Prevalence and Risk Factors of Computer Vision Syndrome in Computer User Health Workers at Tabanan General Hospital

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Abstract
Background: Computer vision syndrome (CVS) is a group of ocular and extra-ocular symptoms that occur associated with high-intensity computer use. The prevalence of CVS increases in conjunction with increasing use of computers in work and daily life, including in the population of health workers. However, there are still few researches that study CVS in health workers, so this research was conducted to study the prevalence and characteristics of CVS in health workers in a general hospital in Bali, Indonesia.
Method: This study used an analytical observational design. Respondents were recruited by convenience sampling technique. Data were collected using questionnaires that were filled out by the respondents. The data collected includes demographic variables, characteristics of computer use, and CVS symptoms. Descriptive data analysis was performed with IBM SPSS 23.0.
Results: This study recruited 100 health workers with 32% male and 47% aged less than 40 years. Almost all respondents reported at least 1 CVS symptom and as many as 62% of respondents were classified as CVS. The most commonly reported symptoms were fatigue eyes (72%), followed by dry eyes, blurred vision, headache, sore eyes, and watery eyes. This study identified 2 independent CVS risk factors, namely the respondent's age and also the frequency of taking breaks from using the computer.
Conclusion: This study identified a high prevalence of CVS in health workers with symptoms dominated by fatigue eyes, dry eyes, blurred vision, headaches, sore eyes, and watery eyes. CVS in health workers can be based on respondent's age and also the frequency of taking breaks from using the computer.
Keywords: *computer vision syndrome, health workers, descriptive, Bali, Indonesia*

I. Introduction

Computer vision syndrome (CVS) is a group of symptoms that are often experienced by prolonged computer use. Symptoms include four aspects: asthenopia, ocular symptoms, visual symptoms, and extra-ocular symptoms.[1] This condition is multifactorial and is mainly related to continuous long-term use of computers, especially if the use of the computer is not ergonomic.[2,3]

Many studies have shown a high prevalence of CVS. Research in India showed that computer workers experienced fatigue eyes (53.8%), itching (47.6%) and burning eyes (66.7%).[4] Domestic research at Udayana University also shown that 58.8% of medical faculty students experience CVS.[5] The prevalence of CVS in particular is expected to increase along with the increasingly integral use of computers in daily activities.[1]

The increase in the epidemiological burden of CVS must be accompanied by increasing efforts to study the epidemiological phenomena of this disease in greater depth. Currently, there are very few research that study the epidemiology of CVS and its related factors in the population of health workers. This is despite the fact that the increase in computer users in the healthcare industry is increasing every year.[6] Another study found the prevalence of CVS in health workers reached 36.2%.[7]

Seeing this gap of knowledge, further research on the burden of CVS epidemiology on health workers is needed. Therefore, this study was conducted to study the characteristics and prevalence of CVS among health workers in a regional general hospital in Bali, Indonesia.

II. Method

This study used an analytical observational design with the aim of knowing the characteristics, prevalence, and risk factors of CVS in health workers at Tabanan General Hospital, Bali, Indonesia. Respondents were recruited using the convenience sampling method and data collection was carried out in the period June 2021 to July 2021 using a questionnaire that was filled out by the respondents themselves.

The variables studied in this study included demographic data (gender and age), characteristics of computer use by respondents including duration of use and use techniques, as well as CVS symptoms including fatigue and strained eyes, dry eyes, blurred vision, headaches, sore eyes, watery eyes, double vision, and difficulty focusing. A respondent is defined as having CVS if he/she suffers from at least 3 symptoms.

The data from the questionnaires were analyzed descriptively and the data were presented in the form of frequency and percentage. Bivariate analysis was performed by cross tabulation with statistical significance values tested using the Chi squared test. A p value of less than 0.25 became the inclusion criteria for variables in multivariate analysis with multiple binomial logistic regression tests where p value less than 0.05 was the cut-off point for statistical significance. All analyzes were performed using IBM SPSS 23.0.

III. Results

Table 1. Basic characteristics of respondents.

Variable	
Gender, n (%)	
Man	32 (32.0)
Woman	68 (68.0)
Age, n (%)	
< 40 year	47 (47.0)
40 years	53 (53.0)
History of chronic disease, n (%)	
Hypertension	4 (4,0)
Diabetes mellitus	1 (1,0)
Not history of chronic disease	95 (95.0)
Use of glasses/contact lenses, n (%)	
Use	54 (54.0)
Not use	46 (46.0)

This study recruited 100 respondents from Tabanan General Hospital health workers who use computers in their work. Of these, 32 (32%) were men and the rest were women. A total of 47 (47%) respondents were less than 40 years old while the majority of respondents were more than or equal to 40 years old. However, only 5 (5.0) respondents reported suffering from comorbidities with 4 people reporting hypertension and 1 person with diabetes mellitus.

The majority of respondents reported using glasses. A total of 54 (54%) respondents admitted to using glasses or contact lenses. Glasses with plus lenses were the most widely used by respondents, which was reported by 28 (28%) people, followed by minus lenses by 26 (26%) people. As many as 13 (13%) respondents admitted to using cylindrical lenses and 7 (7%) people admitted to using reading glasses.

Most of the respondents claimed to have worked with computers for a long time, with 72 (72%) people claiming to have worked with computers for more than or equal to five years. A total of 57 (57%) respondents also admitted to working continuously using computers without taking a break for at least 4 hours a day and 64 (64%) respondents claiming to work using computers, either continuously or with breaks, for at least 4 cumulative hours of the day. However, as many as 59 (59%) respondents admitted that they took a break from using the computer every 2 hours. A total of 61 (61%) respondents also admitted to resting for at least 10 minutes.

Table 2. Characteristics of respondents' computer use.

Variable	n(%)
Duration of working with computer	
< 5 year	28 (28.0)
5 years	72 (72.0)
Duration of using computer continuously	
< 4 hours a day	43 (43.0)
4 hours a day	57 (57.0)
Cumulative time using computer	
< 4 hours a day	36 (36.0)
4 hours a day	64 (64.0)
Frequency of breaks from the computer	
Every < 2 hours	59 (59.0)
Every 2 hours	41 (41.0)

Duration of break from computer	
< 10 minute	39 (39.0)
10 minutes	61 (61.0)
Screen and eye distance	
< 50 cm	46 (46.0)
50 cm	54 (54.0)
Screen position from eyes	
Higher	22 (22.0)
Equal/lower	78 (88.0)
Screen contrast	
Background bright back	76 (76.0)
Background dark back	24 (24.0)

Regarding the ergonomics of computer use, 54 (54%) respondents admitted to using a computer with a screen distance of at least 50 cm from their eyes. A total of 78 (78%) respondents also claimed to use a computer with a screen that is parallel to or lower than the eye's line of sight and 76 (76%) use a computer with a screen contrast display on a bright background.

Table 3. Complaints and diagnosis of computer vision syndrome.

Variable	n(%)
Fatigue/ strained eyes	72 (72.0)
Dry eyes	46 (46.0)
Blurred vision	43 (43.0)
Headache	43 (43.0)
Sore eyes	41 (41.0)
Watery eyes	40 (40.0)
Double view	22 (22.0)
Difficult to focus	27 (27.0)
Computer vision syndrome	62 (62.0)

Almost all respondents complained of at least one CVS symptom. The most frequently complained symptom was fatigue eyes which was reported by 72 (72%) respondents. Other complaints such as dry eyes, blurred vision, headache, sore eyes, and watery eyes were reported by approximately 40% of respondents respectively. Meanwhile, double vision and difficulty focusing were the least reported with 22 (22%) and 27 (27%) respondents, respectively. Overall, 62 (62%) respondents complained of at least 3 CVS symptoms and met the CVS diagnostic criteria in this study.

Table 4. CVS risk factors in health workers.

Variable	OR (95% CI)	aOR (95% CI)
Gender, n (%)		
Man	1	-
Woman	0.65 (0.27 – 1.58)	
Age, n (%)		
< 40 year	1	1
40 years	2.91 (1.26 – 6.71)*	2.83 (1.01 – 7.98)*
Use of glasses/contact lenses, n (%)		
Not use		
Use	1	1
	3.11 (1.35 – 7.22)**	2.43 (0.89 – 6.63)
Duration of working with computer		
< 5 year		
5 years	1	-
	0.87 (0.35 – 2.16)	
Duration of using computer continuously		
< 4 hours a day		
4 hours a day	1	-
	1.33 (0.59 – 3.00)	
Cumulative time using computer		
< 4 hours a day	1	-
4 hours a day	1.27 (0.55 – 2.94)	
Frequency of breaks from the computer		
Every < 2 hours		
Every 2 hours	1	1
	4.27 (1.69 – 10.77)**	5.19 (1.79 – 15.03)**
Duration of break from computer		
< 10 minute	1	-

10 minutes	0.72 (0.31 – 1.67)	
Screen and eye distance		
< 50 cm	1	1
50 cm	0.55 (0.24 – 1.25)+	0.55 (0.21 – 1.44)
Screen position from eyes		
Higher	1	-
Equal/lower	0.91 (0.34 – 2.44)	
Screen contrast		
Background bright back	1	1
Background dark back	2.92 (0.99 – 8.63)+	2.98 (0.88 – 10.14)

+p < 0.25; *p < 0.05; **p < 0.01

Bivariate analysis with cross tabulation identified variables of age, use of glasses, frequency of rest, screen distance from eyes, and screen contrast settings as risk factors for CVS in health workers. In multivariate analysis, two variables were found as independent determinants of CVS risk factors. These two factors are age and frequency of rest. Age 40 years or older increases the risk of CVS with an adjusted odds ratio (aOR) of 2.83 (95% confidence interval 1.01 – 7.98). Meanwhile, the frequency of rest less than every 2 hours increased the risk of CVS with an aOR of 5.19 (95% CI 1.79 – 15.03).

IV. Discussion

This study found that most of the respondents of health workers at Tabanan General Hospital, Bali, Indonesia experienced one or more CVS symptoms with more than half being diagnosed with CVS. The most common symptoms reported by respondents included fatigue eyes, dry eyes, blurred vision, headaches, and sore eyes. Meanwhile, the behavior of using computers by respondents was found to be unsatisfactory. Most respondents reported using the computer for 4 hours a day or more, either consecutively or cumulatively. Meanwhile, almost half of the respondents use a computer with a distance between screen and eyes is less than 50 cm.

The prevalence of CVS found in this study is in accordance with the results in previous studies. One study reported that the most commonly reported symptoms of CVS included eye pain, itching, and sore eyes.[4] However, this study found that the prevalence of CVS among health workers at Tabanan General Hospital, Bali, Indonesia was much higher. Research in Spain found the prevalence of CVS in health workers only reached about 30%.[7]

The prevalence of CVS in health workers found in this study is equivalent to the prevalence of CVS in other professions with a much higher intensity of computer use. Research in Ethiopia reported the prevalence of CVS reached 69% in office workers who use computers.[3] Another study reported a prevalence of up to 75% in office workers with presbyopia.[8]

Multivariate analysis identified 2 independent CVS risk factors in this study, namely the respondent's age and also the frequency of taking breaks from using the computer. These risk factors differ from those identified in several other studies. One study in Ethiopia did not find age as a risk factor. In contrast, the study reported the use of glasses, duration of rest, and ergonomics of sitting position as risk factors.[9] Other studies have identified gender and work ergonomics as risk factors.[2]

Although the specific risk factors identified are different, all research that studying CVS agree that ergonomics is one of the main determinants of the incidence of CVS. Length of work and frequency of rest is one of the main risk factors. One study reported that 13% of respondents used computers for more than 4 hours per day.[10] Another study reported that almost 90% of office workers use computers more than 4 hours a day and more.[11]

Prolonged use or working with a computer screen without a break can cause problems with shifting focus on the screen and keyboard. The constant process of streaming and refocusing on blurry text pixels on the screen can be eye straining and tired. Computer workplace illumination, screen contrast, duration of work on computing, distance and viewing angles, specific work-related tasks, stresses and interests, screen reflections, image quality and workplace ergonomics are also related to CVS.[12,13]

The implication of these findings is the need to increase awareness about CVS among health workers. Health workers are often not seen as a profession that does not use computers much. However, the reality in today's work is increasing use of computers and screens in general, both in the context of work and personal life. This increases the risk of CVS in health workers.[7]

In addition, this research does not escape from several weaknesses. This research is limited to one regional hospital in Bali, Indonesia. This study is limited to the presentation of descriptive data without risk factor analysis between the characteristics that can be a risk factor for CVS. In addition, there may be several CVS risk factors that were not studied in this study. Further research is needed to see if the findings in this study are replicated in a population of health workers in different workplaces and in different work situations.

V. Conclusion

This study found that the prevalence of CVS among health workers at Tabanan General Hospital, Bali, Indonesia was 62%, comparable to the prevalence of CVS in the population of computer workers from other studies. The most common symptoms reported by respondents were fatigue eyes, followed by dry eyes, blurred vision, headache, sore eyes, and watery eyes. The ergonomic risk factor most frequently reported by respondents was the use of a computer for more than 4 hours, either continuously or cumulatively.

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