

RISK FACTOR ANALYSIS OF OCCUPATIONAL DISEASES IN COMPUTER USERS

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Abstract:

Eye fatigue disorders often occur in workers who use computers to carry out their daily activities. This study aims to determine the relationship between long exposure and monitor distance with eye fatigue disorders in computer users. This type of research is quantitative with an analytical survey method that uses a cross-sectional design. The population is computer operator workers, totaling 36 employees. The sampling technique was purposive sampling. They collect data using a questionnaire – analysis of the relationship between the independent and dependent variables using the chi-square test. This study proves that long exposure (5-6 hours without rest) and working at a distance from a computer monitor (<50 cm) poses a danger of eye fatigue. The study results showed that 96.7% of respondents who worked at a distance of <50 cm from the monitor experienced eye fatigue. The chi-square test analysis showed a relationship between the length of exposure and eye fatigue ($\rho = 0.008$) and a relationship between monitor distance and eye fatigue ($\rho = 0.001$). It is suggested that employees arrange the working time and monitor distance ergonomically.

Keywords: Board Time, Monitor Distance, Eye Fatigue Disorder

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INTRODUCTION

Eyestrain disorder often happens to workers who perform their daily activities on the computer. Scholars pointed out that using a computer for a long time will trigger asthenopia or eyestrain.

According to the Occupational Safety and Health Administration (OSHA henceforth), the causal factors attributing to the eyestrain include work device (size, position, and screen display of an object/computer), work environment (lighting), work design (monitor distance and duration of work), individual characteristics (refractive error) or may include all-embracing stated factors. In addition, the American Optometry Association (AOA) (2015) asserted that there are several factors affecting eyestrain or eye fatigue, namely poor screen lighting, glare on the digital screen, improper distance from the screen, poor sitting position, vision disorder, and a combination of a number of the mentioned factors.

The National Institute of Occupational Safety and Health (hereafter NIOSH) uncovered that those working as computer operators suffer from stress levels much higher than other employees of any occupation and that eyestrain has been the primary impediment to computer users [5]. Further, the NIOSH informed that as much as 88% of people interacting with computers within

more than three hours per day would have experienced eyestrain. Subsumed under these reported explorations was the study Dhiman et al. (2012) conducted on 30 patients, where they discovered that 93.33% of the patients suffered from eyestrain. The study carried out by Logaraj et al. (2014) on 416 learners of computer users in which they disclosed that the prevalence of eyestrain was 80.3%.

In the Indonesian context, numerous studies have accounted for eyestrain disorders due to using computers. Take Nourmayanti's (2010) study on 51 employees of computer users at the Corporate Customer Care Center (C4) of Telekomunikasi Indonesia, Inc. as a case in point. Nourmayanti (2010) unearthed that of 51 respondents, 46 of whom underwent eyestrain, while the remaining five did not suffer from the problem. From these data, it can be deduced that as much as 90.2% of employees of computer users have incurred eyestrain, while 9.8% of the sample do not face such a problem. The research was also conducted on 78 computer users at the Office Center of Kalbar Bank, Inc. in 2012 by Anggraini. The study results showed that as much as 88.5% of the respondents endured eyestrain.

Moreover, scholarly work on the eyestrain on eye gaze to computer monitors has also been reported by Ramdhayani and Sudana (2010), involving Mechanical Engineering students at the Bali State Polytechnic as the research sample. The findings of this study indicated an increase in eyestrain in students before and after the experiments of looking at the computer monitor screen during three hours of lectures. The statistical accounts of the study encompassed eyestrain symptoms from reading the characters (letters) on the computer screen with six students (23.08%), picture quality, text quality, reflection on the computer screen, tired eyes, and watery eyes with two students (7.69%) to each emerging case, contrast between the characters and the background against the view on computer screen with four students (15.38%) to each of the cases, dry or itchy eyes with three students (11.54%), blinking on the computer monitor with seven students (26.92%), eye focus on a computer screen with one student (3.85%), and having headache with eight students (30.77%). Besides, a study undertaken by Azkadina (2012) exposed that there had been 87% of computer user employees bemoaning their dilemma on strained and tired eyes. Pertinent to the eyestrain symptom was a 4-hour riotous but unmanageable computer use.

The viewing distance to the computer monitor indicates that the greater the viewing distance, the smaller the eyestrain symptoms. Stemming from the investigation results on the computer users' employees at the Orthopedic Hospital Prof. Dr. Soeharso, the distance of 53.24 cm has been the average viewing distance to a computer monitor. The study's findings signified that solely 5.4% of employees had poor visibility and that sore eyes, blurred vision, and headaches had been the problems to which they complained.

METHODS

This present study deployed an analytical survey method of the qualitative tradition with a cross-sectional research design. The employees working within the Gorontalo provincial government were recruited as the research sample of this study. Further, following non-glasses workers as a set criterion, 64 purposively selected employees serving as computer operators were involved in this study.

RESULT AND DISCUSSION

Frequency Distribution of Respondents on Length of Light Exposure. Concerning the respondents' exposure length to monitor light, the case is divided into risky and non-risky classifications. The results can be seen in the following table:

Table 1. Frequency Distribution of Respondents on the Length of monitor light Exposure

Category of Exposure Length of Monitor	Cases	
	N	z
Risky	54	84.4
Non-risky	10	15.6
Total	64	100.0

Source: Primary Data, 2020

From Table 1 above, it is clearly shown that the distribution of respondents on which the case of exposure length of monitor light is hinged has been in the risky category with as much as 84.4 percent of the total cases (n=54).

Frequency Distribution of Respondents on Monitor Distance. As the length of monitor light exposure, the monitor distance is also classified into two groups: the high-risk <50 cm and the low-risk >50 cm. The information regarding monitor distance is portrayed in the following table:

Table 2. Frequency Distribution of Respondents on the Monitor Distance

Category of Monitor Distance	Cases	
	N	%
High-risk	58	90.6
Low-risk	6	9.4
Total	64	100.0

Source: Primary Data, 2020

Drawing on the above table, it is apparent that of the two classes of monitor distance, the results regarding distance measurements between the respondents' eyes and the computer monitor were found to be most dominant by the high-risk category, with as much as 90.6 percent of the cases (n=29).

Frequency Distribution on Eyestrain Disorder. This sub-theme of eyestrain disorder is also broken down into two categories, the upbeat category, as indicated by having a symptom of eyestrain disorder, and the harmful category, as denoted by not having experienced a symptom of eyestrain disorder. The following information tabulates the findings concerning respondents' eyestrain disorder:

Table 3. Frequency Distribution of Respondents on the Eyestrain Disorder

Category of Eyestrain Disorder	Cases	
	n	%
Positive	56	87.5
Negative	8	12.5
Total	64	100.0

Source: Primary Data, 2020

The table above shows that respondents facing the eyestrain disorder with the positive category were 87.5 percent (n=28), while respondents with the harmful category were only 12.5 percent (n=4).

Bivariate Analysis. In this study, the variables analyzed by the researcher consist of the association between the lengths of monitor light exposure and the eyestrain and the correlation between the monitor distance and the eyestrain. To pin down these variables' relationships entail Chi-square analysis.

Correlation between Length of Monitor Light Exposure and Eyestrain Disorder. Based on the findings of this current study, it is found that there has a relationship between the length of monitor light exposure and eyestrain disorder, as shared in the following table:

Table 4. Correlation between Length of Monitor Light Exposure and Eyestrain Disorder

Exposure Length	Eyestrain Disorder				Cases		Statistical Value
	Positive		Negative				
	n	%	n	%	N	%	
High-risk	52	96,3	2	3,7	54	100	$\rho = 0,008$
Low-risk	4	40	6	60	44	100	
Total	56	87,5	8	12,5	64	100	

Source: Primary Data, 2020

The provided table above plainly shows that of 54 respondents in total who are in the high-risk group, as much as 96.3% of whom (n=52) are employees with eyestrain disorder, while the remaining 3.7% of the cohort (n=2) refer to the employee with no eyestrain disorder. In contrast, from five respondents in the low-risk group, 40 percent of the total respondents (n=4) are employees with eyestrain disorder, while 60 percent of the cohorts (n=6) are employees with no eyestrain disorder.

The data of statistical tests using the Chi-square analysis resulted in the ρ value = 0.008 ($\rho < 0.05$) with a significant level of $\alpha = 0.05$. Given the value of $\rho < 0.05$, the H_0 is rejected, and H_a is accepted, denoting a correlation between the length of monitor light exposure and the eyestrain disorder.

The Correlation between Monitor Distance and Eyestrain Disorder. Stemming directly from the present research results, this study found that a correlation between the monitor distance and the eyestrain disorder does exist, as depicted in the following table:

Table 5. Correlation between Monitor Distance and Eyestrain Disorder

Monitor Distance	Eyestrain Disorder				Cases		Statistical Value
	Positive		Negative				
	n	%	n	%	n	%	
High-risk	56	96,6	2	3,4	58	100	$\rho = 0,001$
Low-risk	0	0	6	100	6	100	
Total	56	87,5	8	12,5	64	100	

Source: Primary data, 2020

The table above displayed that the most dominant respondents with the issue of monitor distance are those in the high-risk category, with 96.6 percent of respondents representing eyestrain disorder. In comparison, solely 3.4 percent of whom (n=2) is the employee with no eye fatigue disorder.

The chi-square statistical test result shows that the ρ value reached 0.001 ($\rho < 0.05$) and the significant level of $\alpha = 0.05$. Again, seeing that the value of $\rho < 0.05$, the H_0 is rejected and H_a is accepted, meaning there is an association between the monitor distance and the eyestrain disorder.

Correlation between Length of Monitor Light Exposure and Eyestrain Disorder. Rooted deeply into the findings of this current study, it is found that the Probability Value (ρ value) of the exposure length of monitor light is 0.008 ($\rho = 0.008$). This ρ value is smaller than the value of the significant level of α , which is 0.05. Bearing this result in mind, it is apparent that there is a significant association between the lengths of monitor light exposure and eye fatigue disorder. Moreover, as the study results showed, it is signified that under the high-risk group, as much as 96.3 percent of

respondents (n=52) with the positive category experiencing eyestrain disorder as a concomitant of long exposure to computer screens. Lack of procedural know-how to properly work with a computer, such as an eye distance from the computer monitor, and lack of working time management, such as working within four hours without taking time to rest, are the underlying causes for such a problem to occur. For office computer operators, having a rest within less than ten minutes will suffer from Computer Vision Syndrome (herein VCS) by as much as thirteen and a half times compared to those employees who take a break for more or at least equal to ten minutes (Azkadina, 2012). Fewer respondents know about time management and the required rest time for the eyes about working on a computer. Therefore, such exposure length of working on a computer screen leads many respondents to have suffered from eyestrain. On the balance sheet of the high-risk class, respondents with the negative category who reported had not experienced any eye fatigue symptoms such as pain or throbbing around the eyeballs, blurred eyes, watery eyes, red eyes, and so forth are only 3.7 percent of respondents (n=2). Maintaining a healthy lifestyle, such as eating healthy cuisine, not smoking, and always taking vitamins to keep the eyes healthy, has been considered a veiled reason for this respondent to have not endured such awful eyestrain symptoms.

Furthermore, the results of this study indicated that the longer the time exposure to computer screens, the higher the risk undergone by the respondents. Conversely, the fewer the respondents are exposed to computer screens, the less the risk being experienced by the respondents will be. As such, the length of monitor light exposure can significantly affect the respondents' work qualities.

Growing out of Mulyono's (2016) theory and taken in conjunction with the correlation analysis between the duration of computer use and the problems with eyestrain, it can be inferred that there is a significant relationship between the two studied variables. The present study's findings corroborate the past related account studied by Sya'ban and Rizki (2014), which argued that the duration of using a computer to work contributed to the ground for eyestrain. It has been acknowledged that eyestrain symptoms are closely associated with the duration of computer use. When working in front of the computer, the eye muscles continuously work to stay focused. This factor, to some extent, leads eye muscles to eyestrain.

Research by Naintika (2016) suggested a correlation between computer use and eyestrain duration. Further, Naintika (2016) reported that as many as 30 out of 43 employees' desks (93%) have lighting intensity that does not meet the standard which is 300 lux, as stipulated in the Regulations of Labor Minister Number 5 of 2018, and that as much as 65 percent of employee (n=56) experienced the eyestrain.

Correlation between Monitor Distance and Eyestrain Disorder. Springing from the present research results, this study uncovered that the ρ value of monitor distance is 0.001 ($\rho = 0.001$). This significant value is smaller than the set α value ($\alpha = 0.05$). With this evidence in mind, there is a significant relation between the monitor distance and the eyestrain disorder the respondents have encountered.

Additionally, findings of this current scrutiny concerning this studied variable show that as much as 96.6% of respondents (n=56) are in the high-risk category, having been undergoing eyestrain due to poor computer monitor distance. A mismatch procedure of the distance between respondents' eyes and the computer screen when working on the computer serves to be the fundamental causal factor. Further, this incongruity occurs by dint of first the wearing glasses respondents and the respondents who do not know the maximum distance between the eyes and the computer monitor. Of these two characteristics of respondents, those with <50 cm distance measure between eyes and computer monitor are in the high-risk category, while those with ≥ 50 cm distance measure between eyes and computer monitor are in the low-risk category. In the case of the low-risk cohort with no disturbance, the findings revealed that only 3.4% of respondents (n=2)

had been in the category. This respondent has not somehow faced any symptoms of eyestrain, including pain or throbbing around the eyeballs, eye pain when working on a computer for quite a long time, blurred eyes, watery eyes, red eyes, and so on. To this respondent's positive frame of mind, it seems to signal that the respondent has maintained a healthy lifestyle, including consuming healthy foods, not smoking, and always taking vitamins to keep the eyes healthy.

Besides, the present study findings show that the closer the monitor to respondents is, the higher the risk for the respondents to experience. On the contrary, the farther the monitor from the respondents is, the less the risk of eyestrain for the respondents to endure will be. For these very reasons, it is safe to assert that the computer monitor distance can impact the quality of the employees' work.

The present research results support the theory postulated by Berliana (2013) and correspond to Febriana's (2012) line of inquiry on the administration department employees at Semarang Power Generation Unit, Inc., Indonesia. Febriana (2012) discovered no correlation between vision distance and age upon eyestrain. The ergonomic distance between the computer screen and computer users ranges from 50 cm to 60 cm. There will raise a risk of eye fatigue when the distance from the monitor is not ergonomic. Study results showed that the ρ -value was 0.011, signifying that a significant association between monitor distance and eyestrain does exist.

Likewise, findings informed by Dean J (2019) using the continuity correction test to detect a correlation between the distance of eyes to monitor and CVS incident results in the ρ -value of 0.028, where this value is smaller than the α value ($\alpha = 0.05$). By this, it is evident that there is a relation between the distance between the eyes and the monitors on the CVS issues. Furthermore, to better determine the strength of the correlation between variables, the contingency coefficient was compared using the ϕ value of 0.345. The results found that the strong association between the eye distance and the computer monitor on the CVS was a moderate correlation.

CONCLUSION

The study presented in this current scrutiny revealed a correlation between the exposure length of computer monitor light and eyestrain. The research findings of the statistical test using $P < 0.05$ result that the ρ value is 0.008 ($\rho = 0.008$). From the findings, it is also discovered that there is a correlation between the computer monitor distance and eye fatigue on the employees of computer operators whereby the statistical test results ρ value is 0.001, $P < 0.05$.

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