Prevalence of computer vision syndrome among students at Bindura University of Science and Education

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A research thesis to be submitted in partial fulfilment of the requirements of the Bachelor of Science Honors Degree in Optometry

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Declaration

Student's declaration

We, Rutendo Enia Chashamba and Vongai Carol Chisayinyerwa, hereby affirm that, except for our supervisor's guidance, this study is our piece of work submitted to fulfil the requirements of the Bachelor of Science Honours Degree in Optometry at Bindura University of Science Education. American Psychological Association referencing style was employed to acknowledge other people's ideas.

Signature_____

Date……20/06/2025…….

Supervisor's declaration

I **Dr Michael Agyemang Kwarteng**, hereby affirm that this study was conducted under my supervision and have been approved for submission in fulfilment of the requirements for the Bachelor of Science Honours Degree in Optometry at Bindura University of Science Education.

Signature_____

Date :

Dedication

The study project is dedicated to our university classmates.

Acknowledgements

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BUSE- Bindura University Of Science Education

CVS- Computer Vision Syndrome

VDT- Video Display Terminals

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Abstract

BACKGROUND: a lot of students are subjected to a number of ocular hazards emanating from prolonged use of electronic devices that might lead to detrimental health outcomes, especially in undeveloped nations like, Zimbabwe. To crown it all, not much is known about computer vision syndrome, its symptoms, causes and the preventative measures**.** This study assessed the knowledge and prevalence of computer vision syndrome among students at Bindura University of Science and Education.

AIM: To determine the prevalence level of knowledge of computer vision syndrome among university students.

METHODS: This cross-sectional survey was carried out among students who are currently studying at BUSE. Stratified random sampling technique was used to divide students according to their faculty thereby yielding a total of 4 strata. A simple random sampling technique was then utilized to haphazardly select participants from each stratum.

RESULTS: The study was conducted among 370 students with majority (56.7%) being females. The mean age of participants was 25.16. The prevalence of computer vision syndrome among undergraduates was 33.34 %(n =). The prevalence was higher in females (20.3%) as compared to males (13.0%). Majority (81.62%) of the students had poor knowledge of computer vision syndrome, with amlws being dominant. The most prevalent symptoms were headache (59.73%), Eye strain and fatigue (40.27%) and tearing (37.30%). Prevalence of computer vision syndrome was found to be significantly associated with the type of digital devices used (p=0.000103), time spent on screens daily (1.36E-05), refractive error (p=5.76E-11), time spent on computers during the night (p=0.043741) and the years spent while using electronic devices (p=1.78E-07).

CONCLUSION: The study's outcomes highlighted that digital device users should improve their knowledge of computer vision syndrome, stakeholders were recommended to hold more

awareness campaigns to help reduce prevalence and improve knowledge of computer vision syndrome among students.

KEY WORDS: Knowledge, prevalence, computer vision syndrome, students

Chapter one

1.1 Introduction

This chapter introduces the research, "Prevalence and knowledge of computer vision syndrome among students at Bindura University of Science Education". It highlights both the context and justification of this study. The problem that motivated the researchers to do the study, the importance of this study as far as optometry is concerned, and the aims, objectives, and background of this research will be discussed.

1.2 Background of the study

Computer Vision Syndrome (CVS), often referred to as digital eye strain, encompasses various eye and vision issues linked to the prolonged use of computers, including desktops, laptops, and tablets, as well as other electronic screens such as smartphones and e-readers (Rosenfield M, 2016).According to the American Optometry Association, computer vision syndrome (CVS) is defined as "a complex of eye and vision problems related to near work experienced during computer use". Digital eye strain is mostly reported by people who use computers and smartphones for an average of three hours daily at a distance of less than six meters, but it does not cause permanent eye damage (Dharn-Munshi and-Munshi 2019). The main issue among physicians is incorrect diagnosis of CVS for it is often mistaken as transient ischemic attack, and this includes eye strain and transient blindness (TIA), leading to incorrect diagnosis and unnecessary harmful medical interventions by physicians (Dharn-Munshi and Munshi 2019). Differential diagnosis of CVS includes TIA, stroke, and neurovascular conditions (Dharn-Munshi and Munshi 2019).

CVS pathophysiology is a result of pixels that are used in computer graphics and displays. These pixels are bright at the center with the brightness reduced towards the periphery, as a result, the eye cannot sustain the pixel characteristics for a long time due to the lag of accommodation that is created by pixel properties (Dharn-Munshi and Munshi 2019). The constant focusing and refocusing required by the ciliary body will in turn cause eye fatigue and other CVS (Dharn-Munshi and Munshi 2019). There are four categories in which the symptoms of CVS falls and these are ocular surface-related, visual problems, asthenia and extraocular muscle-related, with

ocular symptoms being dominant (Dharn-Munshi and Munshi 2019). The table below summarizes possible causes of CVS.

Table 1: Symptoms of CVS

category	Signs and symptoms	Accommodation (binocular vision)
Asthenopic	Tired eyes, eye strain and fatigue, sore eyes	-
Ocular surface-relate	Watery eyes Dry eyes Contact lens problems Irritable eyes	
Visual	Blurry vision Slow focus change Presbyopia diplopia	Accommodation Refractive error Presbyopia correction Binocular vision
Extraocular	Shoulder, neck and back pains	Computer-screen location
Transient blindness	Vision loss	Photo pigment bleaching Light adaptation of the viewing eye

Finding the exact cause of CVS is not easy for it is a combination of various factors for example prolonged working hours, inadequate breaks and constantly staring at a screen (Alemayehu and Alemayehu 2019). The table below is a summary of risk factors associated with CVS and was copied from Alemayehu and Alemayehu 2019.

Table 2: risk factors associated with CVS

Personal factors	**Poor sitting posture** **Improper viewing distances** **Poor viewing angle**

	Ocular abnormalities **Medical diseases** **ageing**
Environmental factors	Poor illumination Imbalanced illumination between the screen and the surrounding
Computer-based factors	Poor contrast Poor resolution Glare Slow rate of refresh

There is no single treatment for CVS as the cause is multifactorial; therefore, a multi-directional approach is recommended to alleviate symptoms of CVS. Preventive measures include correction of refractive error, specifically designed computer glasses and treatment of dry eye (Alemayehu and Alemayehu 2019). Management of binocular dysfunction is also important as it improves accommodation by looking down and simultaneously, use of methyl cellulose eye drops and omega-3 fatty acids which improve tear film are known to alleviate symptoms of CVS (Alemayehu and Alemayehu, 2019). Ergonomic practices also contributes to CVS, thereby it is recommended to take measures like correct sitting posture, computer screen at eye level or relative to the eye and also horizontal and vertical gaze angle to be adjusted relative to the eye (Alemayehu and Alemayehu, 2010)

Proper room illumination, screen brightness, screen contrast, and height of letters on display are to be adjusted in order to manage CVS (Alemayehu and Alemayehu 2019). There is a need to reduce screen luminance in order to increase the blinking rate and maintain the viewing distance between 60-80cm (Alemayehu and Alemayehu, 2019). The 1-2-10 rule is also important in managing CVS that indicates that the cellphones and electronic books shouldbe at one foot, computers should be at 2 feet, and television should be 10 feet. The 20-20-20 rule is one of the best ways to prevent CVS. It indicates that after every 20 minutes of screen work, look at 20 feet for 20 seconds. The table below summarizes the recommended computer distance and angle from different standards (Alemayehu and Alemayehu, 2019).

Table 3: recommended computer distance and angle

standard	Recommended distance	Vertical angle recommended	Horizontal angle recommended
Australian standard (AS 1990)	From 35 to 75 cm for primary display	15 to 45 degrees downward from horizontal, eyelevel gaze; refers to this angle as "optimal"	Within 15 degrees on either side of the centerline of the viewer, for the primary display
International standards organization (ISO,1992)	40cm, at least, and is dependent on size of characters.	0 to 60 degrees downward from horizontal, eyelevel gaze; "preferred" is 20 to 22 degrees downward	
HFES (This is revision of ANSI 100- 1988.)	50 to 100 cm	0 to 60 degrees downward from horizontal, eyelevel gaze; center at15 to 20 degrees downward	Within 17.5 degrees on either side of the centerline of the viewer

1.3Problem statement

In the past years, the world has moved into a technological era where people spend more than 50% of their lives on electronic gadgets. This is especially true for university students who use laptops and cellphones for vocational and avocational activities that include online learning, communication, and gaming. However, little is known about the potential hazards that may arise from these habits. Students at Bindura University are no exception since they are highly dependent on electronic devices for both educational and social interactions, thereby providing the need for the survey at Bindura University.

1.4 Aims

To determine the prevalence and awareness of computer vision syndrome among undergraduate students at Bindura University of Science Education

1.5 Objectives

1. To find the prevalence of computer vision syndrome among Bindura University students through the use of a questionnaire.

2. To determine the extent to which students are knowledgeable about Computer Vision Syndrome

3. To find out how factors like screen time, device type, and gender contribute to the development of computer vision syndrome.

4. To examine the most common symptoms that students are experiencing, which may be related to Computer Vision Syndrome.

1.6 significance of study

The study's findings will improve students' knowledge of Computer Vision Syndrome through educating them on its symptoms, causes, and prevention measures. By addressing the gaps in the knowledge of computer vision syndrome, the study will help design-focused teaching programs and workshops that promote safe use of electronic devices and improved eye health. The study's findings will contribute to the formation of evidence-based policies and interventions on ways to reduce the prevalence of CVS. Increased knowledge of computer vision syndrome may lead to earlier detection of CVS and timely intervention by health care practitioners, thereby lowering long-term health risks. The research also highlights the effects of prolonged screen time on ocular health. This study has opened up the room for further research, such as the link between refractive error and CVS, and the role played by ocular pathologies in the early onset of computer vision syndrome. This study will contribute to the limited body of knowledge on Computer Vision Syndrome, particularly in higher education institutions in Zimbabwe. It could be used as a reference point for future studies and comparisons. Finally, the data could be utilized to push for community health initiatives and campaigns aimed at broader sectors of the public who are becoming increasingly dependent on digital gadgets, rather than just university students.

1.7 conclusion

This chapter has focused on the introduction of the study to be conducted, emphasizing the importance of the survey, the background of the study, the objectives, and the goal.

CHAPTER 2

2.1 Introduction

This chapter is focused on a thorough analysis of studies linked to the prevalence and knowledge of computer vision syndrome. These literature reviews give a brief global overview of CVS prevalence in the first section and detailed continental reviews, that is, Africa, Asia, South and North America, by selecting a single country in each continent in the last section. To acquire information, online electronic databases, including CINAHL, Google Scholar, PubMed and World Health Organization (WHO), among others, were used to retrieve published studies. Important phrases used in the search included prevalence, knowledge, computer vision syndrome, digital eye strain, visual fatigue and asthenopia. Researches included in this review were conducted from 2012 to 2024.

2.2 Global review

Globally, roughly 60 million people are suffering from Computer vision syndrome (CVS), a well-known eye and vision-related problem resulting from prolonged use of electronic devices.(Yaacob et al.,2022). Most global researches on CVS were conducted using systematic reviews and meta-analysis which combine data from worldwide published studies with an aim of finding the pooled prevalence of CVS. In accordance with a meta-analysis by Anbesu and Lema, a sum of 735 surveys were collected, however, only 45 studies were incorporated in the final meta-assessment (Anbesu & Lema, 2023).The pooled prevalence of CVS was calculated to be 66% with Pakistan having the uppermost prevalence of CVS and Japan at the base(Anbesu & Lema, 2023).

Results from the study by Anbesu and Lema are in line with another meta-analysis performed by Ccami-Bernal and crew in 2023. Overally, 103 cross sectional surveys compromising of 66. 577 respondents were incorporated and the combined prevalence was found to be 69.0% (Ccami-Bernal et al, 2023). Point prevalence was found to be elevated in women ((71.4%), undergraduates (76.1%), Africa (71.2%), Asia (69.9) (Ccami-Bernal et al, 2023). Ccami- Bernal and team later concluded that seven in ten people suffer from CVS, thus mitigation strategies and measures are essential in minimizing the prevalence of CVS which has a negative impact on work productivity and quality of life (Ccami-Bernal et al 2023).

2.3 Continental review

2.3.1 Asian review

Malaysia

Lee et al., 2024 conducted a research on the prevalence and knowledge of CVS among undergraduates at the National University of Malaysia. Data on knowledge, prevalence and associated factors of CVS was captured using a pretested and validated self-administered questionnaire forms via Google (Lee et al., 2024). Computer vision syndrome was found to affect 40% of the undergraduates with 91.9% of the students having limited knowledge of CVS (Lee et al., 2024). Strong correlations was found between CVS with refractive error (69.3%), horizontal eye level (79.40), poor sitting posture (79.4%) and close viewing distance (82.6%) (Lee et al., 2024). The major drawback of this study was that the study was done during the covid-19 era where movements were prohibited leading to biases as interpretation of instructions among respondents vary from one person to the other which may yield errors in the results obtained due to lack of supervision.

Sawaya's research, "Asthenopia among University Students: The Eye of The Digital Generation", explored the connection between the use of electronic devices and asthenopia among students in Malaysia (Sawaya et al., 2020). The objective of the survey was to the prevalence of asthenopia among undergraduates pursuing different fields of study at the American University of Beirut (Sawaya et al.,2020).Students completed a self-administered google form that recorded data on demographics, asthenopic complaints, positive risk factors and preventive measures, anonymously (Sawaya et al.,2020). A bivariate analysis was employed to find the association with selected variables (Sawaya et al., 2020). The study found out that 67.8% of the students suffered from CVS (Sawaya et al., 2020). The topmost reported symptom was blurred vision (27.0%). Significant negative correlation was found between asthenopia with limited use of screens per day. (Sawaya et al., 2020).

India

A survey in India (Sigh etal, .2016) reported that 78.6% of the medical students suffered from CVS (Singh et al., 2016). A sample of 200 medical students were used to explore the correlation between the use of smartphones and computers with asthenopia (Singh et al., 2016). A self-reported questionnaire google form was used to compile data about the demographics, type of screens used,

asthenopic complaints experienced and the total screen time (Singh et al., 2016). Data entry was performed using an excel sheet and then analyzed using SPSS version 20 (Singh et al., 2016). The most reported symptoms were headache (56.77%), eye strain (59.22%), blurred vision (49.62%) and eye redness (23.95%). A significant positive correlation was noted between CVS symptoms with type of electronic device used ($p< 0.006$) and students who spent more than four hours on digital devices (0.001) (Singh et al., 2016)

Sri Lanka

A 2016 study by Ranasinghe et al., (2016) investigated the prevalence of CVS and its contributing factors among office workers in Sri Lanka .A sum of two thousand five hundred computer office workers were who emanated from all the provinces of Sri Lanka were summoned for the survey in 2009 (Ranasinghe et al., 2016). Data on demographic variables, gender, CVS symptoms, daily screen time, type of electronic devices, and knowledge of ergonomic practices and angle of gaze was gathered using a self-reported, pre-tried questionnaire form (Ranasinghe et al., 2016). A binary logistic regression was employed in data evaluation giving a prevalence of 66.4% (Ranasinghe et al., 2016). The most frequently experienced symptoms were headache (45.7%), dry eyes (31.1%) and pain in or around the eyes (28.7%) (Ranasinghe et al., 2016). A significant positive correlation was noted between increased risk of CVS with women, period of service, daily screen time, underlying eye conditions, use of contact lenses and poor ergonomic practices (Ranasinghe et al., 2016).

2.3.2 European review

SPAIN

Cantó-Sancho performed a study in 2022 to determine the prevalence of CVS among university students in Spain (Cantó-Sancho et al., 2022). The study also aimed to investigate the correlation between prevalence of CVS with demographic factors, refractive error and the use of video display terminals (VDT), (Cantó-Sancho et al., 2022). Both VDT and CVS questionnaires were used to capture data for the cross factor among the call center operators in Brazil (Cantó-Sancho et al., 2022). A descriptive analysis and logistic regression models were used to analyze and examine the correlation between CVS and other variables, respectively (Cantó-Sancho et al., 2022). The study found out that CVS affected 60% of the university students in Spain with headaches and itchy eyes being the most prevalent symptoms (Cantó-Sancho et al., 2022). A strong positive

correlation was found between CVS with women, prolonged use of VDT's and use of vison correction devices (Cantó-Sancho et al., 2022).

A study on "Prevalence of Computer Vision Syndrome and Its Relationship with Ergonomic and Individual Factors in Presbyopia VDT Workers Using Progressive Addition Lenses" was executed by Sánchez-Brau and colleagues In Spain finding an alarming prevalence of 74.3%in (Sánchez-Brau et al., 2020). A total of 109 VDT workers who use progressive addition lenses were used as the study sample and a self-reported questionnaire was used to collect data from the participants (Sánchez-Brau et al.,2020).. Subjective refraction was done on every participants by an optometrist and spectacles were analyzed using a lens analyzer (Sánchez-Brau et al., 2020)... A strong correlation was noted between CVS with poor sitting posture and compromised work place lighting, with itching (73.4%) and near vision discomfort (72.5%) being the frequently reported symptoms (Sánchez-Brau et al., 2020) The proactive measures encouraged by Sánchez-Brau and team included the provision of training to workers on the significance of appropriate lighting conditions and ergonomic postures when using VDT'S (Sánchez-Brau et al., 2020).

2.3.4 American review

Brazil

Eduardo Costa Sá and team performed a research to evaluate the prevalence of CVS and its risk factors among call center operators in São Paulo located in Brazil (Sa et al., 2012). Data was collected through the use of interviews, work place observations and questionnaires (Sa et al., 2012). CVS was determined by the existence of one or more ocular symptoms responded as always, often or sometimes (Sa et al., 2012). Most operators were young and youthful ranging from 18 to 24 years (Sa et al., 2012). Computer vision syndrome was found to affect 56.4% of the operators (Sa et al., 2012). The most prevalent complaints were eye fatigue (73.94%), weight in the eye (68.21%) and burning sensation (54.6%) (Sa et al., 2012). A significant positive correlation was found between CVS with improper lighting conditions, viewing distance and refractive error (Sa et al., 2012). The down side of their study was that, other elements that can influence the prevalence of CVS such as lifestyle factors, screen brightness settings, type of VDT used and quality of routine eye care checkups were not considered.

2.3.3 African review

Nigeria

A research titled "Prevalence and risk factors associated with computer vision syndrome among at the University of Kaduna in Nigeria by Nwankwo et al., 2021 found a positive significant association between CVS with daily screen time and screen height. Information was gathered through the use of a prevalidated, structured questionnaire form that was administered by an interviewer (Nwankwo et al., 2021). An SPSS version 23 was employed to evaluate the data gathered from 153 undergraduates (Nwankwo et al., 2021).Computer vision syndrome was found to affect 83 (54.3%) undergraduates at the University of Kaduna (Nwankwo et al., 2021). The frequently reported symptoms were eye strain (48.5%) and blurred vision (42.51%). Weakness of their study was that the study population was too small for the results to be generalized among all the undergraduates' students in Nigeria. Although the questionnaire had been pretested the precision and consistency of the methods used for data collection were not highlighted.

Agbonlahor et al., (2016) conducted a study in Abuja, among working class adults so as to evaluate the prevalence, knowledge and effect of CVS on work productivity among FCT (Federal Capital Territory) workers. A pretested self-reported questionnaire was used to collect information from the workers aged between 18 to 35 years. A sum of 255 responses were collected but on 215 responses were used for the study. Computer vision syndrome was calculated to affect 65% of the workers. A chi-square test was performed, prevalence of CVS was found to be positively associated with knowledge of CVS ($p=0.005$) and reduced work productivity ($p=0.036$)

Zimbabwe

There is no known data that has been published up to this date on the prevalence and knowledge of computer vision syndrome in Zimbabwe.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Chapter 3 outlines the approach that was used to evaluate the prevalence and knowledge of computer vision syndrome among students at Bindura University. The research design, study setting, study sample, sampling technique, strategy for data collection, inclusion and exclusion criteria, and strategy for data analysis are explained in this chapter.

3.2 Study setting

The study was carried out at Bindura University of Science Education, which is in Mashonaland Central province, Zimbabwe. It is found in Mazowe valley, which is approximately eighty-seven kilometers north-east of Harare (Mandizha et al., 2023).

3.3 Study design

A cross-sectional design was used in this survey, which is a type of observational study, or descriptive research that involves analyzing information about a population at a specific point in time that is quick, cheap and easy to conduct as it does not require any follow-up with subjects (Julia Simkus. 2023).

3.4 Study period

The research was conducted between 27 August 2024 and 20 June 2025.

3.5 Study population

The survey included all students at Bindura University who agreed to take part.

3.6 Sampling method

Undergraduates at Bindura University of Science Education were divided using a stratified random sampling technique. The population was split into 4 groups (strata) depending on the faculty, that is, the faculty of science education, the faculty of commerce, faculty of agriculture and the faculty of social sciences, thereby yielding three strata. A simple random sampling method was then utilized to haphazardly select participants from each stratum.

3.7 Study sample

The minimum sample size that was needed in this survey was calculated using the formula below

$n=N/ (1+NE^2)$

N= Estimated number of students at Bindura University during the study period.

=5000

E= margin of error

= 0.05

n =370

3.8 Inclusion criteria

Students with refractive errors, systemic conditions and ocular pathologies who complied were included in this study.

3.9 Exclusion criteria

Students who refused to take part were excluded.

3.10 Data collection

Data was obtained using a pretested, self-reported online Google Questionnaire form with 3 sections. The 3 sections were as follows: Section (1) consisted of the socio-demographic data, Section (2) consisted of the prevalence of CVS, and Section (3) consisted of knowledge or awareness of CVS.

Socio-demographic information (SECTION 1)

Section one was made up of 4 items: faculty of study, age, gender and academic year. Participants filled in their age on the space provided, for gender, only two options were provided, male or female.

For faculty of study, respondents selected from the options given, that is, the faculty of science and engineering, the faculty of commerce, faculty of agriculture and the faculty of social sciences. For the academic year, students chose from the options provided, that is, year 1 to year 4.

Computer Vision Syndrome Questionnaire (SECTION B)

The computer vision syndrome Questionnaire developed by Segal in 2015 was utilized to collect data for the section on the prevalence of computer vision syndrome (Yee et al., 2024). The form consisted of 16 questions that asked about the intensity and frequency of 16 symptoms of CVS

using the Likert scale in the form of a matrix scale. To answer frequency, which is how often symptoms occur when using electronic gadgets, 3 options were available: Never, Occasionally and Often or Always. Never signified that the symptom is completely absent, occasionally meant the participant experiences sporadic episodes or CVS symptoms once a week and often or always indicated a symptom that occurs once or thrice a week or daily. To measure intensity, two options were available, which are moderate and intense. Respondents were reminded that if they indicated never for frequency, they should refrain from

Ticking anything for intensity. The total score was calculate by the summation of the expression, (frequency of symptom occurrence) x (intensity of symptom). The expression considered that on frequency Never = 0, occasionally = 1, Often or Always = 2. For intensity, moderate = 1 and intense = 2.

Knowledge of computer vision syndrome (SECTION C)

Twenty-two questions were asked to assess knowledge of computer vision syndrome. Eighteen questions were general questions, whilst the remaining three assessed the level of knowledge of CVS. The three questions were: What are the causes of CVS? What are its symptoms? What are the preventive mechanisms? These were multiple-choice questions where respondents chose from the thirty-one provided elements, and a score of one was given to each of the relevant elements. The total number of elements selected by the respondents will be marked out of 31 and converted to its percentage. Their knowledge will be graded using Bloom's cut-off points that indicate that 80% to 100% represents good knowledge, 60% to 79% indicates moderate knowledge and below 60% will highlight poor knowledge. There were both multiple-choice and short-answer questions on the supportive questions. The questions were as follows: Have you ever heard of CVS? Where did you hear about CVS? How much of your time do you spent on your screen during the night? How much of your time do you spend on your screen during the day? How many years have you spent using screens in this way? Is your time on the screen continuous or interrupted? What are the digital screens you normally use (smartphones, laptops, desktops or tablets)? What is the most common screen size you normally use (small, medium or large)? To what average level do you illuminate your primary screen percentage (10-30, 30-50, 50-70, and 70-100)? Do you have any of the following symptoms (CVS symptoms) with screen use over the last 12 months (respondents

were reminded to choose all that apply and to leave blank if there is none)? How many symptoms attacked you on average, if any, in the last 12 months? Are your symptoms attack-related to screen use? Do you have a previous diagnosis of dry eye or use drops to treat it? Do you have any refractive errors or wear glasses? Do you feel that digital screens affect your lifestyle or eye health? Is your school involved in a mandatory computer system use program? How do you usually study (screens, books or both? What is your main purpose that consumes most of your screen time? A pilot study was conducted to check the validity of this section.

3.11 Data analysis

Data was evaluated using the Statistical Package for Social Sciences (SPSS) version 20, charts, graphs and frequency tables were then created.

3.12 ethics considerations

Consideration of ethics was acquired from the ethics committee of Bindura University of Science Education. Participants were first provided with a research participation consent form with a detailed explanation of the survey.

Confidentiality was assured throughout the procedure as information obtained was shared with only authorized personnel, moreover, names and email addresses were not part of the questionnaire. Participation of respondents was completely optional, and participants were permitted to withdraw from the survey at any moment without penalty.

Chapter 4

Results

4.1introduction

In this chapter research findings are presented, accompanied by tables as well as graphs. It presents the distribution of measured parameters, including age, sex, and the highest level of study. It also explores level of knowledge and awareness level of computer vision syndrome among

undergraduate students at Bindura University. Section C outlines the prevalence of CVS among students.

4.2 Demographic Information

The total number of participants was 370, which made up 100% response rate. The mean age of participants was 25.16 and a standard deviation of 4.66 years. Half of the participants were between the ages of 22 and 26. The modal age was 23 years. Among the 370 participants, 208 (56.2%) were female and 162 (43.8%) male. The majority of participants were from the Faculty of Science and Engineering (115 or 31.1%), followed by the Faculty of Commerce (112 or 30%). Participants from the Faculty of Social Sciences and Humanities were 92 (24.6%), and the Faculty of Agriculture had 45 (12%) participants. In terms of academic year, 119 (32.2%) were in second year, 105 (28.4%) in fourth year, 74 (20%) in first year, and 72 (19.5%) in third year of study.

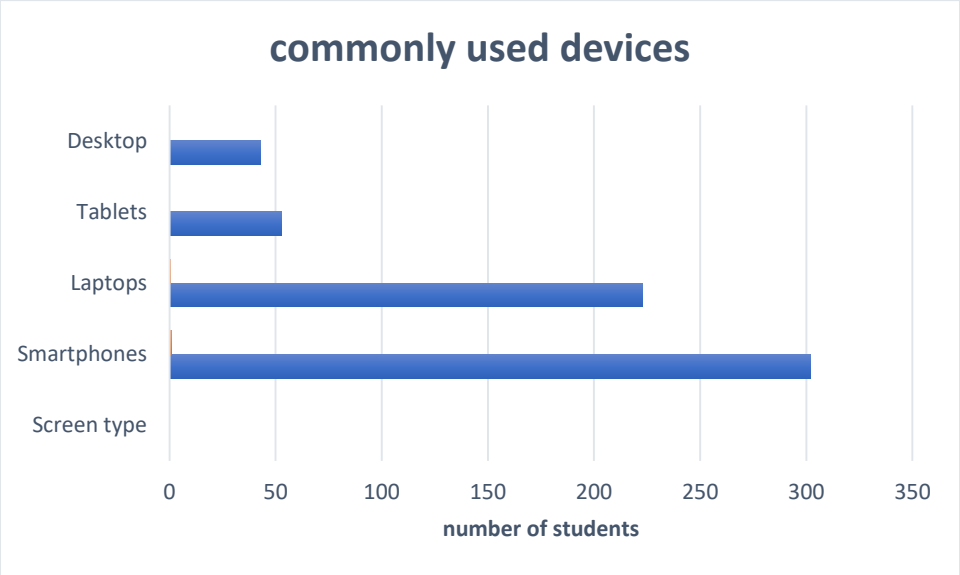
Table 4.2 Demographic Information of Participants

Variables	**mean +(SD)**	**n**	**%**
Age	Mean +SD		
	25.16 (4.66)		
Gender			
Male		208	56.2%
Female		162	43.8%
academic year			
1		74	20%
2		119	32.2%
3		72	19.5%
4		105	28.4%
Faculty			
Faculty of Agriculture		45	12%
Faculty of Commerce		112	30%
Faculty of Science And Engineering		115	31.1%

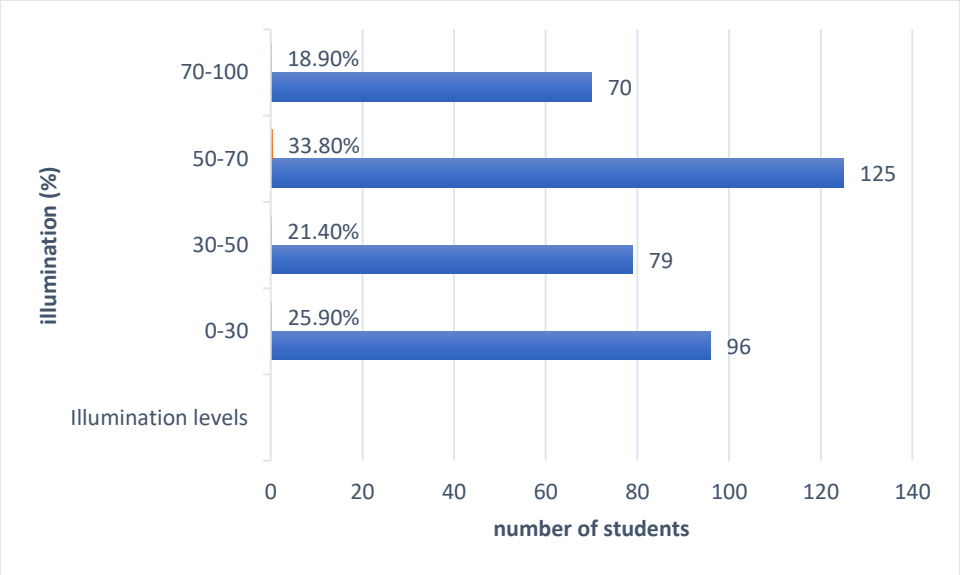
Faculty of Social Sciences And Humanities	98	26.5%

4.3 Device Usage

Most of the students used smartphones, 302 (81.6%) users, followed by laptops, used by 223 (60.3%) students. There are quite a number of students, 43(12%), 43(12%) and others who use tablets as well, which adds up to 53(14%). These percentages do not add up to 100% because a significant number of students use more than one device.



Illumination levels are presented as follows: 96 (25.9%) use their devices at 0-30, 79 (21.4%) use their devices at 30-50, 125 (33.8%) use their devices at 50-70, and 70 (18.9%) use the illumination of 70-100. The graph below summarizes illumination levels.



Since most of the students use more than one device, information about the type of their commonly used device out of all the devices they use was collected in categories of screen sizes. 179 (48%) used small sized devices, 138 (37.3%) used medium sized devices and 53(14.3%) use large screens. The small-sized screens are the smartphones, the medium-sized screens are the laptops and tablets, while the large screens are the desktops and laptops. Table 4.2 summarises devices used and their nature.

Table 4.3 Device Usage and Illumination Levels

variable	n	%
Screen type		
Smartphones	302	81.6%
Laptops	223	60.3%
Tablets	53	14.3%
Desktop	43	11.6%
Screen size		
Small	179	48.4%
Medium	138	37.3%
Large	53	14.3%
Illumination levels		

0-30	96	25.9%
30-50	79	21.4%
50-70	125	33.8%
70-100	70	18.9%

4.4 Prevalence of CVS

The prevalence of CVS was 33% and this was distributed among different groups with different habits. Among males, 48 (13.0%) had CVS compared to 114 (30.8%) without CVS. Among females, 75 (20.3%) had CVS versus 133 (35.9%) without CVS. The table also breaks down data for age groups, faculties, academic levels, time spent on screens during the day and night, continuous versus interrupted screen use, screen types, lighting levels, refractive errors, and years of screen use. For instance, 114 (30.8%) among students who used screens for more than 4 hours during the day had CVS, compared to 213 (57.6%) without CVS in that group. Similarly, 112 (30.3%) of those who used screens for more than 4 hours at night had CVS. Students with refractive errors showed a higher rate of CVS (65 or 17.6%) compared to students without refractive errors (58 or 15.7%).

Table 4.4 Prevalence of CVS

Variables	With CVS (n)	With CVS (%)	Without CVS (n)	Without CVS (%)
Gender				
male	48	13.0%	114	30.8%
female	75	20.3%	133	35.9%
age				
19-28	90	24.3%	204	55.1%
28-38	32	8.6%	40	10.8%

38-48	1	0.3%	3	0.8%
faculty				
agriculture	16	4.3%	29	7.8%
commerce	29	7.8%	83	22.4%
Science and engineering	41	11.1%	74	20.0%
Social sciences and humanities	33	8.9%	61	16.5%
academic level				
1	18	4.9%	56	15.1%
2	38	10.3%	81	21.9%
3	30	8.1%	42	11.4%
4	37	10.0%	68	18.4%
time spent during the day				
4 hours or less	9	2.4%	34	9.2%
more than 4 hours	114	30.8%	213	57.6%
time spent during the night				
4 hours or less	11	3.0%	43	11.6%
more than 4 hours	112	30.3%	204	55.1%
time spent				
interrupted	46	12.4%	153	41.4%
continuous	77	20.8%	94	25.4%
screen type				
small	41	11.1%	138	37.3%

medium	63	17.0%	75	20.3%
large	19	5.1%	34	9.2%
illumination level				
0-30	24	6.5%	72	19.5%
30-50	25	6.8%	54	14.6%
50-70	46	12.4%	79	21.4%
70-100	28	7.6%	42	11.4%
refractive error				
yes	65	17.6%	47	12.7%
no	58	15.7%	200	54.1%
years spent				
5 years and below	12	3.2%	89	24.1%
more than 5 years	111	30.0%	158	42.7%

4.5 Knowledge of CVS

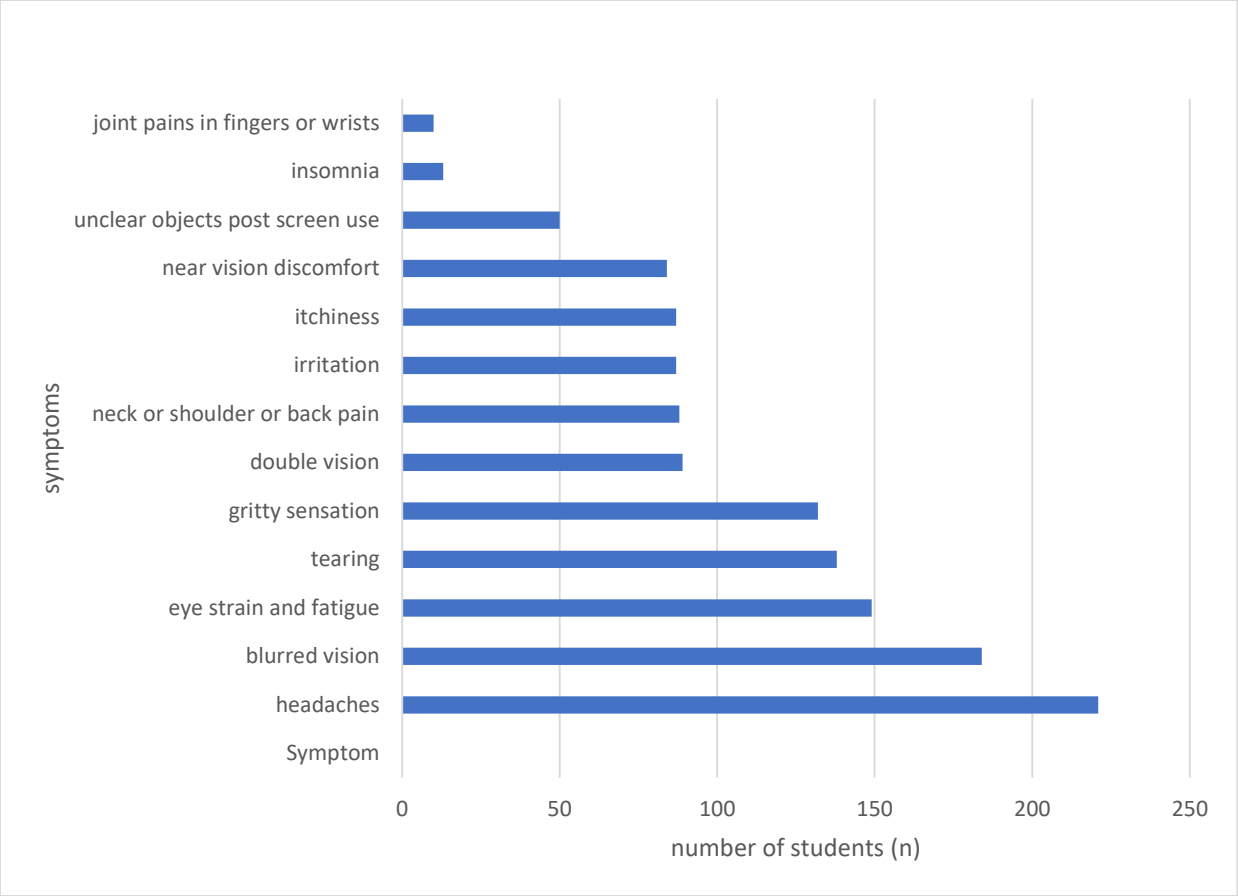
Of the participants, 181 (49%) had heard about CVS from some source, while for 189 (51%), it was their first encounter with the term. Among those who had heard about it, 75 (20.3%) heard from friends or relatives, 56 (15.1%) from health institutions, 76 (20.5%) from mass media, and 109 (29.5%) from the internet. A few others heard about it from newspapers. The table further breaks down knowledge levels (Poor, Fair, and Good) by gender, age, faculty, and academic level. For example, a significant number of participants across all demographics showed poor knowledge of CVS.

Table 4.5 Knowledge of Computer Vision Syndrome (CVS)

Variables	Poor(n)	Poor (%)	Fair (n)	Fair (%)	Good (n)	Good (%)
Gender						
Female	162	43.8%	36	9.7%	10	2.7%
Male	140	37.8%	17	4.6%	5	1.4%
Age						
19-28	258	69.7%	44	11.9%	12	3.2%
29-38	60	16.2%	9	2.4%	3	0.8%
39-48	4	1.1%	0	0%	0	0%
Faculty						
Agriculture	34	9.2%	5	1.4%	6	1.6%
Commerce	97	26.2%	14	3.8%	1	0.3%
Science and engineering	89	24.1%	19	5.1%	7	1.9%
Social sciences	82	22.2%	15	4.1%	1	0.3%
Academic level						
1	63	17.0%	6	1.6%	5	1.4%
2	103	27.8%	12	3.2%	4	1.1%
3	52	14.1%	18	4.9%	2	0.5%
4	84	22.7%	17	4.6%	4	1.1%

4.5 symptoms of CVS

The most commonly reported symptoms were headache, blurred vision, eye strain and tearing. 221(59.7%) complained of headaches, 184(49.7%) complained of blurry vision. 149(40.3%) complained of eyestrain and fatigue, and 138(37.3%) complained of tearing.



Other reported symptoms included gritty sensation (132 or 35.7%), double vision (89 or 24.1%), neck or shoulder or back pain (88 or 23.8%), irritation (87 or 23.5%), itchiness (87 or 23.5%), near vision discomfort (84 or 22.7%), unclear objects post screen use (50 or 13.5%), insomnia (13 or 3.5%), and joint pains in fingers or wrists (10 or 2.7%). Table 4.4 summarises the complained symptoms.

Table 4.6 Reported Symptoms of Computer Vision Syndrome

Symptom	Number of People	Percentage
headaches	221	59.7%
blurred vision	184	49.7%
eye strain and fatigue	149	40.3%
tearing	138	37.3%
gritty sensation	132	35.7%
double vision	89	24.1%

neck or shoulder or back pain	88	23.8%
irritation	87	23.5%
itchiness	87	23.5%
near vision discomfort	84	22.7%
unclear objects post screen use	50	13.5%
insomnia	13	3.5%
joint pains in fingers or wrists	10	2.7%

4.6 Ocular history

A significant majority, 278 (75.1%), of students reported symptoms associated with screen use, while 35 (9.5%) did not, and 57 (15.4%) were not sure. Regarding previous diagnosis of dry eye, 52 (14.1%) students had a diagnosis, and 318 (85.9%) did not. For refractive error, 112 (30.3%) students had a refractive error, while 258 (69.7%) did not.

Table 4.7 Association with Screen Use, Dry Eye, and Refractive Error

Variable	Yes	%	No	%	Not sure	%
Symptoms associated with screen-use	278	75.1%	35	9.5%	57	15.4%
Previous diagnosis of dry eye	52	14.1%	318	85.9%		
With refractive error	112	30.3%	258	69.7%		

Association of demographic variables and prevalence of CVS

A chi-square analysis was carried out to find the association between prevalence of CVS and some selected demographics. (Table 4.8) The null hypothesis was rejected when $p<0.05$ and accepted when $p> 0.05$. Results from the table below shows that there was no significant association between CVS with gender, faculty, Academic level and illumination. A significant correlation was found between CVS with prolonged daily screen use, refractive error, time spent on electronic devices at night and the years spent using electronic devices.

Variable	Chi-Square Statistic	P-Value
Gender	1.418372365	0.233671
	5.110164777	0.077686
Faculty	3.231470619	0.357295
Academic level	5.234915269	0.155382
Time spent during the day	2.725779256	0.09874
Time spent during the night	4.066526951	0.043741
Time spent	18.92597286	1.36E-05
Screen type	18.35815699	0.000103
Illumination level	5.182937371	0.158881
Refractive error	42.90008719	5.76E-11
Years spent	27.2579046	1.78E-07

4.8 conclusion

In conclusion, out of the 370 students, 33.2% had computer vision syndrome. A notable number had no knowledge about the cvs. Different behaviours on screens led to different outcomes of symptom presentation. The most commonly reported symptoms were associated with those that spent more time on screens

Chapter 5 discusses the outcomes from the study's attempt to assess the knowledge and prevalence of computer vision syndrome among undergraduates at Bindura University. The discussion commences with demographic findings, followed by prevalence and knowledge of CVS in the following sections, respectively.

5.2 Demographic Data

Both males and females took part in this study, with a total of 56.7% females and 43.3% males with females dominating because there are more female students at BUSE as compared to males. Similarly, other studies in Nigeria (Agbolahor. 2019), India (Thampi et al., 2014), Pakistan (Noreent al 2016) also reported female dorminances. Their demographic data was 54.0%, 67.29%, 67.2% females, respectively. These findings contradict with other studies conducted in, Sri Lanka (Ranasinghe et al., 2016), Chennai (Laraja et al., 2014) and Saudi Arabia (Rashidi et al., 2017) which had male dominance. Their findings had 50.08%, 52.4%, and 77.28% males the rest being females.

The age ranged from 19 to 45, with a mean age of 25.16 because both undergraduates and postgraduates were included in this survey. This is in line with studies in Ethiopia (Gebresellassie et al., 2019), Pakistan (Maqbool et al, 2024) and Pakistan (Cheema et al., 2019), which had a mean age of 26, 23 and 23, respectively. The mean age was lower than that reported in the Saudi population by Turkistani et al., (2021) because they conducted their study through a randomly distributed questionnaire on social media platforms, which was open to the general public where individuals from all age groups participated. Noreen et al., (2016) reported a lower mean age because they did their research on a specific age group that is 17 to 25 years. Ranasinghe et al., (2016) reported a much higher mean age of 30.8, the reason being that the survey was conducted among workers rather than students.

5.3 Prevalence of CVS

The present study was conducted among students at Bindura University and the point prevalence of CVS was found to be 33.34% which is in range with the worldwide prevalence of 25% to 93%. This is because use of laptops is not mandatory in other faculties. Additionally, our study population was mostly made up of younger participants (mostly twenties) which are less prone to

CVS as compared to adults since CVS symptoms are closely related with increasing age (Anthonyet al.,2021). These results closely resemble a study in Italy (Mocci et al., 2017) with a prevelence of 31.9% due to better ergonomic practices by participants and good work environment. Similarily, another study among engineering students in Hawass University Institution of Technology Campus in Ethiopia had a prevalence of 41.7% (Gebresellassieet al., 2022) because only engeeering students were involved in thier study excluding other faculties which might have caused a lower prevelence. The prevalence of CVS in this study is higher than that reported in Pakistan (25%). In contrast, a study in Chennai (Lagaraj M and Madhpriya V, .2014), reported a higher prevelence of 78.6% because the study was conducted among medical and engeeering students who might be involved more with computers. Additionally, studies in Malaysia (Reddy et al, .2013) and. Pakistan (Noreen et al., 2016) reported higher prevalence of 89.9% and 67.3% respectively because participants with at least one symptom of CVS were considered to suffer from computer vision syndrome. A survey of computer vision syndrome conducted in Sri Lanka (Ranasinghe et al., 2016) also reported a prevalence of 67.4% due to poor workin environment.

Findings from this study revealed that computer vision syndrome is prevalent in females as compared to males. This is in harmony with studies in Egypt (Ashkar et al., 2016), Nigeria (Agbonlarhor O., 2019) and Ranasinghe et al. (2016), which concluded females are prone to CVS. On the contrary, a study in Ethiopia among engineering students at Hawass University (Gebresellassie et al.,2019 reported CVS being prevalent among males (61.4%) as compared to females (38.6%). The reason was that the engineering department was composed of more males than females. Studies that also confirm the former opinion were done in India (Patil et al., 2019) and Chennai (Lagaraj et al, 2014).

The most reported symptom was headache (59.73%). Blurred vision (49.73%), Eye strain and fatigue (40.27%) and tearing (37.30%) were among the top four reported symptoms. Thampi et al., 2014 also reported headache (76.6%) and eye strain (65.5%) being the most prevalent symptoms. Other studies conducted by Anthony et al. (2016 and Thampi et al. follow headaches being the most reported symptom. Blurred vision (65%) and tearing (62.3%) were also among the most reported symptoms (Anthony et al., 2022). Other studies which do not subscribe to headaches

being the most frequent symptoms are (Thampi et al., 2022), which reported eye burning (71%) being prevalent.

Prevalence of computer vision syndrome was found to be significantly associted with the type of digital devices used (p=0.000103), time spent on screens daily (1.36E-05), refractive error (p=5.76E-11), time spent on computers during the night (p=0.043741) and the years spent while using electronic devices (p=1.78E-07). This confirms a study by Maqbool et al., (2024) that stated that CVS was significantly associated with refractive error (p<0.001), time spent on electronic gadgets daily (p=0.007) and people who use screens in the dark or with dull light environments (p=0.06). Ashkar et al., (2024) also subsribes to the fact that prolonged use of laptops (p=0.039) and wearing corrective eyeglasses is associated with increased prevelence of CVS. The use of small sized devices was associated with higher level of CVS prevelence as suported Cuellar and lanman. (2017). Addutionally, Turkistan et al., (2021) and Noreen et al., (2017) reported a positive correlation of CVS with time spent on dital devices. In contrast, Anthony et al., 2021 reported no associaton between demorgraphics except age. Agbonlahor O., (2016) reported that only knowledge and prevelence of computer vision syndrome had a significant correlation whereas Senthil Kumar.,2020 did not report any factor that had a significant positive correlation with CVS.

5.4 Knowledge of CVS

Most students (81.62%) had poor knowledge of CVS, with 14% having fair knowledge and 4% good knowledge. In the same vain, a study by Yeel et al. (2024) also reported 91.9% of students have poor knowledge of CVS. Similarly, a study in Nepal among medical students by (Sitaula and Kwatri, 2018) found out that most of the students had poor knowledge of CVS. The lack of knowledge is due to lack of exposure and awereness of CVS symptoms and its preventive measures (Yee et al., 2024). Also, Kumar et al., (2020) reported 80% of the medical students at Vanayaka Missions Kirupananda Variyar College in India having poor knowledge of CVS. In contrast, a study in Nigeria (Agb. In contrast, a study in Nigeria (Agbolahor O., 2019) among FCT (Federal Capital Territory) workers reported more than half (51.6%) having good knowledge of CVS. This is that most elderly people visit eye practices more often than people visit eye practices more often than students. Similarly, a study among ophthalmologists in India reported all participants (100%)

having good knowledge of CVS (Bali et al., 2007). Moreover, Patil et al., 2019 reported only 23.54% having poor knowledge of CVS, whilst 76.47% having average and good knowledge altogether.

5.5 Study limitations

The major constraints of the study were that it was a cross-sectional study, which did not include ophthalmic examinations. The symptoms reported were self-reported, where others overestimate the severity of their symptoms while others underestimate them, leading to biases. This study did not take into consideration the contribution of ergonomic practices and the background screen colour that may affect CVS symptoms. Moreover, other students were too busy to participate, and others refused for reasons best known to themselves.

Chapter 6

Conclusion and recommendations

6.1 Conclusion

This descriptive cross-sectional study determined quantitatively the level of knowledge and prevalence of computer vision syndrome among university students. The most significant findings were that there was a 33.3% prevalence of CVS and a 4% good knowledge of it. Most of the participants who had poor knowledge of CVS are exposed to screens for more than 8hours a day. There were more complaints of headaches, itchiness, blurry vision and tearing.

6.2 Recommendations

The recommendations will be provided to relevant stakeholders as follows:

6.2.1 Awareness campaigns

The university must implement awareness campaigns to educate students on the symptoms, causes, and prevention of CVS. Informational materials are to be used such as posters, brochures and social media posts can help disseminate this knowledge effectively.

6.2.2 Promote the 20-20-20 Rule:

Students should be advised to practice the 20-20-20 rule. This says that every 20 minutes, look at something 20 feet away for 20 seconds to minimize eye strain.

6.2.3 Vision Screening access

Eye examinations should be made available on campus to identify and address visual problems in the early stages to avoid complications

6.2.4Improve infrastructure

Libraries and computer labs should be designed with ergonomic standards in mind. They should include adjustable chairs, screen filters, and optimal lighting which can significantly reduce CVS risk.

Further Research

Future studies should explore the long-term impacts of CVS on academic performance and mental well-being. Qualitative research could also provide deeper insight into students' lived experiences and coping strategies.

Creating an ergonomically friendly study environment can significantly reduce the risk of CVS.

6.2.6 Support Further Research

This study brings out the need for ongoing research into:

- Long-term impacts of CVS on visual health, academic outcomes, and mental well-being
- The effectiveness of various preventive interventions
- Knowledge, attitudes, and practices related to digital device use among different student demographics

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Appendix 1: informed consent

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Informed Consent Form for Participation in Research Study

Title of research: Prevalence and knowledge of computer vision syndrome among students at Bindura University of science education.

Name: 1. Rutendo Enia Chashamba
2 Vongai Carol Chisayinyerwa

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Contact details: +263 774770803
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Date:

Introduction

You are invited to participate in a research study conducted by Rutendo Enia Chashamba, an undergraduate student at Bindura University. The purpose of this study is to determine the prevalence and knowledge of computer vision syndrome among students at Bindura University of Science Education.

Study Procedures

If you agree to participate, you will be asked to fill in a questionnaire form with three sections which includes social demographic information, associated signs and symptoms of computer vision syndrome and knowledge of computer vision syndrome. This procedure will take at most 10 minutes.

Risks and Benefits

There are no risk or benefits involved by participating.

Confidentiality

Your participation in this study will be kept confidential. All data collected will be stored securely and will only be accessible to the research team. No identifying information will be used in any reports or publications.

Voluntary Participation

Your participation in this study is completely voluntary. You may choose not to participate or to withdraw at any time without any consequences.

Questions

If you have any questions about this study, please contact Rutendo Enia Chashamba at 0774770803

Consent

By signing below, you indicate that you have read and understood the information provided Above and agree to participate in this study.

Participant's Name: _____

Participant's Signature: _____

Date: _____