Prevalence and knowledge of Computer Vision Syndrome (CVS) among the Working Class Adults in F.C.T. Nigeria

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Abstract

Purpose: This study was conducted to determine the prevalence of Computer Vision Syndrome (CVS) among working class adults within the Federal Capital Territory (FCT) Nigeria, as well as to know if CVS has an impact on work productivity.

Methods: This was a quantitative, descriptive cross-sectional study design. Pre-tested questionnaire was self-administered to 255 participants aged 18-35 years, who work at the Federal Capital Territory (FCT) Abuja, Nigeria. A total of 255 questionnaires were collected and 215 (84%) were analysed for the study. Data was analysed using chi-square test.

Results: The prevalence of CVS in the study population was calculated to be 65%; prevalence of CVS was highest in the female gender (74%) as compared to the male (56%). Association between the dependent variable (presence of CVS) and most of the independent variables were not statistically significant; the only association that was statistically significant was presence of CVS with knowledge of CVS (χ^2: 7.748; df: 1; p= 0.005), and presence of CVS with work productivity (χ^2: 6.641; df: 2; p= 0.036).

Conclusion: This study has been able to establish the fact that there is a high prevalence of CVS in FCT, which influences work productivity. It also found out that knowledge and awareness of CVS is a major factor that can influence the development of CVS, meaning that if the knowledge or perhaps awareness of CVS improves, there could be lower occurrence of CVS and vice versa, therefore creating more awareness in this regard can never be over emphasized.

Introduction

Advancement in technology has become the focus of most countries (especially the under-developed) for the past few decades[1]. These countries were mostly involved in the 'analog' ways of carrying out official assignments; for example, the typists in 18th century made use of the typewriter machines in preparing documents. Nowadays, things are a lot different, the advancement in technology has made things easier and quicker as compared to the earlier days of the 18th century; an example of such technological advancement is the wide usage of computers to carry out both official and non-official assignments[1,2].

1. Ranasinghe P, Wathurapatha WS, Perera YS, Lamabadusuriya DA, Jayawardana N, Katylanda P. Computer vision syndrome among computer office workers in a developing country: an evaluation of prevalence and risk factors. BMC Res. Notes. 2016; 9: 150
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There is no doubt to the fact that the computer has relieved us from the cumbersome methods of carrying out tasks; however, its constant usage brings about unforeseen visual and health challenges particularly when caution is not applied. These visual and health problems related to use of computers is known as Computer Vision Syndrome (CVS). It therefore means that CVS is a matrix or complex of both oculo-visual and non-oculo-visual complaints associated with computer usage[3]. The association of Optometrists in the United States of America[4] described CVS as an affiliation of visually associated complaints that are mainly concerned with the usage of computers and most visible show gadgets like screens. In other words, any discomforting visual related complaints caused by the extended use of illuminated screens can be called CVS.

A number of these signs and symptoms or perhaps complaints of CVS includes but not confined to the following; asthenopia, eye and headaches, intermittent blurry vision, burning sensation, overall weakness mainly across the neck and shoulder areas[1], among others. The pathophysiology of these signs and symptoms of CVS as described by Loh and Redd[5] emanates from three (3) areas, these areas include Accommodation, Ocular surface and Extra-ocular muscles. CVS complaints arising from accommodative problems include blurry vision particularly at near and double vision. Complaints emanating from the second area (Ocular surface) include dryness of the eyes which could result in burning or peppery sensation; while those originating from the third area (extra-ocular muscle) are the head, neck, shoulder and overall ache. Razman[6] in his study observed that the majority of computer users present with these complaints after extended computer usage.

CVS may be labelled as a rising non-communicable 'dis-ease' having the capacity of being a public health threat if serious attention is not paid to it; as it is with other health problems, its signs and symptoms could be prevented or treated depending on the scenario. Nevertheless, the prevention of CVS is most appropriate particularly in this era where public health focuses more on preventive care in relation to curative care. One significant rule that has been accepted overtime to prevent CVS particularly for office workers is the 20-20-20 rule. Liao and Drury[7] describe this rule to involve looking away from your screen every 20minutes at a 20feet distance for 20seconds. Some other ways of preventing CVS is summed up in having good working ergonomics; which involves proper lighting office environment, ideal sitting position as relating to proximity and angle your body makes with the computer, height of chair and desk, and so on[3,8,9]. Ergonomics takes into cognisance posture when working with the computer, distances (from eyes to screen, table, chair, etc) angles (elbows, knees, hip, etc).

Figure 2 shows an ideal workstation of which study participant's information concerning their workstations were compared[22]. Assuming preventing CVS cannot be achieved, treatment of its symptoms is the next option; which can also be described as primary/secondary level of care[10,11]. Just as CVS is an aggregate of individual complaints, its treatment would involve addressing each of these complaints; for example, Arif and Alam[12] reported that the use of glasses with antiglare properties is essential for CVS patients with blurry vision, eye or a headache; especially those with refractive errors like hyperopia, myopia and astigmatism. They also asserted that symptoms like dry eyes or burning sensation can be addressed with eye drops (artificial tear drops), while regular exercises can take care of

1. Ranasinghe P, Wathurapatha WS, Perera YS, Lamabadusuriya DA, Jayawardana N, Katylanda P. Computer vision syndrome among computer office workers in a developing country: an evaluation of prevalence and risk factors. BMC Res. Notes. 2016; 9: 150
3. Logaraj M, Madhupriya V, Hedge S. Computer Vision Syndrome and associated factors among medical and engineering students in Chennai. Ann, Med. Health Sci. Res. 2014; 4 (2) : 179-185
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the neck and shoulder aches. CVS can also deteriorate to a level where tertiary care is needed; Gangamma et al.[13] and Eagles[14] mentioned that specialists like the Neurologists, Orthopedics, Optometrists, Orthoptists, etc, can be involved when such situation arises.

Many evidences in literature have shown that CVS is mainly associated with those who actively use the computer. Gupta et al.[15] in their study to determine the prevalence of CVS among college staff and student in Punjab observed that 66% of the study population who use computers presented with CVS symptoms. This finding was supported by Ranasinghe et al.[1] when they carried out similar study on workers in Sri-Lanka; a one year prevalence of CVS among the study population was about 67%. Hassan et al.[16] tried to investigate the frequency of CVS among engineering students in Lahore, and found out that the frequency of CVS was over 70%. With all these findings, the occurrence of CVS is linked to computer use. However, no study has been carried out in order to know the prevalence of CVS in Nigeria; the closest study in this regard was done by Akinbinu and Mashalla[17] in which the authors tried to ascertain the knowledge of CVS among Nigerian workers. They found out that less than half of the study population (40%) have heard about CVS, and 74% of these presented with a minimum of one CVS symptom.

The aim of this study is to identify the rates of occurrence of CVS in the FCT, with particular focus on the adult working population (18-35 years) who actively make use of the computer more than 3 hours every day and to determine if CVS has an impact on their work productivity.

Methods

Study setting

This study was carried out in the Federal Capital Territory (FCT), the capital city of Nigeria. The FCT also known as Abuja city comprises 6 area councils which are; Abuja Municipal Area Council (AMAC), Bwari, Kuje, Kwali, Gwagwalada, Kuje. AMAC constitutes the most developed part of Abuja, where most offices are located. There are approximately ten thousand offices located within the FCT[18] , which includes federal and state ministries, agencies and departments, private business like banks, health maintenance organisations (HMO's), telecommunication outfits and cyber cafe centres.

Study Population

This study focused on the adult working-class population (18-35years) within the FCT who work in offices that make use of computers for their daily tasks, or those who mostly work with computers at home.

Sampling procedures

A simple random and systematic sampling method was used in this study. The researcher randomly selected offices within the FCT to source for study participants (random sampling); however, it was ensured that selected offices were of different categories. In other words, there was a mixture of public and private offices, large, medium and small-scaled offices, schools, religious centres, health care facilities, etc (Systematic sampling) (See Table 1). Equal number of public and private offices was ensured, as well as equal number of small, medium and large scaled offices; this was done to make the study population a good representation of the entire population.

Inclusion Criteria

- Study participants who are between the ages 18 and 35.
- Use the computer more than 3 hours every day.
- Must have spent more than 6 months on current job.
- Must have a good visual acuity of not less than 6/9 and N_6 with or without corrective lenses
- Must be in a good state of overall health during the study time frame.

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18. Abuja-NG.com. Abuja Nigeria. 2018 Available at: https://www.abuja-ng.com/ (Accessed: 04/03/2018)

Exclusion Criteria

- Those who did not meet the inclusion criteria were excluded for the study.

Accessing the overall ocular and health condition of the participants was beyond the scope of this study; however, vision at distance and near were measured using the Snellen's acuity chart, and those having less than 6/9, N_6 with or without correction were excluded. Cover test and "push up to blur" method was performed only to **screen** for binocular and accommodative problems respectively, and those with abnormal findings were excluded. More so, the blood pressure of each participant was measured using the automated sphygmomanometer to rule out high blood pressure.

Table 1 showing types and categories of offices used as study sample

S/N	Offices	Categories	Number of Participants	%
01	Federal Parastatals	Large scale	71	27.8
02	Banks	Large Scale	37	14.5
03	HMO's	Medium Scale	57	22.4
04	International organisations	Large Scale	40	15.7
05	Telecoms organisations	Large Scale	20	7.8
06	Private offices and others	Small Scale	30	11.8
Total			**255**	**100**

S/N: Serial number.

Sample size estimation

A sample size estimation of 212 was calculated by Roasoft software having a Margin of Error (MOE) of 5%, Confidence Level (CL) of 95% and a response distribution of 50%, since the population size(N) is less than 10,000[19]. For a much easier form of computation, the sample size estimation of 212 was rounded up to 215 (n=215).

Data collection

Data collected were not secondary, rather it was self-generated; this was to enhance the originality and flexibility of the researcher's data, as well as the inclusion of specific non-conventional information concerning ergonomics and lightening. The tool used for data collection in this study was a pretested structured questionnaire. Visual acuity, Phoria/Tropia, amplitude of accommodation and blood pressure were evaluated with Snellen's visual acuity chart, Cover test (using handheld occluder), near point card and a Double G automated sphygmomanometer (model number: BP-103H) respectively, after questionnaires were distributed and results recorded on individual questionnaire forms. The questionnaire had 3 components; A (Social demographic information), B (CVS symptoms experienced during work or after work) and C (Knowledge of CVS and ergonomic practices). Questionnaires contained 34 closed-ended questions, which were prepared from extensive studies of similar previous research, as well as professional opinions to ensure validity of questionnaire.

Informed consent was obtained from each participant, and approval from the ethics research committee of the Federal Capital Territory Administration (FCTA) was obtained before proceeding with the research.

Data Analysis

IBM SPSS software was used for data entry and analysis. Completed questionnaire forms were manually screened for errors, data was coded and carefully entered in the IBM SPSS (v. 21) for analysis. The dependent variable was "presence of CVS" and it was coded as "absent=0, and present=1". Other independent or covariate variables were coded as well; gender was coded "male=0 and female=1", CVS symptoms was coded "none=0 and present=1", knowledge or awareness of CVS was coded "just knowing=0 and have always known=1". Colour on screen background was coded "black=0, blue=1, red=2, green=3 and others=4", use of glare filters was coded "No=0 and yes=1", ergonomic practice was coded "poor=0 and good=1", while work productivity was coded "reduced=0, stable=1 and increased=2". These variables are categorical; however, some others were continuous which did not need any coding, they included age, number of working hours and working experience in years.

Mean and mode (descriptive statistics) was used in data analysis and interpretation, as well as frequency tables, percentages and figures. Relationships between variables (dependent and independent) were tested using Chi-square; and a p-value of less than 0.05 was considered statistically significant. Two hundred and fifteen (215) questionnaires

19. Raosoft. Sample Size calculator. 2004 Available at http://www.raosoft.com/samplesize.html (Accessed: 07/03/2018)

(84%) were analyzed after a thorough manual screening was done by the researcher for all questionnaires collected. Forty (40) questionnaires were excluded for reasons of ages below 18 years and above 35 years and incomplete forms or incorrect entry of details.

Result

Socio-Demographic Characteristics

The used sample size was 215, a valid response rate of 84% (255 participants completed questionnaire), an average (mean) age of 30.4years (S.E: 0.261), with a range of 18 to 35 years. Most of the study participants were 35 years old (20.9%), followed by 30 and 28 years with a percentage of 13.5 and 10.7 respectively (Table 2). Female gender was more with a percentage of 54% while the males 46% (Table 2); majority of the study participants had working experience of 4 years (15.3%) and daily working hours of 9 (30.2%), with mean values of 6.23 and 8.98 respectively. (Table 2)

Table 2
Socio-demographic characteristics.

S/N	Socio-Demographic Characteristics	Frequency	%
01	**Gender**		
	Male	99	46
	Female	116	54
02	**Age of Participants(years)**		
	18-21	6	2.9
	22-25	22	10.1
	26-29	51	23.8
	30-35	136	63.3
03	**Work experience (years)**		
	1-4	90	41.8
	5-9	82	38.2
	10-14	32	14.9
	15-18	11	5.2
04	**Working hours**		
	3-7	19	8.9
	8-13	194	90.2
	14-19	1	0.5
	20-24	1	0.5

S/N: Serial number.

Table 3
Descriptive statistics of age, work experience and number of working hours

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age of participants (Years)	215	18	35	30.38	3.831
Work experience (Years)	215	1	18	6.23	3.795
Number of working hours (hours)	215	3	24	8.98	1.683
Valid N	215				

Table 4: Association between presence of CVS, gender, age, work experience, number of working hours.

Socio-Demographic Characteristics	CVS PRESENT	CVS ABSENT	Total	Chi-square (X^2)	p-value
Gender					
Male	**55**	**44**	99	9.345	0.189
Female	**86**	**30**	116		

Socio-Demographic Characteristics	CVS PRESENT	CVS ABSENT	Total	Chi-square (X^2)	p-value
Age of Participants(years)					
18-21	2	4	6	12.987	0.235
22-25	11	11	22		
26-29	37	14	51		
30-35	91	45	136		
Work experience (years)					
1-4	62	28	90	20.769	0.350
5-9	51	31	82		
10-14	21	11	32		
15-18	7	4	11		
Working hours					
3-7	14	5	19	15.991	0.141
8-13	124	70	194		
14-19	0	1	1		
20-24	1	0	1		

Using chi square test to determine association between presence of CVS and work experience in years, there was no statistical significance (χ^2: 20.769; df: 19; *p*= 0.350). The association between the presence of CVS and number of working hours was also not statistically significant (χ^2: 15.991; df: 11; *p*= 0.141). The same was the case for age and gender respectively (χ^2: 12.987; df: 10; *p*=0.189 and χ^2: 9.345; df: 10; *p*=0.235). See table 4.

Prevalence of CVS

A prevalence rate of 65% was gotten from our study. The prevalence of CVS (Table 5) was more in females (74%) than in males (56%). Headache was the most frequently reported CVS symptom (48.4%), with back-ache and neck/shoulder/wrist pain coming second and third with 47% and 32.6% respectively; the least reported symptom was double vision (3.3%). Table 6 provided details of reported CVS symptoms;

At ***least one*** CVS symptom was present in 172 participants (80%); this was similar to reports given by Akinbinu and Mashalla[17] as prevalence of CVS. However, this did not confirm the presence of CVS; as it was defined earlier as presence of ***more than one*** symptom. Forty three (43) participants (20%) were asymptomatic.

Table 5
Prevalence of CVS by gender

	CVS Present	CVS Absent	Total
Male	55 (56%)	44 (44%)	99 (100%)
Female	86 (74%)	30 (26%)	116 (100%)
Total	140 (65%)	75 (35%)	215(100%)

Table 6
Percentage of CVS symptoms

S/N	Symptoms	Percentage of occurrence (%)
01	Headache	48.8
02	Eyestrain	27.0
03	Blurred near vision	14.4
04	Blurred far vision	13.0
05	Dry/irritating eyes	14.0
06	Double Vision	3.3
07	Red eyes	17.2
08	Light sensitivity	30.2
09	Neck/shoulder/wrist pain	32.6
10	Backache	47.0

S/N: Serial number.

Knowledge of CVS

More than half of the study participants had previous knowledge of CVS (precisely 51.6%), leaving 48.4% who were just hearing of the condition for the first time. Though the questionnaire did not capture the level of education or how the participants learnt about CVS, the fact that 51.6% knew about the condition was not strange as most participants have worked with the computer for a long time now. **Table 7** shows level of knowledge of CVS among participants. Association between presence of CVS and knowledge of CVS was statistically significant (χ^2: 7.748; df: 1; p=0.005).

Colour on Screen Background

Current research have proven that certain colours particularly blue light may have some detrimental effects on vision, thereby causing lots of visual disturbances like dry eyes and eye fatigue which could consequently leads to CVS[20,21]. Background colours of study participants were investigated to know which colour was predominant (primary colours-blue, red and green as well as black and others were investigated). 109 of the 215 participants (50.7%) reported that blue was the colour on their screen background, followed by black having 17.2% (Table 7 and Figure 1). Despite the supposed troubles blue light could cause to vision, there was no significant association between CVS and colour on screen background (X^2: 1.315; df: 3; p= 0.726)

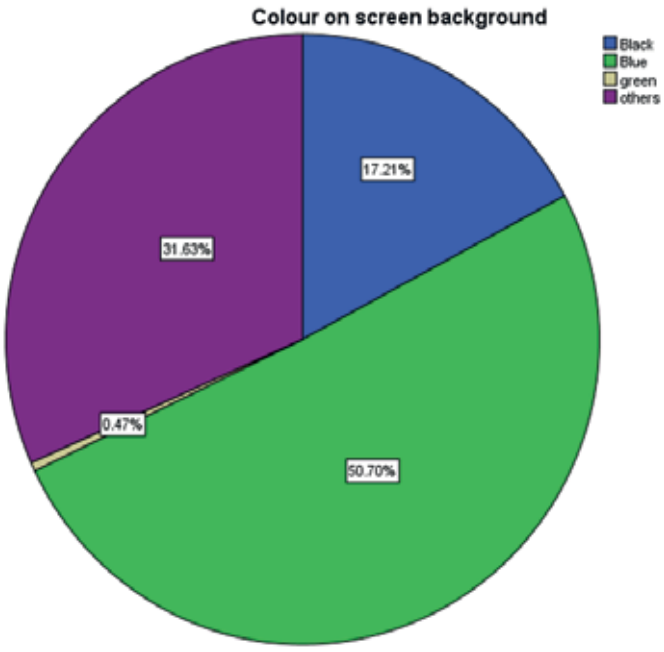

Figure 1: Pie chart showing frequency of colours on screen background

Use of glare filters

Approximately78.1% of participants used their computers for many years (>3years) without anti-glare filters; 168 participants reported that their screen was void of any screen guard or filter. Only 47 participants (21.9%) employed the use of glare filters when working with the computer (Table 7). Association between CVS and use of glare filters was not statistically significant (χ^2: 0.813; df: 1; p= 0.367), regardless of the challenges glare presents with.

Ergonomic practice

Our study showed that 179 participants (83.3%) had poor ergonomics practice, with only 36 (16.7%) observing good ergonomic practice (Table 7). There was no significant association between CVS and ergonomics practice (χ^2: 1.740; df: 1; p= 0.817).

Figure 2: Showing ideal work station[22]

Work productivity

Ninety-five (95) study participants (44.2%) reported that their work productivity has been stable since they began work, 85 (39.5%) of them reported that their productivity had increased, while only 35 (16.3%) mentioned that their productivity at work has reduced (Table 7). Association between CVS and work productivity was statistically significant (χ^2: 6.641; df: 2; p=0.036); in other words, the presence of CVS could determine one's productivity at work.

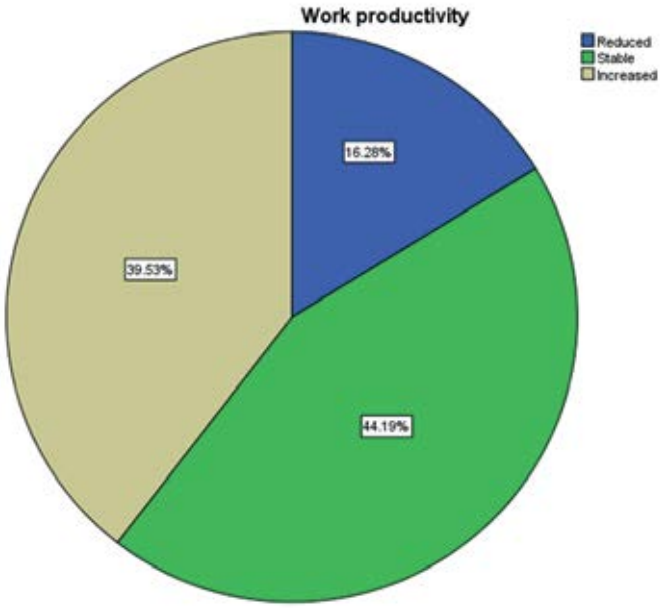

Figure 3: Pie chart showing frequency of work productivity

Table 7: Showing frequency and percentages of other variables.

S/N	Other Variables	CVS Present	CVS Absent	Frequency	Percent (%)	Chi Square (X^2)	P-Value
01	Knowledge/Awareness of CVS						
	Just knowing	57	47	104	48.4	7.748	**0.005***
	Have always known	86	25	111	51.6		
02	Color on screen background						
	Black	17	20	37	17.2		
	Blue	56	53	109	50.7	1.315	0.726
	Green	0	1	1	0.5		
	Others	30	38	68	31.6		
03	Use of Filters						
	No	88	80	168	78.1	0.813	0.367
	Yes	18	29	47	21.9		

22. Human-Solution-Sitting-desk-height. Available at: http://lowendmac.com/human-solution-sitting-desk-height/ (Accessed: 21/03/2018)

S/N	Other Variables	CVS Present	CVS Absent	Frequency	Percent (%)	Chi Square (X^2)	P-Value
04	Ergonomic Practice						
	Poor	80	99	179	83.3	1.740	0.817
	Good	20	26	36	16.7		
05	Work Productivity						
	Reduced	28	7	35	16.3		
	Stable	44	51	95	44.2	6.641	**0.036***
	Increased	30	55	85	39.5		

S/N: Serial number.
*Statistically significant

Discussion

The prevalence of CVS discovered from this study is 65%; as 140 participants out of the 215 who took part in the study presented with more than one CVS symptom. The prevalence rate in our study is similar to that reported in literature; the study by Ranasinghe et al.[1] showed a one-year prevalence of CVS to be 67.4%, and that of Arumugam et al.[23] was 69.3% and Noreen et al.[24] showed 67%. Although some other studies have reported higher prevalence of CVS; for example studies by Rahman and Sanip[8], Logaraj et al.[3] and Reddy et al.[25] had a prevalence of 74%, 80.3% and 89.9% respectively; other studies reported lower prevalence of CVS, like that of Subratty[26] having a prevalence of 59.9%. In all of these studies, a common finding remains that the prevalence of CVS is above 50% which is significant and worthy of causing remarkable health problems within the society if adequate attention is not paid to it. Unfortunately, no published studies on the prevalence of CVS in Nigeria have been seen; therefore, a comparison cannot be made to know if there is an increase or decrease in prevalence. However, a prevalence of 65% is significant enough to arouse rapid awareness in work places in order to combat this health issue in Nigeria.

The most common symptom of CVS in this study was headache (48.8%), followed by backache (47%) and neck /shoulder/wrist pain (32.6%). Other symptoms included light sensitivity (30.2%), eye strain (27%), red eyes (17.2%), blurred near vision (14.4%), dry irritating eyes (14.0), blurred far vision (13.0%) and double vision (3.3%). Most studies confirmed headache as the most prevalent symptom of CVS; Ranansinghe et al.[1] mentioned that headache (45.7%) was the most common CVS symptom presented, followed by dry eyes (31.1%) and pain around the eyes (28.7%). Megwas and Daguboshim[27] reported headache (41.8%) as the most common CVS symptom, with pain (31.6%) and eyestrain (26.7%) following; in a similar fashion Shahid et al.[28] in their study headache (46%) was reported as the most common symptom, followed by tired eyes (45%) and neck pain (41%). Akinbinu and Mashalla[17] reported headache and eye strain (30.9%) as the most common symptoms followed by double vision (12.9%) and watery eyes (10.8%). These studies above opined that headache is the most common CVS symptom, but in contrast there are studies which reported other symptoms being more prevalent. Study by Rosenfield et al.[29] reported tired eyes (40%) as the most common followed by dry eyes (32%) and eye discomfort

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(31%), Al Rashidi and Alhumaidan[30] reported eye strain (62.14%) as the most common with burning sensation (7.57%) following. No doubt headache seems to be the most common symptom associated with CVS or computer use, the link between both may be because digital prints on the screen are more visually tasking compared to hard copy prints. This is due to the tiny dots called pixels which make up digital prints, making them clear at the centre and blurry at the edges (poor edge resolution), this inconsistency in digital prints pushes the eyes to work extra, thus resulting in eye strain and consequently headaches. According to Ranasinghe et al.[1], a computer user who constantly looks at the computer screen and hard copy prints simultaneously experiences focusing and refocusing of the visual system to maintain clear prints at various distances, this causes marked stress on the eye muscles, consequently leading to eye fatigue and headache.

Prevalence of CVS was found to be highest in females (74%) than males (55.9%); this could be attributed to the fact that the female gender participants (54%) were more than the males (46%). It has been very clear from studies and anecdotal evidence that higher prevalence of CVS is strongly influenced by the number of each gender group in the study population; that is, if there are more males, there would be higher prevalence of CVS in males and vice versa. Although, Ranasinghe et al.[1] reported that the prevalence of CVS was higher in females (69.5%) than males (65.4%), and the study population comprised of 49.2% females and 50.8% males. Studies that confirms the former opinion includes Logaraj et al.[3], which reported higher prevalence of CVS in males, others that showed higher prevalence in females are [31,32,33].

It was seen that more than half of the study participants are quite acquainted with the term CVS; although, the FCT is a cosmopolitan city, so it is assumed that most persons living and working there should be well informed. Although it should be made very succinct that having good knowledge or awareness of CVS alone does not stop it from becoming a health problem, what actually mitigates the effects of CVS is a conscious effort in placing measures to avert, prevent or cure it as the case may be. This study confirms this fact, because despite the high awareness of CVS (51.6%), the prevalence was still high (65%). This is not to undermine the importance of awareness in addressing public health issues; rather, it is to ensure that further steps are taken to curb these issues. Statistical analysis revealed that association between presence of CVS and Knowledge or awareness of CVS is significant; this explains that knowledge of CVS plays a major role in the development of CVS; it is a factor that influences CVS. Study by Ranasinghe[1] showed that knowledge of CVS and ergonomic practice are significantly associated with developing CVS.

Studies[20, 21] have shown that the blue light in particular has some detrimental effects on the visual system, such as dry eyes and eye fatigue. Such condition as we already know assumes or constitutes the symptoms of CVS; thus linking blue light to CVS. However, our study did not concur to this statement, as most study participants (50.7%) had blue colour as their screen background, yet there was no statistically significant association between CVS and colour on screen background. Similarly, the use of anti-glare filters on screen has been shown to reduce glare which could result in visual disturbances. Shrivastava and Bobhate[34] and Kanitka et al.[35] opined that very few visual complaints are experienced with the use of visual display filters (or anti-glare filters), making computer users more comfortable and productive. In our study, 78.1% of study participants were not using anti-glare filters, one would expect that this could be a factor to the development of CVS, just like Ranasinghe et al.[1] asserted saying that lack of glare filters strongly

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predicted the risk of developing CVS. On the contrary there was no significant association between the use of anti-glare filters and the development of CVS according to our study. The study by Reddy et al.[25] held a similar stance; they explained that the use of glare filters did not help in reducing or preventing the development of CVS.

Working ergonomics has also been perceived to be a factor that can influence the development of CVS among computer users. Distance between the eyes and screens, height of chair and table and the overall posture of computer users must be ideal, anything short of the ideal could lead to CVS. Our study observed that majority of the participants (83.3%) had poor ergonomic practice, this could be due to lack of knowledge of what ergonomics is, the failure of not having an ideal working environment or probably the cost to maintain good ergonomics in the office environment. Our study did not explore the reasons as it is outside the scope; the association or relationship between ergonomic practice and presence of CVS was the focus. The study revealed that there is no significant relationship between them, making ergonomics not a factor that can determine the development of CVS. However, the Ranasinghe et al.[1] study mentioned that ergonomic practice knowledge was associated significantly with developing CVS; and the lack of implementation of the ergonomic practice could be responsible for the high prevalence of CVS.

One of the main essence of this study is to identify the effect of CVS on work productivity among computer users, there are lots of anecdotal reports and few studies that confirms that the higher the productivity of workers within a society, the more the growth and development in the society, cutting across all spheres of the economy. It can further affect the quality of life of the population. Our study reported that 44.2% of participants had stable productivity at work, 39.5% and 16.3% reported that theirs increased and reduced respectively; despite a CVS prevalence rate of 65%, very few participants reported a decreased productivity at work. There could be other incentives that made participants to have a rather stable or increased productivity, incentives such as, good remunerations, welfare packages, sufficient breaks at intervals, etc. Statistical analysis revealed that work productivity is significantly associated with presence of CVS; in other words, CVS is a factor that influences the productivity rate of computer users.

One of the limitations of this study is that the questionnaires did not capture some information that could be needed to provide a more robust knowledge concerning CVS, information like; the source of the knowledge about CVS (internet, friends, eye doctors, etc,) and also having almost equal number of sexes as study participants to have a more valid CVS prevalence in gender. Another limitation is that the incidence of CVS could not be achieved due to the type of study design used; in other to calculate the incidence rate, a follow up must be done for study participants within a given period. Therefore, this study focused on prevalence of CVS, leaving a new research ground on the incidence of CVS in Nigeria. Other areas that could be researched further include knowing the relationship between CVS and refractive errors as well as accommodative function. Refractive error of participants was not obtained in this study, although amplitude of accommodation was done, it was strictly for screening purposes, excluding those who have less or more than expected amplitude of accommodation for their ages.

We recommend that more effort be put to reduce the prevalence of CVS in the country. Nigeria as a developing country has just scratched the surface of technological advancement with this current upsurge of technology and digitalisation as compared to other parts of the world. Therefore, if proper measures are not put in place by stakeholders especially the government, to prevent or perhaps mitigate these rising problems, then we are in for a chaotic digitalised era in the near future. The first line of action to be recommended is the prevention of CVS by maintaining an ideal working environment (ergonomics), use of some form

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of protection from rays coming from the screen, and most importantly employ series of breaks between work hours. The 20-20-20 rule suggested by Liao and Drury[7] is of essence here, it involves looking 20 feet away from your screen after every 20 minutes for 20 seconds. Arif and Alam[12] asserted that this rule has been proven to prevent and/or reduce the development of CVS. Policies that encourage such rules should be made in the bid to intervene in this 21st century visual and health problem[36]; strong political will is therefore encouraged for such fight to be won. The second line of action would be when the disease is already present, and then one is advised to visit an Optometrist who is highly skilled in visual function and rehabilitation.

This study has succeeded in contributing to the global information concerning CVS from a developing world like Nigeria, as the readily available information would be used to better safe guard the upcoming digitalized population from the negative effects of digitalization. Policies to back up the fight against the rising threat of CVS would be easy to create and implement as facts and statistics are readily available; thus, making economic growth and development inevitable.

Conclusion

This study has been able to establish the fact that the frequency of CVS in Nigeria high, as well as its influence on work productivity which is very critical to economic growth and nation building. It also found out that knowledge and awareness of CVS is a major factor that can influence the development of CVS, therefore creating more awareness in this regard can never be over emphasised. Despite the fact that this study did not find any significant association between other perceived risk factors like ergonomic practice, years spent on the job, working hours, use of anti-glare filters, it does not entirely rule them out as risk factors, perhaps more studies should be carried out with this in mind.

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