. These scores are within the range 0 to 27 reported for university students by other authors [32, 33, 34].

Our results show that 55.1% of students in Taurama campus and 82.0% in Waigani campus were positive for CVS. The result for Taurama campus was lower than the 70% reported for students in Ethiopia [33]. The 82% for students in Waigani was higher than the 70% reported for the study in Ethiopia [33]. Other studies among students in some universities in Malaysia reported that 89.9% of the students had CVS [35]. This score is higher than the CVS scores for students in both Taurama and Waigani campuses.

In another study among university students in Colombo [36], most (76.7%) of the students suffered from CVS. This value is higher than the 55.1% among students in Taurama, but lower than the 82.0% among students in Waigani campus. According to the authors 76.1% of the CVS sufferers had poor head posture; a vast majority reported dull environmental illumination, leaning forward during device usage. In addition, the top line of the screen above eye level was reported by 80.9% of students who suffered from CVS [36]. These values are not significantly different from the values obtained in our present study.

We agree with the authors [32, 33, 36] that taking short breaks, proper posture, less duration using the computer, adequate illumination, and correct viewing angle may alleviate symptoms of CVS. These findings underline the importance of preventing CVS among university students and encouraging the use of computers in an ergonomic way to get the advantage of posture-related health risks. Suitable preventive measures must be adopted, giving special importance to those presenting risk factors.

CONCLUSION:

The findings of this study highlight the prevalence of Computer Vision Syndrome (CVS) among undergraduate students at the UPNG, with 55.1% of students on the Taurama campus and 82.0% on the Waigani campus exhibiting symptoms associated with CVS. The high prevalence rates in both campuses, particularly in Waigani, indicate a pressing need for increased awareness and preventive measures among students regarding the potential ocular impacts of prolonged digital device usage.

Despite the popularity of laptops and smartphones among students, there is a concerning lack of knowledge regarding CVS and effective protective practices. While some students demonstrated awareness of proper sitting positions and screen distances, many reported limited understanding of how to mitigate eye strain, underscoring the necessity for educational interventions.

Additionally, the study reveals that posture-related issues, such as neck and shoulder pain, are prevalent, which may be linked to the overall ergonomic awareness of students. These findings suggest that the appropriate authorities in the UPNG should consider implementing awareness programs and ergonomic assessments to promote healthier habits among students. Regardless of the low sample size in this study, the results clearly show that a significant proportion of the students that participated suffer from symptoms of CVS.

Overall, this study serves as an important initial assessment of CVS among students at UPNG, paving the way for future research and the development of strategies to address this growing health concern.

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