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Factors Associated with the Risk of Eye Disorders in Computer-Using Employees at the Dumai Branch of BPJS Kesehatan

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Abstract

Introduction: The risk of eye disorders is a health problem frequently experienced by workers, especially those who work with digital devices for long periods of time. This condition is known as Computer Vision Syndrome (CVS) or Digital Eye Strain. CVS is characterized by symptoms such as dry eyes, blurred vision, headaches, and discomfort around the eyes. **Purpose:** of this study was to determine factors associated with the risk of eye disorders in computer users. **Methods:** This research was quantitative. This study was conducted at the Dumai Branch of BPJS Kesehatan in July 2025. The number of respondents was 54 people. **Results:** of the bivariate analysis using the chi-square test showed no significant relationship between age and gender. However, there was a relationship between the use of glasses, eye rest, and screen time duration with the risk of eye disorders in computer/laptop users at the Dumai Branch of BPJS Kesehatan. **Conclusion:** From the results of this study, it is recommended that the Dumai Branch of BPJS Kesehatan increase greater attention to factors related to the risk of eye disorders in computer users by providing educational guidance to employees.

Introduction

The human eye plays a crucial role in the performance of tasks in various occupations. Therefore, maintaining eye health is essential for effective work performance. The risk of visual disturbances arises from eye strain caused by prolonged visual impairment, often accompanied by discomfort in vision. This visual disturbance risk, commonly referred to as eye strain or asthenopia, is characterized by ocular fatigue or tension in the visual organs, leading to eye discomfort and headaches associated with intensive eye use [1]. Eye disturbance risks represent a significant health issue frequently experienced by workers, particularly those engaged in prolonged digital device usage. This condition is known as Computer Vision Syndrome (CVS) or Digital Eye Strain. CVS is marked by symptoms such as dry eyes, blurred vision, headaches, and discomfort around the eyes. The primary causes include continuous digital device use without adequate breaks, poor lighting, and non-ergonomic work positions [2].

Occupational health and safety (OHS) programs are established by employers to prevent work-related accidents and occupational diseases. Contributing factors include inadequate implementation and monitoring of OHS protocols, as well as a general failure among workers and society to recognize the importance of OHS standards in the workplace (Siahaan & Hartono, 2022) [3]. In the current era of globalization, technology is rapidly advancing and has become essential for facilitating work processes, particularly computers. Computer usage spans various sectors, including retail, education, health, security, and transportation. According to data from the Central Statistics Agency (BPS, 2021), computer usage in Indonesia was at 18.24% in 2021. Provincial data indicates that Jakarta experienced an increase in computer usage, rising from 23.51% in 2019 to 25.34% in 2021 [4]. Alongside increased computer usage, various health symptoms have emerged, including eye fatigue. Eye fatigue can be defined as an uncomfortable condition affecting the eyes, potentially leading to visual disturbances, resulting from eye strain and prolonged screen staring [5].

According to the World Health Organization (WHO) in 2014, the incidence of asthenopia or eye fatigue ranged from 40% to 90%. Data from worldwide internet usage in 2016 indicated that the number of computer users had reached 60%. In the United States, over 143 million people work with computers daily, with 90% experiencing eye fatigue. A survey conducted by the American Optometric Association revealed that over 10 million eye exams are performed annually for computer users, with approximately one million new cases reported each year [6]. In Indonesia, complaints of eye disturbances among computer users are frequently observed. A study conducted on UNRIYO employees at Respati University Yogyakarta found that 60.9% experienced eye fatigue [7]. Computer usage is widespread across Indonesia, with rates of 24.5% in Sumatra, 11.5% in Kalimantan, 30.6% in Java, 8.3% in Bali and Nusa Tenggara, 15.6% in Sulawesi, and 9.5% in Maluku and Papua. Visual symptoms appear in 75-90% of computer users, leading to higher health issues compared to other occupations [8].

According to data from the Ministry of Health's Infodatin, in 2015, the incidence of visual disturbances affected 253 million people (3.38%), including 36 million who were blind and 217 million with moderate to severe visual impairments. In 2020, the prevalence of eye fatigue among computer users was reported at 46.3% in India, 31.9% in Italy, 68.5% in Mexico, and 63.4% in Australia [5]. In Indonesia, based on Riskesdas data, the prevalence of severe low vision among the productive age group (15-64 years) is 1.49%. A study conducted on computer operators at PT Semen Padang in 2020 indicated that approximately 67.5% of 40 respondents experienced eye fatigue [9]. Symptoms of eye fatigue include redness, watering, irritation, heavy eyelids, blurred vision, and difficulty focusing. If not addressed, individuals may experience a decline in visual acuity, potentially leading to ocular diseases. Additionally, eye fatigue can negatively impact work performance, resulting in decreased productivity, increased errors, and a higher incidence of workplace accidents. In 2022, a study on computer users at Jambi Express found that 18 out of 35 respondents (85.75%) reported a correlation between eye fatigue and viewing distance. Research at PT Indonesia Power Up Semarang among computer users indicated a relationship between computer usage duration exceeding four hours and eye fatigue, with 32 out of 62 respondents (71.1%) affected [5].

Factors influencing eye disturbances, according to Asnel and Kurniawan (2020), indicate a significant relationship between age and monitor distance with eye disturbances among computer users. Workers over 45 years of age are at greater risk of experiencing eye fatigue compared to those under 45. Additionally, workers using computers at a distance of less than 50 cm from the monitor are at a higher risk of eye disturbances due to the proximity forcing the eyes to strain for extended periods [10]. According to Putri and Siana (2022), a factor related to complaints of eye fatigue is the duration of computer use exceeding four hours, computer users working over four hours are more likely to experience refractive changes [11]. Darmawan and Wahyuningsih concluded that insufficient lighting intensity below 300 lux can contribute to eye fatigue (Darmawan & Wahyuningsih, 2021). Suryatman and Hermawan asserted that there is a correlation between eye fatigue and lighting levels, suggesting that computer users are optimally supported with room lighting between 300-500 lux [12].

Eye disturbances can result from various factors, including individual factors such as gender (Zulaiha et al., 2018), age (Nourmayanti, 2020), eyeglass use (Kharel et al., 2018), eye rest (Nopriadi & Pratiwi, 2019), and posture (Harahap, 2020) [13-17]. Factors related to digital devices include screen time duration anti-glare features (Sari et al., 2018), monitor/laptop distance (Yunitia et al., 2018), and smartphone distance (Maimanah, 2018). Environmental factors, including room lighting (Arianti, 2016) and temperature (Anggraini, 2013), also relate to eye disturbances. Workers in poor lighting conditions are [18-22].

Initial global research on individuals using Video Display Terminals (VDT), including computers, laptops, and touchscreen phones, reported 40 users experiencing eye disturbances. At the Dumai Health BPJS Branch, the prevalence of eye fatigue among workers using computers/laptops reached 92.9%. The proportion of workers utilizing electronic media in their jobs experiencing eye disturbances is primarily attributed to prolonged computer or laptop use. Common symptoms of eye disturbances include a burning sensation in the eyes, itching, excessive blinking, redness, eye pain, heavy eyelids, blurred vision, double vision, difficulty focusing, deteriorating vision, and headaches [23].

At the Dumai Health BPJS Branch, workers actively utilize computers/laptops as part of their health service delivery tasks. According to a preliminary study of five workers, symptoms of eye fatigue reported included: redness (40%), itching (60%), sensation of a foreign object in the eye (40%), watering (60%), excessive blinking (60%), redness (60%), eye pain (40%), heavy eyelids (60%), dryness (40%), blurred vision (40%), double vision (20%), difficulty focusing on near vision (40%), light sensitivity (60%), colored circles around objects (20%), worsening vision (40%), and headaches (80%).

The data indicates that eye disturbances are likely to affect all workers, including employees at the Dumai Health BPJS Branch. The nature of their work, which involves data entry, claims verification, and data checking on applications under time constraints, requires employees to sit for an average of eight hours a day in front of a computer or laptop. The extended working hours often lead employees to neglect considerations regarding viewing distance to the computer, sitting posture during work, and room lighting.

Methods

This study is a quantitative research project, which employs a numerical approach to measure the relationships between predetermined variables [24]. The research will be conducted among employees at the Dumai Health BPJS Branch. The study will span from proposal development to the presentation of results, planned for the period from April to August 2025. In this research, the sample comprises the entire population, totaling 54 employees. Data analysis involves the processing and interpretation of the data collected during the study to understand the phenomenon under investigation and draw valid conclusions. In quantitative research, data analysis is conducted using statistical methods to test hypotheses, evaluate relationships between variables, and obtain objective results. According to [25], data analysis in quantitative research can be divided into two main stages: univariate analysis and bivariate analysis. These two stages help provide a comprehensive overview of the collected data.

Results

Age

The age of respondents from the Dumai Health BPJS Branch is presented in Table 1 below:

Table 1. Frequency Distribution of Respondent Based on Age

Category	Frequency (n)	Percentage (%)
At Risk (> 40 years)	19	35.2%
Not at Risk (< 40 years)	35	64.8%
Total	54	100.0%

Source: Primary data analysis, 2025

Based on Table 1, the majority of respondents fall into the at-risk category, with 19 individuals (35.2%) aged 40 years or older. Meanwhile, 35 individuals (64.8%) are classified as not at risk, being under 40 years of age.

Gender

The gender distribution of respondents from the Dumai Health BPJS Branch is shown in Table 2 below:

Table 2. Frequency Distribution of Respondts Based on Gender

Category	Frequency (n)	Percentage (%)
Male	23	42.6%
Female	31	57.4%
Total	54	100.0%

Source: Primary data analysis, 2025

According to Table 2, the majority of respondents are female, totaling 31 individuals (57.4%). In comparison, 23 individuals (42.6%) are male.

Eyewear Use

The use of corrective eyewear among respondents from the Dumai Health BPJS Branch is indicated in Table 3 below:

Table 3. Frequency Distribution of Respondents Based on Eyewear Use

Category	Frequency (n)	Percentage (%)
Not Wearing Glasses	20	37.0%
Wearing Glasses	34	63.0%
Total	54	100.0%

Source: Primary data analysis, 2025

As shown in Table 3, the majority of respondents wear glasses, totaling 34 individuals (63.0%). Conversely, 20 individuals (37.0%) do not use glasses.

Eye Rest

Respondents from the Dumai Health BPJS Branch regarding eye rest while working in front of a computer or laptop are shown in Table 4 below:

Table 4. Frequency Distribution of URTI Incidence Rsik among BPJS Kesehatan Employees

Category	Frequency (n)	Percentage (%)

Risky	24	44.4%
No Risk	30	55.6%
Total	54	100.0%

Source: Primary data analysis, 2025

According to Table 4, the majority of respondents (30 individuals, 55.6%) take breaks, while 24 individuals (44.4%) do not rest while working in front of a computer or laptop.

Screen Time Duration

The screen time usage among respondents from the Dumai Health BPJS Branch is provided in Table 5 below:

Table 5. Frequency Distribution of URTI Incidence Rsik among BPJS Kesehatan Employees

Category	Frequency (n)	Percentage (%)
> 6 Hours	51	94.4%
< 6 Hours	3	5.6%
Total	54	100.0%

Source: Primary data analysis, 2025

As indicated in Table 5, the majority of respondents (51 individuals, 94.4%) reported a screen time duration of 6 hours or more. In contrast, 3 individuals (5.6%) reported less than 6 hours.

Relation Between Age and Eye Disturbance Risk

Among the 54 respondents, 19 individuals (35.2%) are aged 40 years or older, while 35 individuals (64.8%) are under 40. Among the 19 at-risk individuals, 11 (20.4%) experienced eye disturbances, while 8 (14.8%) did not. Among those under 40 years, 27 individuals (50.0%) reported eye disturbances, while 8 (14.8%) did not.

The chi-square test results indicated a p-value of 0.243 with an alpha of 0.05. The p-value for the age variable was 0.407, which is greater than 0.05, indicating no significant relationship between age and eye disturbances. The odds ratio (OR) of 0.407 suggests that respondents aged 40 years or older have a relative (odds) of 0.407 (lower) for experiencing eye disturbances compared to respondents under 40 years. However, since the confidence interval includes the number 1 (0.122-1.359), this result is not statistically significant, indicating no substantial difference between the age groups.

Relationship Between Gender and Eye Disturbance Risk

Among the 54 respondents, 31 individuals (57.4%) are female, and 23 individuals (42.6%) are male. Among the 31 female respondents, 22 (40.7%) reported eye disturbances, while 16 (16.7%) did not. Among the 23 male respondents, 16 (29.7%) experienced eye disturbances, while 7 (12.9%) did not.

The chi-square test results indicated a p-value of 1.000 with an alpha of 0.05, and the OR was 1.069. The p-value for the gender variable was 0.671, which is greater than 0.05, indicating no significant relationship between gender and eye disturbance risk. The OR of 1.069 suggests that female respondents have nearly double the odds of experiencing eye disturbances compared to male respondents. However, the confidence interval (95% CI: 0.329 – 3.447) spans the number 1, rendering this result statistically insignificant and unable to confirm any real risk difference. The wide CI indicates a small sample size (N=54) or considerable data variation, suggesting insufficient evidence to establish a link between gender and eye disturbances.

Relationship Between Eyewear Use and Eye Disturbance Risk

Among the 54 respondents, 20 individuals (37.0%) do not wear glasses, while 34 individuals (63.0%) do wear glasses while working in front of a computer. Among those not wearing glasses, 18 individuals (33.3%) reported eye disturbances, while 2 (3.7%) did not. Among those who wear glasses, 20 individuals (37.1%) reported eye disturbances, while 14 (25.9%) did not.

With an alpha of 0.05, the p-value for the eyewear variable was 0.034, which is less than 0.05, indicating a significant relationship between eyewear use and eye disturbances. The OR of 6.300 indicates that respondents who do not wear glasses have approximately 6.3 times the likelihood of experiencing eye disturbances compared to those who do wear glasses. Since the confidence interval does not include the number 1 (1.256-31.601), this result is statistically significant, confirming that eyewear use is associated with a reduced risk of eye disturbances.

Relationship Between Eye Rest and Eye Disturbance Risk

Among the 54 respondents, 24 individuals (44.4%) reported not taking breaks, while 30 individuals (55.6%) utilized breaks while working at a computer. Among those not taking breaks, 12 individuals (22.2%) reported eye disturbances, while 12 (22.2%) did not. Among those utilizing breaks, 26 individuals (48.2%) reported eye disturbances, while 4 (7.4%) did not.

With an alpha of 0.05, the p-value for the eye rest variable was 0.08, indicating a significant relationship between eye rest and eye disturbances. The OR was 0.154 (95% CI: 0.041-0.577), suggesting that respondents who do not take breaks have a smaller chance (0.154 times) of avoiding eye disturbances compared to those who do take breaks. Since the confidence interval does not include 1, this result is statistically significant. In other words, the presence of breaks is associated with a reduced risk of eye disturbances.
The risk estimate of 0.577 (95% CI: 0.378 – 0.882) indicates that respondents who take breaks are 42.3% less likely (value < 1) to experience eye disturbances compared to those who do not take breaks. As the CI does not include 1, this result is significant. The risk estimate of 0.750 (95% CI: 1.385 – 10.155) suggests that respondents who take breaks have
3.75 times greater odds of avoiding eye disturbances compared to those who do not take breaks; since the CI does not include 1, this result is significant.

Relationship Between Screen Time Duration and Eye Disturbance Risk

Among the 54 respondents, 51 individuals (94.4%) reported a screen time duration of 6 hours or more, while 3 individuals (5.6%) reported less than 6 hours. Among the 51 individuals with 6 hours or more of screen time, 38 (70.4%) experienced eye disturbances, whereas no respondents with less than 6 hours reported such disturbances.

With an alpha of 0.05, the p-value for the screen time duration variable was 0.006, which is less than 0.05, indicating a significant relationship between screen time duration and eye disturbances. The risk estimate of 0.255 indicates that this group has only a 25.5% chance of avoiding eye disturbances compared to the reference group. Since the confidence interval (0.159 – 0.408) does not include the number 1, this result is statistically significant. This suggests that the factor or condition under analysis is related to an increased risk of eye disturbances, as the likelihood of not experiencing eye disturbances is lower in this group. The comparison of eye disturbance risk between those with screen time of 6 hours or more and those with less than 6 hours shows that respondents with screen time greater than 6 hours have an odds ratio 18.4 times higher for experiencing eye disturbances compared to those with screen time of less than 6 hours.

Discussion

Relationship Between Respondents' Age and Eye Disturbance Risk

The study results based on Table 4.6 indicate that out of 54 respondents, 12 individuals (22.2%) are over 40 years old, while 42 individuals (77.8%) are under 40. Among the 12 individuals over 40, 9 (16.7%) are at risk of eye disturbances, while 3 (5.5%) are not at risk. Conversely, among those under 40 years, 38 individuals (70.4%) are at risk of eye disturbances, and 4 (7.4%) are not at risk. Chi-square test results showed no significant relationship between age and eye disturbances. The odds ratio (OR) obtained is 0.316, indicating that individuals over 40 years have a relative odds of experiencing eye disturbances about 0.316 times compared to those under 40 years. Since OR < 1, individuals over 40 are less likely to experience eye disturbances than those under 40. Additionally, the 95% confidence interval (0.060 - 1.667) crosses the number 1, making this result statistically insignificant (indicating no confirmed risk difference).

Eye disturbances occurring at ages 16-18 appear more rapidly than in adulthood. Tear production decreases with age, and adolescence is a time of increased academic demands, leading to higher computer, laptop, and mobile phone usage for obtaining necessary information. This finding aligns with the theory that increasing age leads to declining physical capabilities. Workers over 40 years are more vulnerable to vision issues due to physiological changes and aging of the eyes. Aging reduces the eye's elasticity, and in the elderly, this elasticity is lost, diminishing the lens's ability to focus objects on the retina, leading to discomfort and accelerated eye fatigue [26].

Relationship Between Gender and Eye Disturbance Risk

The study indicates no significant relationship between gender and eye disturbances. Descriptively, females appear slightly more at risk for eye disturbances than males (OR > 1). However, since all confidence intervals include the number 1, there is no statistically significant difference between males and females regarding eye disturbances. In other words, in this gender data, there is no proven relationship with the incidence of eye disturbances.
This finding is consistent with research by Kumasela et al. (2013) showing that eye fatigue occurs more frequently in females, though not significantly related. In the current globalization era, both men and women actively use computers, laptops, and mobile phones. Women tend to be more meticulous and diligent than men, which may lead them to focus more on screens to minimize typing errors while learning or working (Kumasela et al., 2013). To minimize the occurrence of eye disturbances in both genders, using anti-reflective glasses and/or radiation-protective glasses is recommended to avoid extreme temperatures that can cause tears to evaporate easily [17].

Relationship Between Eyewear Use and Eye Disturbance Risk

The study found no significant relationship between eyewear use and eye fatigue. Among respondents, 20 individuals (37%) do not wear glasses, while 34 individuals (63%) do. This finding aligns with research by Arianti (2016), which found no significant relationship between eyewear use for refractive errors or radiation protection. Focusing intensely on screens reduces blinking frequency, leading to dry eyes and redness due to friction between the eye lens and eyelids [21], Additionally, decreased blinking frequency can cause tears to evaporate, leading to dry eyes [17].

Protective eyewear for refractive errors and anti-radiation glasses is recommended when using computers, laptops, and touch screen mobile phones, whether separately or combined, for correcting refractive errors. Furthermore, installing anti-glare protection on touch screen devices can reduce eye disturbances [27].

Relationship Between Eye Rest and Eye Disturbance Risk

The study found no significant relationship between eye rest and eye disturbances. This may be due to employees taking more eye breaks than those who do not. This finding aligns with research by Arjuna (2019), which also found no significant relationship between eye rest and disturbances. This may be influenced by other factors, such as long screen time durations exceeding 6 hours daily without regular breaks. Moreover, poor room lighting and suboptimal temperatures (22° - 25°C) can contribute to eye disturbances [28].

It is essential for individuals to rest their eyes regularly for eye health. Additionally, reminder applications such as alarms or similar tools can help remind individuals to take regular eye breaks and monitor screen time. Limiting daily screen time to less than 6 hours can help prevent eye fatigue [29].

Relationship Between Screen Time Duration and Eye Disturbance Risk

The study found a significant relationship between screen time duration and eye disturbances. This may be due to a higher number of respondents falling into the poor screen time category compared to those in the good category. Employees with poor screen time duration (> 6 hours) totaled 96 (87.3%), while those with good duration (< 6 hours) were 14 (12.7%). Both groups experienced eye disturbances. This aligns with research by Iis Qori Lestari titled "Analysis of Risk Factors for Eye Disturbances in Employees at Harian Tribun SUMSEL Palembang in 2018," which states that eye disturbances generally arise from using computers for four hours or more continuously.

Conversely, the findings align with research by Munif et al. (2020), which showed no significant relationship between screen time duration and eye disturbances. This could be attributed to the average screen time of respondents reaching 10 hours daily [30]. Other factors, such as poor posture when using computers/laptops, a distance of < 40 cm between screens, and the absence of anti-glare features, as well as light reflections from outside or windows, may influence eye fatigue [31]. It is advisable to limit the use of computers/laptops and touch screen devices to less than 6 hours daily. Utilizing reminder applications similar to alarms can signal when screen time reaches the maximum limit of < 6 hours daily [32]

Conclusion

Based on the research conducted on the factors associated with the risk of eye disturbances among computer-using employees at the Dumai Health BPJS Branch, the following conclusions can be drawn:

1. There is no relationship between age and the risk of eye disturbances among computer/laptop users at the Dumai Health BPJS Branch working for more than 4 hours.
2. There is no relationship between gender and the risk of eye disturbances among computer/laptop users at the Dumai Health BPJS Branch.
3. There is a relationship between eyewear use and the risk of eye disturbances among computer/laptop users at the Dumai Health BPJS Branch.
4. There is a relationship between eye rest and the risk of eye disturbances among computer/laptop users at the Dumai Health BPJS Branch.

5. There is a relationship between screen time duration and the risk of eye disturbances among computer/laptop users at the Dumai Health BPJS Branch.

Ethics approval

The ethical approval of this research was issued by the Faculty of Health and Informatics, Institut Kesehatan Payung Negeri Pekanbaru.

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