Level of Awareness, Perception And Uptake Of Interventions For Computer Vision Syndrome Among University Students, Maseno, Western Kenya

Shadrack Muma (✉ mumashadrack275@gmail.com)

Maseno University <https://orcid.org/0000-0002-0598-1632>

Dickens Omondi Aduda

University of Kabianga

Patrick Onyango

Maseno University

Research article

Keywords: Computer vision syndrome, Awareness, Perception, Uptake of interventions

Posted Date: October 8th, 2019

DOI: <https://doi.org/10.21203/rs.2.15734/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background Computer vision syndrome is a multi-factorial condition of the eye that results in symptoms of stress and discomfort among computer users. It causes chronic vision-related morbidity and reduced work productivity. Ninety percent and 75% of computer users globally and in Africa respectively suffer from CVS. It is an insidious chronic condition that however, has hitherto received little attention, both by health providers as well as computer users. Also, it is likely to be under diagnosed as it mimics other eye conditions. The risk factors for CVS include prolonged period of electronic device use and glare. In Kenya, lack of awareness of the disease is a key barrier to early detection, health seeking and use of interventions. The burden of CVS and how much computer users in learning institutions are aware of and perceive CVS remains unknown.

Methods This study adopted cross-sectional study design to determine the level of awareness, perception of CVS, uptake of preventive measures by students at Maseno University. In total, we administered questionnaires to 384 randomly selected students.

Results The mean age was 19.5 years (SD= 0.747) with 18-24 years as the modal age group. Females comprised 51.3% (n=197) and males 48.7%. Participants who had at least 5 symptoms of CVS were 60.4% (n= 232). Awareness level was classified as low in 47.8%; medium level in 38.2% and high level in 13.8% of respondents . Sixty percent of respondents did not perceive CVS as an issue of public health concern compared to 39.8% who perceived CVS as an issue of public health concern ($p=0.001$). In terms of precautionary measures, only duration of computer use (46.2%, $p = 0.001$) were practiced. The study results show that at least 3 out of 5 students have at least five symptoms of CVS, whereas awareness of the disease and related risks remain low.

Conclusion The results of the present study indicate that CVS is a less recognized health concern among university students. Consequently, screening for the disease sensitization of students on CVS and awareness campaigns to improve early recognition and diagnosis of disease as well as uptake of interventions is recommended.

Background

Electronic devices have become an integral part of studying at higher institutions. The use of computers with little caution may results in a vision related problem called computer vision syndrome (CVS), an epidemic which is widely spread but largely unknown among computer users (Yan, Hu, Chen, & Lu, 2008). Computer vision syndrome, synonymous with digital eye strain is a multi-factorial disease of the eye that result in symptoms of stress and eye discomfort among computer users (AOA, 2013; Randolph, 2017). Generally, CVS patients may experience eye strains, tired eyes, headache, watering eyes , irritation of eyes, dry eyes, blurred vision, slowness of focus change and double vision while using computers, making the condition a major reason for visit to ophthalmologists and optometrists (Shahid et al., 2017). Computer vision syndrome largely exists as temporary and symptoms subside after computer work. However, some individuals may experience continued reduced visual abilities even after stopping computer work and if nothing is done to address the cause of the problem, the symptoms will continue to recur and perhaps worsen with future computer

use (Rosenfield et al., 2012). Individuals who use computer for a prolonged period of time with poor lighting, glare, high screen brightness, refractive errors and improper workstation setup are at higher risk of CVS (Assefa et al., 2017; Gupta et al., 2016; Han et al., 2013).

As the use of personal computers become ubiquitous, CVS cases and related adverse impact on economic performance and quality of life are likely to continue rising (Venkatesh et al., 2016). Prevention and control of CVS is therefore crucial. Studies show that people in developed countries perceive CVS as a public health issue and are more likely to use preventive measures unlike their counterparts in the developing world (Julius et al., 2014; Manjusha et al., 2013; Martinez-de Dios et al., 2008; Torrey, 2003; Zucker, 2013). In Kenya, while the government has scaled up use of computer-based learning programs, uptake of interventions to mitigate CVS is minimal. There is need, therefore, for epidemiological evidence to guide development of relevant institutional regulatory and health promotion interventions. Since CVS is a multi-factorial disease, and spans individual factors (e.g. perceptions, knowledge and efficacy) to more distal environmental factors (organizational and regulatory issues) (Reddy et al., 2013) the current study provides epidemiological evidence on individual level components that may be addressed by health promotion interventions.

Exposures to risks of CVS across learning institutions vary widely depending on multiple factor components, including extent of involvement with computer devices as well as individual behavior issues. Likewise, awareness and perception of CVS as a disease and as well as related interventions vary among individuals and population-groups. At the individual user level, awareness of CVS, its related risk factors and appropriate preventive and control measures as well as adoption of the interventions are essential for successful healthcare programs.

Regular use of recommended preventive measures for CVS may have a direct effect on the prevalence to be reported among computer users. Computer vision syndrome prevalence of 83.5%, 73% and 75% has been reported among software professionals, bank workers and university staff respectively (Shahid et al., 2017; Venkatesh et al., 2016). Being that CVS arises from multiple risk factors; uptake of the interventions may influence the magnitude of CVS prevalence to be reported. Computer vision syndrome is associated with multiple symptoms with reduced job accuracy and productivity by up to 40% and in Africa, it affects productivity by 4% to 19% indicating the need to explore status of uptake of interventions among at risk populations such as university students (Arif & Alam, 2015; Charpe & Kaushik, 2009; Shantakumari et al., 2014). Given that computer vision syndrome is associated with considerable health burden with resultant adverse impacts on work, there is a call for behavioral programs to help computer users address this epidemic of visual impairment (Ranasinghe et al., 2011). The magnitude of CVS prevalence and

negative effects such as reduced job accuracy maybe determined by the proportion of computer users who regularly use the recommended preventive measures of CVS based on perception. However very little if any research, has been done to investigate the level of CVS awareness and perception among university students. This study was designed to fill this gap by assessing the level of CVS awareness and perception among students at Maseno University, Kenya. Specifically, the study aimed to determine the proportion of university students who report symptoms of computer vision syndrome; assess their level of awareness of and perception on computer vision syndrome as well as determine uptake of recommended interventions for computer vision syndrome

Methods

Electronic devices have become an integral part of studying at higher institutions. The use of computers with little caution may results in a vision related problem called computer vision syndrome (CVS), an epidemic which is widely spread but largely unknown among computer users (Yan, Hu, Chen, & Lu, 2008). Computer vision syndrome, synonymous with digital eye strain is a multi-factorial disease of the eye that result in symptoms of stress and eye discomfort among computer users (AOA, 2013; Randolph, 2017). Generally, CVS patients may experience eye strains, tired eyes, headache, watering eyes, irritation of eyes, dry eyes, blurred vision, slowness of focus change and double vision while using computers, making the condition a major reason for visit to ophthalmologists and optometrists (Shahid et al., 2017). Computer vision syndrome largely exists as temporary and symptoms subside after computer work. However, some individuals may experience continued reduced visual abilities even after stopping computer work and if nothing is done to address the cause of the problem, the symptoms will continue to recur and perhaps worsen with future computer use (Rosenfield et al., 2012). Individuals who use computer for a prolonged period of time with poor lightning, glare, high screen brightness, refractive errors and improper workstation setup are at higher risk of CVS (Assefa et al., 2017; Gupta et al., 2016; Han et al., 2013).

As the use of personal computers become ubiquitous, CVS cases and related adverse impact on economic performance and quality of life are likely to continue rising (Venkatesh et al., 2016). Prevention and control of CVS is therefore crucial. Studies show that people in developed countries perceive CVS as a public health issue and are more likely to use preventive measures unlike their counterparts in the developing world (Julius et al., 2014; Manjusha et al., 2013; Martinez-de Dios et al., 2008; Torrey, 2003; Zucker, 2013). In Kenya, while the government has scaled up use of computer-based learning programs, uptake of interventions to mitigate CVS is minimal. There is need, therefore, for epidemiological evidence to guide development of relevant institutional regulatory and health promotion interventions. Since CVS is a multi-factorial disease, and spans individual factors (e.g. perceptions, knowledge and efficacy) to more

distal environmental factors (organizational and regulatory issues) (Reddy et al., 2013) the current study provides epidemiological evidence on individual level components that may be addressed by health promotion interventions.

Exposures to risks of CVS across learning institutions vary widely depending on multiple factor components, including extent of involvement with computer devices as well as individual behavior issues. Likewise, awareness and perception of CVS as a disease and as well as related interventions vary among individuals and population-groups. At the individual user level, awareness of CVS, its related risk factors and appropriate preventive and control measures as well as adoption of the interventions are essential for successful healthcare programs.

Regular use of recommended preventive measures for CVS may have a direct effect on the prevalence to be reported among computer users. Computer vision syndrome prevalence of 83.5%, 73% and 75% has been reported among software professionals, bank workers and university staff respectively (Shahid et al., 2017; Venkatesh et al., 2016). Being that CVS arises from multiple risk factors; uptake of the interventions may influence the magnitude of CVS prevalence to be reported. Computer vision syndrome is associated with multiple symptoms with reduced job accuracy and productivity by up to 40% and in Africa, it affects productivity by 4% to 19% indicating the need to explore status of uptake of interventions among at risk populations such as university students (Arif & Alam, 2015; Charpe & Kaushik, 2009; Shantakumari et al., 2014). Given that computer vision syndrome is associated with considerable health burden with resultant adverse impacts on work, there is a call for behavioral programs to help computer users address this epidemic of visual impairment (Ranasinghe et al., 2011). The magnitude of CVS prevalence and negative effects such as reduced job accuracy maybe determined by the proportion of computer users who regularly use the recommended preventive measures of CVS based on perception. However very little if any research, has been done to investigate the level of CVS awareness and perception among university students. This study was designed to fill this gap by assessing the level of CVS awareness and perception among students at Maseno University, Kenya. Specifically, the study aimed to determine the proportion of university students who report symptoms of computer vision syndrome; assess their level of awareness of and perception on computer vision syndrome as well as determine uptake of recommended interventions for computer vision syndrome

Results

Study Setting

The study was carried at Maseno University Main Campus situated on the Equator, about 25 km NE of Kisumu City, approximately 400 km west of Nairobi.

Study Design

A descriptive cross-sectional research design was used in this study. A descriptive research design provides accurate account of the distributions of characteristics of a particular individual, event or group in real-life situations for the purpose of discovering new meaning, describing what exists, determining the frequency with which something occurs and categorizing information. Using standard normal deviate of 1.96; a conservative proportion of 0.5 in the target population estimated to have CVS and a level of statistical significance fixed at 0.05; a sample size of 384 participants was determined.

Participants

Consenting, undergraduate and postgraduate students aged 18–39 years were surveyed using a pre-piloted questionnaire. This age bracket is included since there is an age related condition called presbyopia which sets above 39 years with similar symptoms like those of CVS minimizing misclassification bias. Students wearing low vision devices such as magnifiers were excluded since low vision makes individuals not to see clearly ergo aspects such as straining; a symptom similar to that of CVS is already established.

Sampling Procedure

Participants were selected by simple random sampling procedure of the student's population from all schools at the university. An online random number calculator was used to identify the participants from each school. The numbers obtained from the calculator were selected from the list containing all units. Identified participants were approached and were interviewed a consenting session during which the purpose of the study and ethical issues in research involving human participants were discussed.

Data Collection Instrument

Self-administered questionnaire was developed for this study in which the respondents were able to choose more than one answer depending on the instructions attached to each section. The approach was used for the following reasons: *a)* to rapidly reach out to a large number of respondents within a short period of time, *b)* to give the respondents adequate time to respond to the items and, *c)* it offered a sense of anonymity to the respondents. In order to minimize ambiguity and difficulty in comprehension, simple multiple choices questions were used in the questions to explore the level of awareness on CVS. The internal consistency of items in the *Likert's scale* as measures of level of awareness on CVS and perception were tested using Cronbach's alpha which yielded a reliability of 0.974 and 0.936 respectively.

Data Analysis

Data was coded and then entered into a SPSS (version 21) (Brosius, 2013). Using a five point *Likert* scale of 10 items, students awareness level on CVS was coded as 1 = not at all aware, 2 = slightly aware, 3 =

somewhat aware, 4 = moderately aware and 5 = extremely aware. Scores of 1 and 2 were regarded as negative 4 and 5 were considered positive, while 3 were ambivalent and omitted from analysis. Respondents who scored 5 in all the 10 items had a maximum awareness score of 100 while those who scored 1 in all the 10 items had a composite awareness scale of 20. Hence a composite awareness scale ranging from 20 to 100 was designed with awareness level categorized as: low/unaware (score of 20–40), medium (score of 41–79) and high (score of 80–100). The distribution of awareness categories were presented as percentages.

Students perceived susceptibility to CVS, severity of the symptoms and benefits of using interventions were assessed using 19 statements on a 5 point likert scale and coded as 1 = strongly disagree, 2 = disagree, 3 = don't know, 4 = agree and 5 = strongly agree. Of the 19 items, 5 assessed perceived susceptibility, 9 perceived severity and 5 perceived benefits. A summative perception score was derived from Zainuddin and Isa, (2014) where students who scored 19 to 57 were considered not to perceive CVS susceptibility, severity, benefits of using interventions as issues of public health concern in contrast to those who scored 58 to 95.

Results

Summary of variables characteristics

Of the 384 participants, there were 51.3% (n=197) females compared to 48.7% (n=187) males. The mean age was 19.5 years and the modal age group was 18-24 years (Table 1.0).

Table 1.0: Summary of Variable Characteristics

Variable and Variable Characteristics		Count	%	X ²	df	p-value
Gender	Male	187	48.7	40.793	1	0.001
	Female	197	51.3			
Age group	18-24	230	59.9	499.385	3	0.001
	25-29	80	20.8			
	30-34	54	14.1			
	35-39	20	5.2			
Students with CVS	Yes	232	60.4	6.750	1	0.009
	No	152	39.6			
Awareness	Low	184	47.2	46.167	2	0.001
	Medium	147	38.2			
	High	53	13.8			

Proportion of students with CVS

Based on the World Council of Optometry criteria for CVS, 60.3% (n=232) had at least 5 symptoms. Of these 54.3% (n=126) were females compared to 45.7% of males and 58.6% (n=136) being age 18-24 years (Table2).

Table 2: Proportion of Students Experiencing CVS

Variables		CVS absent		CVS present		X^2	df	p-value
		Count	%	Count	%			
Age	18-24	30	19.7	136	58.6	73.662	3	<0.001
	25-29	94	61.8	50	21.6			
	30-34	18	11.8	36	15.5			
	35-39	10	21.6	10	4.3			
Gender	Male	81	43.4	106	45.7	2.123	1	0.145
	Female	71	36.0	126	54.3			

Using a modified two category summative perception score, about 39.8% (n=153) of respondents fell in a category of 58 to 95 where students here were considered to perceive CVS risk factors, preventive measures, benefits of preventive measures and an issue of public health concern. Most students, 60.2% (n=231), fell in the category of 19 to 57 a category where students were considered not to perceive CVS risk factors, preventive measures, benefits of preventive measures and not as an issue of public health concern.

Students were more likely to keep arms-length 40.0% ($X^2=100.669$; $df= 2$; $p<0.001$). Likewise, 46.2% and 25.7% of the students continuously spent <3 hours and 3 - 6 hours respectively viewing the computer screens compared to 28.1% who spent >6 computer viewing hours ($X^2=94.668$; $df= 2$; $p<0.001$)

Table 1.1: Students Uptake of Interventions for CVS (n=384)

CVS interventions	CVS absent		CVS present		X ²	df	p-value
	Count	%	Count	%			
Seating position							
Appropriate	117	30.5	59	15.4	98.270	1	<0.001
Inappropriate	35	9.1	173	45.1			
Viewing distance							
Arm length	107	27.9	47	12.2	100.669	2	<0.001
<arm length	32	8.3	91	23.7			
>arm length	13	3.4	94	24.5			
Duration of use							
<3hours	116	3.0	62	16.1	94.668	2	<0.001
3-6 hours	24	6.3	74	19.3			
>6 hours	12	3.1	96	25.0			
Taking breaks							
>20 minutes	45	1.2	175	45.6	78.816	1	<0.001
<20 minutes	107	2.8	57	14.8			
Using eye glasses							
Yes	131	3.4	30	7.8	202.388	1	,<0.001
No	21	5.5	202	52.6			
Use of glasses							
Computer use	82	2.1	7	1.8	236.857	2	<0.001
Vision	55	1.4	28	7.3			
N/A	15	3.9	216	56.3			
Contrast							
Yes	118	3.1	72	18.8	79.767	1	<0.001
No	34	8.9	160	41.7			
Antiglare lenses							
Yes	126	3.3	25	6.5	200.183	1	<0.001
No	26	6.8	207	53.9			

Discussion

Computer vision syndrome and vision related problems are the most frequently reported health related problems, occurring in over 70% of computer users (Mathew & Menon, 2016; Mowatt et al., 2018; Shrivastava & Bobhate, 2012). Worldwide, 90% of computer users suffer from CVS, compared to 75% in Africa (Mallik, Gahlot, Maini, & Garg, 2017). The observed mean CVS prevalence of 60.4% reported in this study is high, even at the sub-group level. Other studies (Mathew & Menon, 2016; Noreen et al., 2016; Singh et al., 2016) have reported prevalence of 55.46%, 67.2% and 51.56% among medical students, engineering students and dental students respectively. This consistently high prevalence among different groups indicates considerable unmet visual needs among computer users globally.

Computer vision syndrome largely exists as temporary condition and symptoms may subside after computer work. In addition, it is subtle, insidious and presents similar symptoms similar to other visual conditions (Nursyifa, Teesa, Santoso, & Musa, 1016). In the current study, majority of the students were scarcely or moderately aware of the condition. Similar proportions did not perceive CVS to be an important public health concern. Consequently, early diagnosis of this condition may be missed as users may ignore symptoms or just fail to seek help.

Whereas computer use increases work efficiency, it is necessary to determine how users in different contexts perceive this condition to guide planning for interventions. Prevention and control of computer vision syndrome is feasible through simple behavioral measures. However, as demonstrated in the current study, uptake of preventive measures may be low across nearly all age categories. This might be due to, among other factors, low awareness of the disease, individual reticence or hesitancy towards preventive interventions. Interventions targeting raising awareness of the condition and feasibility for its prevention and control, both at group and individual levels as well as enhancing the context in which individuals work is recommended. Uptake of the interventions as a comprehensive package targeting multiple causes should be encouraged given that CVS is multi-etiological.

Conclusions

The present study confirms the presence of CVS among students in a tertiary institution, particularly among females than males. Also, most students had a low to medium level of awareness on CVS while uptake of interventions was largely low. This indicates considerable unmet visual health needs for computer users in similar institutions. In sum these findings support the need for public health awareness campaigns and occupational health education pertaining to CVS to mitigate its insidious effects.

Declarations

List of Abbreviation

CVS: Computer vision syndrome

Acknowledgement

We wish to thank all university students who participated in this study and the research assistants.

Author's contributions

SM is a master of public health candidate. He initiated the research concept, developed the proposal, did the data collection, analyzed the data and wrote the manuscript. PO and DO

improved the research concept, assisted with proposal development and reviewed the proposal, thesis and the manuscript. All authors contributed equally to the research work.

Availability of data and materials

The dataset for university students generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Consent for publication

Not applicable.

Ethics Approval

The study obtained ethical clearance from Maseno University Ethics and Review Committee. Eligible participants signed written consent. Names were not used to safeguard the privacy of the participants but only relevant demographic information as well as random number code was used. A separate document that links the study code to participants identifying information was only accessible to the researcher. Fact sheets on CVS were provided to the participants.

Funding

This research was fully funded by the corresponding author.

Competing interests

SM declares that they have no competing interest related to this study.

References

- AOA. (2013). The Effects of Computer Use on Eye Health and Vision. *American Optometric Association*, (314), 1–9. Retrieved from <http://www.aoa.org/Documents/optometrists/effects-of-computer-use.pdf>
- Arif, K. M., & Alam, M. J. (2015). Review Article Computer Vision Syndrome, *10*(1), 33–35. Retrieved from <https://www.banglajol.info>
- Assefa, N. L., Weldemichael, D., Alemu, H. woretaw, & Anbesse, D. H. (2017). Prevalence and associated factors of computer vision syndrome among bank workers in Gondar City, northwest Ethiopia, 2015. *Clinical Optometry, Volume 9*, 67–76. <https://doi.org/10.2147/OPTO.S126366>

- Bali, J., Navin, N., & Thakur, B. R. (2017). Computer vision syndrome: a study of the knowledge, attitudes and practices in Indian ophthalmologists. *Indian J Ophthalmol*, 55(4), 289-294.
- Brosius, F. (2013). *Spss 21. Mitb*. https://doi.org/10.1007/978-3-540-72978-5_23
- Charpe, N. A., & Kaushik, V. (2009). Computer Vision Syndrome (CVS): Recognition and Control in Software Professionals. *J Hum Ecol*, 28(1), 67-69.
- Chiemeke, S. C., Akhahowa, A. E., & Ajayi, O. B. (2007). Evaluation of vision-related problems amongst computer users: A case study of University of Benin, Nigeria. *World Congress on Engineering 2007, Vols 1 and 2, I*, 217-221.
- Gupta, N., Moudgil, T., & Sharma, B. (2016). Computer Vision Syndrome: Prevalence And Predictors Among College Staff And Students. *IOSR Journal of Dental and Medical Sciences*, 15(9), 28-31. <https://doi.org/10.9790/0853-1509022831>
- Han, C. C., Liu, R., Liu, R. R., Zhu, Z. H., Yu, R. B., & Ma, L. (2013). Prevalence of asthenopia and its risk factors in Chinese college students. *Int J Ophthalmol*, 6(5), 718-722. <https://doi.org/10.3980/j.issn.2222-3959.2013.05.31>
- Julius, N., Computer, K., & Syndrome, V. (2014). Take-A-Break Notification. *2014 International Conference on Information Technology and Multimedia (ICIMU)*, 390-395.
- Mallik, D., Gahlot, A., Maini, A., & Garg, S. (2017). Prevalence of dry eye amongst computer workers in Kanpur. *International Journal of Community Medicine and Public Health*, 4(7), 2308-2311.
- Manjusha, V., Devakumar, V. S., & Babu, B. K. (2013). Computer Vision Syndrome. *International Journal of Innovative Research and Development*, 2(5).
- Martinez-de Dios, J. R., Arrue, B. C., Ollero, A., Merino, L., & Gómez-Rodríguez, F. (2008). Computer vision techniques for forest fire perception. *Image and Vision Computing*, 26(4), 550-562. <https://doi.org/10.1016/j.imavis.2007.07.002>
- Mathew, A., & Menon, L. (2016). the Prevalence of Computer Vision Syndrome Among Information Technology Students. *International Journal of Current Research*, 8(11), 2-5.
- Mowatt, L., Gordon, C., Santosh, A. B. R., & Jones, T. (2018). Computer vision syndrome and ergonomic practices among undergraduate university students. *International Journal of Clinical Practice*, 72(1). <https://doi.org/10.1111/ijcp.13035>

- Noreen, K., Batool, Z., Fatima, T., & Zamir, T. (2016). Prevalence of Computer Vision Syndrome and Its Associated Risk Factors among Under Graduate Medical Students. *Pakistan Journal of Ophthalmology Pak J Ophthalmol*, 140(3). Retrieved from <http://www.pjo.com.pk/32/3/3. OA-Khola Noreen.pdf>
- Nursyifa, G., Teesa, P., Santoso, R., & Musa, I. R. (1016). Computer Vision Syndrome among Call Center Employees at Telecommunication Company in Bandung. *Althea Medical Journal*, 3(2), 181-185.
- Oruonye, E. D. (2015). An assessment of the level of awareness of the effects of climate change among students of tertiary institutions in Jalingo Metropolis , Taraba State Nigeria, (January 2011).
- Ranasinghe, P., Perera, Y. S., Lamabadusuriya, D. A., Kulatunga, S., Jayawardana, N., Rajapakse, S., & Katulanda, P. (2011). Work related complaints of neck, shoulder and arm among computer office workers: a cross-sectional evaluation of prevalence and risk factors in a developing country. *Environmental Health*, 10(1), 70. <https://doi.org/10.1186/1476-069X-10-70>
- Randolph, S. A. (2017). Computer Vision Syndrome. *Workplace Health and Safety*. <https://doi.org/10.1177/2165079917712727>
- Reddy, S., Low, C., Lim, Y., Low, L., Mardina, F., & Nursaleha, M. (2013). Computer vision syndrome : a study of knowledge and practices in university students. *Nepal Journal of Ophthalmology*, 5(10), 161-168. <https://doi.org/10.3126/nepjoph.v5i2.8707>
- Rosenfield, M., Bababekova, Y., & Portello, J. K. (2012). Prevalence Of Computer Vision Syndrome (CVS) And Dry Eye In Office Workers. *Investigative Ophthalmology & Visual Science*, 53(14), 5459. Retrieved from <http://dx.doi.org/>
- Sen, a, & Richardson, S. (2007). A study of computer-related upper limb discomfort and computer vision syndrome. *Journal of Human Ergology*, 36(2), 45-50. https://doi.org/10.11183/JHE1972.36.2_45
- Shahid, E., Burhany, T., Siddique, W. A., Fasih, U., & Shaikh, A. (2017). Frequency of Computer Vision Syndrome in Computer Users. *Pakistan Journal of Ophthalmology*, 33(2), 108-112.
- 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. <https://doi.org/10.4103/2141-9248.129058>

- Shrivastava, S., & Bobhate, P. (2012). Computer related health problems among software professionals in Mumbai: A cross-sectional study. *International Journal of Health & Allied Sciences*, 1(2), 74. <https://doi.org/10.4103/2278-344X.101684>
- Singh, H., Tigga, M. J., Laad, S., & Khan, N. (2016). Prevention of Ocular Morbidity Among Medical Students By Prevalence Assessment of Asthenopia and Its Risk Factors. *J. Evid. Based Med. Healthc*, 3(15), 532-536. <https://doi.org/10.18410/jebmh/2016/122>
- Torrey, J. (2003). Understanding Computer Vision Syndrome. *Employment Relations Today*, 30(1), 45-51. <https://doi.org/10.1002/ert.10073>
- Venkatesh, S. H., Girish, A. T., Kulkarni, P., & Mannava, S. (2016). A Study of Computer Vision Syndrome at the Workplace - Prevalence and Causative Factors, 3(8), 2375-2377.
- Yan, Z., Hu, L., Chen, H., & Lu, F. (2008). Computer Vision Syndrome: A widely spreading but largely unknown epidemic among computer users. *Computers in Human Behavior*, 24(5), 2026-2042. <https://doi.org/10.1016/j.chb.2007.09.004>
- 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), 39-44.
- Zucker, S. (2013). Computer Vision and Human Perception. *Journal of Chemical Information and Modeling*, 53(9), 1689-1699. <https://doi.org/10.1017/CBO9781107415324.004>