Received: 12 February 2022 *Accepted: 21 May 2022*

The Prevalence and Associated Factors of Computer Vision Syndrome (CVS) among the Academic Staff of a Non-State University in Sri Lanka amidst the COVID-19 Pandemic

Anthony, D. K.[1]*, Jayakody, L. W[1]., Bandara, P.C[1]., Liyanage, K[2]., Wijekoon, W. M. P. D. S[1]., & Guruge, M. L[2].

kushan.a@sliit.lk, 99lakshmiwasundara@gmail.com, pinidiyabandara1@gmail.com, kavindi.l@sliit.lk, dswijekoon@yahoo.com, malika.l@sliit.lk

[1]*School of Nursing, Faculty of Humanities and Sciences, Sri Lanka Institute of Information Technology,*

[2]*Department of Mathematics and Statistics, Faculty of Humanities and Sciences, Sri Lanka Institute of Information Technology.*

Abstract

Computer Vision Syndrome (CVS) is considered an occupational hazard in the 21st century resulting from the high utilization of computers, laptops, and mobile phones in the workplace. The current study aimed at determining the prevalence of computer vision syndrome and its associated factors among the academic staff of Sri Lanka Institute of Information Technology (SLIIT), Malabe campus amidst the COVID-19 pandemic using a sample of 145 academics based on stratified random sampling procedure. Required data were collected through a structured questionnaire. The participants of the study comprised 50.3% of females and 49.7% of males. About 45% were 20-30 years irrespective of gender. Dryness in the eyes (52.4%), itching (54.5%), eye pain (65.5%), and headache (76.6%) were the most common symptoms reported by the staff members, while colored halos around objects and double vision were experienced by around 20%. Most of the academics (42.1%) work 6-8 hours in front of the digital screen. Taking breaks in-between the working time (73.8%), adjusting the screen (62.1%), and adjusting the chair and posture (60.0%) were the most common methods used by the participants to minimize CVS. The rate of prevalence of CVS among the academic staff of SLIIT is 42.8%. This figure is lower than the corresponding figure reported in other countries. However, no significant association was found between the prevalence of CVS and gender, type of faculty, type of devices used, duration spent, preferred time to utilize the device, awareness of CVS, and actions to minimize CVS, but a strong significant association ($p < 0.01$) was found between the prevalence of CVS and age of the academic staff members. The rate of prevalence of CVS among academics aged over 60 years is 87.5%. Thus, a regular ocular screening program is recommended to reduce the prevalence of CVS among the academic staff of SLIIT starting from higher age groups.

Keywords: Academic staff, Computer vision syndrome, Covid-19, Dryness in the eyes.

Introduction

With the advancement of technology, computers, and mobile phones have become an essential part of human life. The continuous use of computers for an extended time leads to several visual and ophthalmic problems known as Computer Vision Syndrome (CVS) (Barthakur, 2013; Sen & Richardson, 2007). CVS is also referred as digital eye strain by Rosenfeild (2011). The American Optometric Association (2007), defines CVS as "a complex of eye and vision problems related to activities, which stress the near vision, and which are experienced in relation or during the use of a computer." Symptoms of CVS include dry and irritated eyes, eye strain, blurred vision, red eyes, double vision, burning eyes, excessive tearing, headache, light/glare sensitivity, slowness in changing focus, and changes in color perception (Gangamma, Poonam & Rajagopala, 2010).

The risk factors for CVS are prolonged computer use, inadequate lighting, screen brightness, the strain on the eye muscles to read the content on the computer screen, vision difficulties, bad posture, inappropriate workstation setup, or a combination of any of the above factors (Kozeis, 2009; Assefa et al., 2017). Modern e-device screens have built-in protective systems to protect the user from harmful lights emitted from the device, but the duration of use mostly contributes to CVS (Munsamy & Chetty, 2020).

According to a study by Rosenfield (2011), between 64% to 90% of computer users may experience CVS during prolonged computer usage. The term 'prolonged computer usage' refers to the usage of a digital screen for 3 hours or more without a break in between (Sen & Richardson, 2007). Studies show that the prevalence of CVS among the working community, who work with e-devices has increased because of the COVID-19 pandemic (Bhattacharya, Saleem & Singh, 2020). Alabdulkader (2021) has analyzed the total hours per day spent on e-devices by computer users during and before imposing the curfew in Saudi Arabia due to the COVID-19 pandemic and discovered that those who used digital devices during the curfew had a higher prevalence of digital eye strain.

As reported by World Health Organization (2020), COVID-19, also known as 2019-nCoV, is an infectious disease caused by a newly discovered coronavirus named SARS-CoV-2. At the beginning of 2020, COVID-19 was the biggest concern of health professionals as it spreads rapidly throughout the community and the symptoms and complications were unknown to the health sector (Velavan & Meyer, 2020). As a result of the community-imposed restrictions aimed at preventing the transmission of COVID-19, many occupations were conducted at home using computers and other electronic equipment (Baker, 2020). However, consequently, computer users have become habituated to excessive computer use, which results in several health problems.

Healthcare providers are concerned about these health problems related to CVS. Studies provide evidence that CVS can be prevented by altering the habits of the consumer while working with computers (Munsamy & Chetty, 2020). Adjusting the posture and the position of the screen, taking breaks in-between

working time, using blue light blocking glasses, use of artificial lubricants on the eyes, and taking Omega-3 supplements were recommended by previous studies to prevent and control CVS (Rosenfield, 2011; Coles-Brennan, Sulley & Young, 2019; Munsamy & Chetty, 2020). The CVS-Q is a questionnaire that has been developed to identify the frequency and intensity of the CVS symptoms present in the participants and the prevalence of CVS (Seguí et al., 2015). The CVS-Q has been developed and validated to administer among the English-speaking population and has been used in previous research studies in different South Asian countries (Mohan et al., 2021; Arshad et al., 2019).

With the onset of the Covid-19 pandemic, mandatory e-learning has emerged. Therefore, it was a common practice for students and academic staff to spend most of their time in front of digital screens (Chandasiri, 2020). Ranasinghe et al. (2016) conducted a study on the prevalence and risk factors of computer vision syndrome among computer office workers in Sri Lanka. A sample of 2210 was examined aged from 18 – 60 years and a length of service from 1-5 years. The 1-year prevalence of CVS was found to be 67.4% in the sample population.

While there have been multiple studies on the prevalence of CVS among the working community, there have been limited studies on CVS among university academic staff amidst the COVID-19 pandemic. The aim of this study was to identify the prevalence of CVS and its associated factors among the academic staff of SLIIT during the COVID-19 pandemic.

Materials and Methods

Sample size

The sample size (n) for this study was calculated by using the following method. At first, the sample size without considering the finite population correction factor (n0) was calculated as 384 using the equation,

$$n0 = \frac{z^2 p^*(1\text{-}p)}{e^2}$$

5% margin of error (e), z =1.96 (critical value at 5% significance level) and p=0.5.

As the population size, N is 318, the minimum sample size (n) was calculated as 175 by considering the correction factor for the population size using,

$$n = \frac{N^* n_o}{n_o + (N\text{-}1)}$$

However, due to lack of resources and time, the sample size was forced to reduce to 145. In fact, it represents 42% of the population.

Sampling method

As there are four faculties in SLIIT, the sampling method was stratified random sampling method. The strata are the four faculties. The selected sample size was proportionally allocated among faculties based on the number of academics in each faculty (Table 1).

Table 1.
Distribution of the sample size.

Faculty	Sample size
Computing	63
Engineering	44
Business school	15
Humanities and sciences	23
Total	145

Data collection

Data were collected through a self-administered questionnaire (Google form) that comprised demographic questions and a standard questionnaire (CVS-Q). The questionnaire was sent as an online survey to the randomly selected permanent academics in each faculty (Table 1) who have been working with computers. The prior approval to administer the CVS-Q English version to the Sri Lankan community was obtained from a Committee of Sri Lankan experts representing statistics, health, and language fields (Tamil, Sinhala & English language).

Data analysis

A scoring system has been developed in the validated questionnaire in which a standard expression was used to obtain the prevalence in the selected population. Based on prior research (Segu et al., 2015), sixteen symptoms were selected as the most common symptoms related to CVS. The questionnaire was used to determine the frequency of occurrence and the intensity of each symptom. The authors have assigned 0–2-point rating scale with the following categories to determine the frequency of occurrence, or how often the symptom was present: 0=never, 1=occasionally (once a week) and 2=often (two or more times a week). The two levels of intensity of the symptom were graded similarly, on a scale of 1 and 2 points, where 1=moderate and 2=intense. In the study, a symptom that was never reported was given a score of 0 on the intensity scale, irrespective of the frequency. According to the Rasch analysis (Segu et al., 2015) the marks given for the three levels of the frequencies and three levels of intensities are shown in Table 2.

Table 2.
Marks allocated for different symptoms.

Frequency	Intensity	Frequency*Intensity	Mark given
0	0	0	0
1	1	1	1
1	2	2	1
2	1	2	1
2	2	4	2

Based on the above the total score ('sum') of CVS for each academics was computed using the following equation.

$$\text{Sum} = \sum_{1}^{16} (\text{frequency of symptom occurrence}) * (\text{intensity of symptom})$$

If the sum ≥ 6, the academic staff member was identified as a person suffering from CVS and otherwise not suffering from CVS. The ethical approval was obtained from the ethics working committee of SLIIT. SPSS version 22 was used in the data analysis. Basic statistics and Chi-squared analysis to test the significance of association between two factors were used.

Results and Discussion

Demographic variables

Table 3 shows that the total number of responses (n=145) were almost equally received from female (50.3%) and male (49.7%) participants.

Table 3.

The distribution of demographic variables.

Variables	Category	N (%)
Gender	Male	72 (49.7)
	Female	73 (50.3)
Age (years)	20-30	68 (46.9)
	31-40	43 (29.7)
	41-50	16 (11.7)
	51-60	10 (6.2)
	≥ 61	8 (5.5)
Faculties	Computing	63 (43.5)
	Engineering	44 (30.3)
	SLIIT Business school	15 (10.3)
	Humanities & Sciences	23 (15.9)
Type of device used while working	Desktop computers	2 (1.4)
	Desktop computers & laptops	6 (4.1)
	Desktop computers, laptops & mobile phones	35 (24.1)
	Desktop computers, laptops, mobile phones & tablets	14 (9.7)
	Desktop computers & mobile phones	2 (1.4)
	Laptops	25 (17.2)
	Laptops & mobile phones	48 (33.1)
	Laptops, mobile phones & tablets	13 (9.0)
Time spent in front of the device (hours)	≤ 2	0 (0.0)
	2.1-4	3 (2.1)
	4.1-6	23 (15.8)
	6.1-8	61(42.1)
	> 8	58 (40)
Preferred time to use the device	Daytime	49 (33.8)
	Nighttime	25 (17.2)
	No preference	71 (49.0)
Awareness of CVS	Yes	142 (97.9)
	No	3 (2.1)

Most of the responses (46.9%) were from participants between 20-30 years of age category. About 30% of the participants used both laptops and mobile phones to perform their tasks while at work. The type of device is essential to identify the effect of the screen size of the device on academics. A higher percentage of participants (42.1%) have spent 6-8 hours whereas 40% have spent more than 8 hours in front of digital devices. Further, 15.9% of participants have experienced 4.1-6 hours of screen time. Similar results were observed among computer users in Debre Tabor Town, Northwest Ethiopia (Dessie et al., 2018). The study stated that workers who used computers for more than 4.6 hours per day were more likely to develop CVS as compared to those who used computers for less than 4.6 hours. (Other similar studies have also reported that an increase in the number of hours spent on the computer raises the risk of CVS significantly (Ranasinghe et al., 2016; Logaraj, Madhupriya & Hegde, 2014; Sharma, Khera & Khandekar, 2006).

Most of the participants of the current study have used electronic devices without a preference on the time of the day. Though there was no significant association between the preference and prevalence of CVS, Blehm et al. (2005) stated that the lighting within the workstation area affects the vision of the employees who work with computers. According to Dessie et al. ((2018) computer users with a high understanding of computer safety measures and awareness of CVS were found to be less affected by CVS. A study conducted at the University of Benin, Nigeria by Chiemeke & Akhahowa (2008) claimed that the awareness and knowledge about CVS among the participants highly contribute to adhering to CVS preventive methods that occurred during working hours.

Symptoms of Computer Vision Syndrome (CVS)

Table 4 shows the distribution of CVS symptoms among the academic staff of SLIIT.

Table 4.

Occurrence of computer vision syndrome.

CVS symptoms	Never (%)	Occasionally (%)	Often & always (%)
Burning	54.6	37.5	7.9
Itching	45.5	49.0	5.5
Feeling of a foreign body	77.2	20.7	2.1
Tearing	51.0	44.1	4.9
Excessive blinking	60.7	36.6	2.7
Eye redness	66.2	30.3	3.5
Eye pain	34.5	51.7	13.8
Heavy eyelids	64.1	28.3	7.6
Dryness	47.6	41.4	11.0
Blurred vision	56.5	34.5	9.0
Double vision	78.6	15.2	6.2
Difficulty focusing near vision	62.8	29.7	7.6

Table 4. (Continued)

CVS symptoms	Never (%)	Occasionally (%)	Often & always (%)
Increased sensitivity to light	60.0	28.3	21.7
Colored halos around objects	79.3	20.7	-
Feeling the sight is worsening	61.4	31.0	7.6
Headache	23.4	54.5	22.1

Dryness in the eyes, itching, eye pain, and headache were the common symptoms experienced by the staff members. Most of the participants (54.5%) have suffered from headaches at occasional intervals due to prolonged computer usage, while only a few responses (20.7%) have observed colored halos around objects during working hours. A considerable number of participants have experienced burning in the eyes, tearing, excessive blinking, and blurred vision while utilizing the digital device. According to Bali, Navin & Thakur (2007) 82 % of their study population complained of headaches, whereas 43% and 45% were among medical and engineering students, respectively (Logaraj, Madhupriya & Hegde, 2014).

It has been proven that if a person sits at a computer screen for an extended amount of time, their blinking rate can be lowered by 60% (Akinbinu & Mashalla, 2013). As a result, tear production will be reduced, leading to dry eyes (Anshel, 2004). Dry eyes were more common in women, the elderly, and contact lens wearers, and less common in younger age groups and non-contact lens wearers (Schaumberg et al., 2003). However, the findings of the present study found that the prevalence of dryness in the eyes is high among the 20-40 age category. The possible reason could be due to, a sample containing a high percentage of 20-40 years old participants. Although itching and eye pain were complained by most of our participants, prior studies show that redness in the eye, eyestrain, double vision, & watery eyes were also frequently observed among the employees who use computers (Ranasinghe et al., 2016; Akinbinu & Mashalla, 2013; Talwar et al., 2009; Singh, 2009; Chiemeke & Akhahowa, 2008; Anshel, 2004).

Preventive measures of CVS

Taking breaks in between the working time, adjusting the screen, and adjusting the chair & posture were the common methods used by the participants to prevent and control CVS. The use of eye lubricants and performing eye exercises were practiced by a limited number of staff members (Table 5).

Table 5.
Preventive measures of CVS.

Actions used to minimize CVS	%*
Use of overhead lighting	28.9
Adjusting the chair and posture	60.0
Adjusting the position of the screen	62.1
Taking breaks in-between working time	73.8
Use preventive eyewear (blue light blocking glasses)	45.5
Performing regular/daily exercises for the eyes	10.3
Use of eye lubricants	5.5

*Sum is not hundred due to multiple response

Upon assessing the preventive measures of CVS taken by the academic staff, adjusting the chair & posture, adjusting the screen, and taking breaks in-between the working time were the most common methods used by the participants. Taking a work break during long periods of computer work can help to relieve eye strain by allowing the eye muscles to rest by shifting their attention away from the computer screen (Alexis & Gregory, 1997). In a study conducted in Malaysia by Rahman & Sanip (2011), taking breaks (at least 10 minutes during continuous one-hour computer work) was found to be significantly associated with CVS. Previous studies show that improper workstations, unsuitable viewing angle and distance, incorrect positioning of the keyboard, inadequate room illumination, and improper screen brightness were factors associated with CVS symptoms (Parihar et al., 2016; Ranasinghe et al., 2016). In this study, improper ergonomic practices were prevalent among the participants who were identified as having CVS. According to Ranasinghe et al (2016), individuals at workstations that were noncompliant with standard ergonomic recommendations had a greater prevalence of CVS.

Prevalence of computer vision syndrome

Based on the total score (Table 2) participants were allocated into two groups: (i) present CVS and (ii) absent CVS (Table 7). The prevalence of computer vision syndrome among the academic staff of SLIIT was 42.8%. Alarmingly, other studies also have reported CVS prevalence with higher values among the working community who use computers: 63% among the administrative staff of a university in Malaysia, (Zainuddin & Isa, 2014), 73.9% in University of Gondar, Ethiopia, among secretaries and data processors (Alemayehu et al., 2014), 67.4% in Sri Lanka among office workers (Ranasinghe et al., 2016) and 72% in Ajman, United Arab Emirates (Shantakumari et al., 2014). The highest percentage of responses came from the Faculty of Computing, where a majority of participants work as computer experts who work with digital devices more frequently than other employees. Since they are spending more time with computers, the participants were aware of the causes of prolonged computer use. The possible reason for a lesser prevalence compared to other studies may be due to the awareness of CVS and the ergonomic practices among the academic staff members of SLIIT.

Association of demographic variables and prevalence of CVS

To find the association between the status of CVS and selected factors, chi-square analyses were carried out (Table 6).

Table 6.
Selected factors for CVS.

Factors	value	p-value
Gender	0.084	0.361
Age (years)	12.485	0.006
Faculties	1.915	0.590
Types of devices used	7.301	0.398
Duration spent Infront of the device	4.888	0.087
Preferred time to use the device	4.619	0.099
Awareness of CVS	0.879	0.349
Actions to minimize CVS	29.822	0.921

Results in Table 6 indicate that there was no significant association between the prevalence of CVS and gender, type of faculty, types of devices used, duration spent, preferred time to utilize the device, awareness of CVS, and actions to minimize CVS. However, a strong significant association (p=0.006) was found between the prevalence of CVS and age groups. The percentage of academic staff members having CVS is 42.8% irrespective of age and other factors (Table 7). Furthermore, percentage of having CVS among academics of more than 60 years of age is 87.5% and it is significantly higher than the corresponding percentages in other groups. The percentage of having CVS of the age group 51-60 years old is 60%.

Table 7.
Association between the age and the prevalence of CVS.

Age group (years)	Prevalence of CVS	
	Yes	No
20 - 30	42.6	57.4
31 - 40	32.6	67.4
41 - 50	37.5	62.5
51 - 60	60.0	40.0
> 61	87.5	12.5
Total	42.8	57.2

Conclusions, Suggestions and Limitations

Conclusions

The present study showed a 42.8% prevalence of Computer Vision Syndrome among academic staff of SLIIT. A significant association was only observed between the age categories and the prevalence of CVS while a significant association was not identified between the prevalence of CVS and the factors; gender, types of digital devices used, time spent in front of the device, preferred time to use the device, awareness of CVS and actions use to minimize CVS. The presence of CVS is very high (87.5%) among the academics of over 60 years of age and the corresponding figure among academics of age 51-60 years is 69%.

Dryness in the eyes, itching, eye pain, and headache were the most common symptoms among the staff members irrespective of age. Taking breaks in-between the working time, adjusting the screen, and adjusting the chair and posture were the most common methods used by the participants to minimize CVS.

Suggestions

Educational sessions were recommended to be conducted on preventive measures of CVS and workplace ergonomics. Receiving consultations from a physiotherapist is suggested to get further information regarding workplace ergonomics and eye muscle strengthening. Furthermore, those who experienced multiple CVS symptoms were recommended to refer to an ophthalmologist for further treatment.

Limitations

The main limitation of the study was that the CVS-Q has not been adapted and validated for Sri Lankan population although it was validated to be used in the English language. Another limitation was that a proper examination of the eyes was not performed by an ophthalmologist. Therefore, all the symptoms related to CVS depended on self-reported measures by the study participants. The study setting was limited only to SLIIT due to COVID 19 restrictions in the country. Hence, the overall results cannot be generalized to academic staff who utilize computers in other universities in Sri Lanka.

Acknowledgment

All the academic staff of the Sri Lanka Institute of Information and Technology, Malabe, who participated in the study are acknowledged.

References

Akinbinu, T. R. & Mashalla, Y. J. (2014). Impact of computer technology on health: Computer Vision Syndrome (CVS). *Academic Journals,* Vol. 5(3), 20-30. https://doi.org/10.5897/MPR.2014.0121.

Alabdulkader, B. (2021). Effect of digital device use during COVID-19 on digital eye strain. *Clinical and Experimental Optometry*, 104(6), 698-704. doi: 10.1080/08164622.2021.1878843.

Alemayehu, M., Nega, A., Tegegne, E. & Mule, Y. (2014). Prevalence of Self-Reported Computer Vision Syndrome and Associated Factors among Secretaries and Data Processors Who are Working in University of Gondar, Ethiopia. *Journal of Biology, Agriculture and Healthcare*, Vol.4, No.15.

Alexis, M. H. & Gregory, R. W. (1997). Working Safely with Video Display Terminals. United States, Department of Labour.

Anshel, J. (2005). Visual Ergonomics Handbook. Taylor and Francis, New York.

Arshad, S., Faisal Qureshi, M., Ali, M., Piryani, K., Shafqat, K., & Mateen, M. (2019). Computer vision syndrome: prevalence and predictors among students. *Annals of Psychophysiology*, 6(01), 15-22. doi: 10.29052/2412-3188.v6.i1.2019.15-22.

Assefa, N., Weldemichael, D., Alemu, H., & Anbesse, D. (2017). Prevalence and associated factors of computer vision syndrome among bank workers in Gondar City, northwest Ethiopia, 2015. *Clinical Optometry*, 9, 67-76. doi: 10.2147/opto. s.126366.

Bali, J., Navin, N., & Thakur, B. (2007). Computer vision syndrome: A study of the knowledge, attitudes, and practices in Indian Ophthalmologists. *Indian Journal of Ophthalmology*, 55(4), 289. doi: 10.4103/0301-4738.33042.

Baker, M. (2020). Who cannot work from home? Characterizing occupations facing increased risk during the COVID-19 pandemic using 2018 BLS data. doi: 10.1101/2020.03.21.20031336.

Barthakur, R. (2013). Computer vision syndrome. *Internet Journal of Medical Update*. Retrieved from: http://www.akspublication.com/ijmu.

Bhattacharya, S., Saleem, S., & Singh, A. (2020). Digital eye strain in the era of COVID-19 pandemic: An emerging public health threat. *Indian Journal of Ophthalmology*, 68(8), 1709. doi: 10.4103/ijo.ijo_1782_20.

Blehm, C., Vishnu, S., Khattak, A., Mitra, S., & Yee, R. (2005). Computer Vision Syndrome: A Review. *Survey of Ophthalmology*, 50(3), 253-262. doi: 10.1016/j.survophthal.2005.02.008.

Chandasiri, O. (2020). The COVID-19: Impact on Education. *Journal of Asian and African Social Science and Humanities*, 6(2), 37–42. Retrieved from https://www.aarcentre.com/ojs3/index.php/jaash/article/view/207.

Chiemeke, S., & Akhahowa, E. (2008). Computer Vision Syndrome (CVS) among Users in Nigeria. *Information Technologist*, 3(2). doi: 10.4314/ict.v3i2.32014.

Coles-brennan, C., Sulley, A., & Young, G. (2019). Management of digital eye strain. *Clinical and Experimental Optometry*, 102(1), 18-29. doi: 10.1111/cxo.12798.

Dessie, A., Adane, F., Nega, A., Wami, S., & Chercos, D. (2018). Computer Vision Syndrome and Associated Factors among Computer Users in Debre Tabor Town, Northwest Ethiopia. *Journal of Environmental and Public Health*, 2018, 1-8. doi: 10.1155/2018/4107590.

Gangamma, M., Poonam, A. & Rajagopala, M. (2010). A clinical study on "Computer vision syndrome" and its management with Triphala eye drops and Saptamrita Lauha. *International Quarterly Journal of Research in Ayurveda*, *31*(2), 236. doi: 10.4103/0974-8520.72407.

Kozeis, N. (2009). Impact of computer use on children's vision. *Hippokratia*, 13(4), 230.

Logaraj, M., Madhupriya, V., & Hegde, S. (2014). Computer vision syndrome and associated factors among medical and engineering students in Chennai. *Annals of Medical and Health Sciences Research*, 4(2), 179. doi: 10.4103/2141-9248.129028.

Mohan, A., Sen, P., Shah, C., Jain, E., & Jain, S. (2021). Prevalence and risk factor assessment of digital eye strain among children using online e-learning during the COVID-19 pandemic: Digital eye strain among kids (DESK study-1). *Indian Journal of Ophthalmology*, 69(1), 140. doi: 10.4103/ijo.ijo_2535_20.

Munsamy, A., & Chetty, V. (2020). Digital eye syndrome – covid19 lockdown side effect? *South African Medical Journal*, 110(7). doi:10.7196/samj.2020.v110i7.14906.

Parihar, J., Jain, V., Chaturvedi, P., Kaushik, J., Jain, G., & Parihar, A. (2016). Computer and visual display terminals (VDT) vision syndrome (CVDTS). *Medical Journal Armed Forces India*, 72(3), 270-276. doi:10.1016/j.mjafi.2016.03.016.

Ranasinghe, P., Wathurapatha, W., Perera, Y., Lamabadusuriya, D., Kulatunga, S., Jayawardana, N., & Katulanda, P. (2016). Computer vision syndrome among computer office workers in

a developing country: an evaluation of prevalence and risk factors. *BMC Research Notes*, 9(1). doi:10.1186/s13104-016-1962-1.

Rosenfield, M. (2011). Computer vision syndrome: a review of ocular causes and potential treatments. *Ophthalmic and Physiological Optics*, 31(5), 502-515. doi:10.1111/j.1475-1313.2011.00834.x.

Rahman, Z., & Sanip, S. (2011). P2-493 Computer vision syndrome: the association with ergonomic factors. *Journal of Epidemiology & Amp. Community Health*, 65(Suppl 1), A357-A357. doi: 10.1136/jech.2011.142976m.20.

Schaumberg, D., Sullivan, D., Buring, J., & Dana, M. (2003). Prevalence of dry eye syndrome among US women. *American Journal of Ophthalmology*, 136(2), 318-326. doi: 10.1016/s0002-9394(03)00218-6.

Seguí, M., Cabrero-García, J., Crespo, A., Verdú, J., & Ronda, E. (2015). A reliable and valid questionnaire was developed to measure computer vision syndrome at the workplace. *Journal of Clinical Epidemiology*, 68(6), 662-673. doi: 10.1016/j.jclinepi.2015.01.015.

Sen, A. & Richardson, S. (2007). A study of computer -related upper limb discomfort and computer vision syndrome. Volume 36 (2), 45-50.

Shantakumari, N., Eldeeb, R., Sreedharan, J., & Gopal, K. (2014). Computer use and vision-related problems among university students in Ajman, United Arab Emirate. *Annals of Medical and Health Sciences Research*, 4(2), 258. doi:10.4103/2141-9248.129058.

Sharma, A., Khera, S., & Khandekar, J. (2006). Computer related health problems among information technology professionals in Delhi. *Indian Journal of Community Medicine*, 31(1), 36. doi: 10.4103/0970-0218.54936

Talwar, R., Kapoor, R., Puri, K., Bansal, K., & Singh, S. (2009). A study of visual and musculoskeletal health disorders among computer professionals in NCR Delhi. *Indian Journal of Community Medicine*, 34(4), 326. doi: 10.4103/0970-0218.58392.

Velavan, T., & Meyer, C. (2020). The COVID-19 epidemic. *Tropical Medicine & International Health,* 25(3), 278. doi: 10.1111/tmi.13383.

Zainuddin, H., & Isa, M. M. (2014). Effect of human and technology interaction: computer vision syndrome among administrative staff in a public university. *International Journal of Business, Humanities and Technology*, 4(3),38-44.