

CHARACTERISTICS AND RELATIONSHIP OF COMPUTER VISION SYNDROME (CVS) RISK FACTORS WITH CVS COMPLAINTS IN EDUCATION WORKERS

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ABSTRACT

BACKGROUND

The frequency and duration of using electronic devices have increased rapidly due to working from home during the Covid19 pandemic. This causes many complaints of vision such as tired eyes, heat, blur, foreign body sensation in the eyes and various other symptoms. All of these are known as Computer Vision Syndrome (CVS) symptoms, which could happen in and/or outside the eye. This study aims to analyze the relationship between the use of electronic devices with CVS symptoms felt by employees of the Faculty of Medicine, Universitas Trisakti, Jakarta.

METHODS

Fifty-three employees aged 25-60; were recruited for this cross-sectional study. A complete questionnaire consisting of several questions, including the type and number of electronic devices used, how many hours of use in a day, and complaints felt when using electronic devices, was applied to determine the CVS symptoms. In addition, a visual inspection was conducted to determine the visual acuity. Fisher's exact test was used for analyzing the statistics.

RESULTS

More than half of the subjects (52.8%) used 3-4 electronic devices for more than 6 hours daily (56.6%). Multiple CVS symptoms were complaint by 52.83% of subjects, such as tired eyes, blurred vision, and dry eyes observed in 71.7%, 45.3%, and 33.9% of subjects, respectively. Bivariate analysis using Fisher's exact test assessed the relationship between risk factors, such as the use of electronic devices, gender, age, number of electronic devices used, duration of usage in a day, visual acuity, and the incidence of CVS complaints. There was no significant relationship between the various risk factors with CVS complaints, indicated by $p > 0.05$ in all variables.

CONCLUSION

Users of electronic devices often feel various complaints in their eyes when using these devices. Although there was no association between the risk factors studied and complaints of CVS, it is still critical to investigate other factors that may be associated with the incidence of CVS due to its multifactorial pathogenesis.

KEYWORDS: Computer Vision Syndrom, CVS, Electronic Devices, Vision

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ABSTRAK

Karakteristik dan Hubungan Faktor Risiko Computer Vision Syndrome (CVS) dengan Keluhan CVS pada Pekerja Bidang Pendidikan**LATAR BELAKANG**

Frekuensi dan durasi penggunaan perangkat elektronik meningkat pesat akibat *Work From Home* (WFH) selama pandemi Covid19. Hal tersebut banyak menimbulkan keluhan pada penglihatan seperti mata lelah, panas, buram, sensasi benda asing di matanya dan berbagai gejala lainnya. Semua ini dikenal sebagai gejala *Computer Vision Syndrome* (CVS) dimana gejala CVS meliputi gejala pada mata dan diluar mata. Penelitian ini bertujuan untuk menganalisa hubungan penggunaan perangkat elektronik dengan gejala CVS yang dirasakan oleh karyawan Fakultas Kedokteran Universitas Trisakti, Jakarta.

METODE

Sebanyak 53 orang karyawan berumur 25-60 tahun berpartisipasi dalam penelitian *cross-sectional* ini. Wawancara tentang jenis dan jumlah perangkat elektronik yang digunakan, berapa jam penggunaannya dalam sehari serta keluhan yang dirasakan saat menggunakan perangkat elektronik Sedangkan pemeriksaan visual acuity dilakukan untuk mengetahui berapa visual acuity subyek penelitian. Uji *Fisher* dengan nilai $p < 0.05$ digunakan dalam analisis statistik.

HASIL

Sebanyak 52.8% subyek menggunakan 3-4 perangkat elektronik dengan durasi lebih dari 6 jam setiap hari (56.6%). Keluhan CVS dialami oleh 52.83% subyek penelitian, dan keluhan yang dirasakan merupakan keluhan *multiple symptom*, keluhan terbanyak adalah mata lelah sebanyak 71.7%, penglihatan buram sebanyak 45.3% dan keluhan mata kering sebanyak 33.9%. Analisis bivariat dengan uji *Fisher* menilai hubungan antara faktor risiko penggunaan perangkat elektronik seperti jenis kelamin, umur, jumlah perangkat elektronik yang digunakan, durasi penggunaannya dalam sehari serta visual acuity dengan timbulnya keluhan CVS. Tidak terdapat hubungan yang bermakna antara berbagai faktor resiko tersebut dengan keluhan CVS, ditunjukkan dengan nilai $p > 0.05$ pada semua variabel.

KESIMPULAN

Pengguna perangkat elektronik sering merasakan berbagai keluhan di matanya saat menggunakan perangkat tersebut. Walaupun pada penelitian ini tidak ditemukan kaitan antara faktor risiko yang diteliti dengan keluhan CVS, namun karena CVS adalah penyakit multifaktorial sehingga masih perlu diteliti faktor-faktor lain yang mungkin berhubungan dengan kejadian CVS.

KATA KUNCI: *Computer Vision Syndrome*, CVS, Perangkat Elektronik, Visual acuity

INTRODUCTION

The development of digital technology has been very rapid in the last few decades, including the development of computer technology. The number of computer users is increasing day by day. In 1997 it was reported that 18% of Americans used computers, then in 2009, it increased to 68.7% and in 2013 to 83.8%.⁽¹⁾ A survey conducted by the Indonesian Ministry of Communication and Informatics in 2017 obtained data that there are far fewer personal computer users than laptops or smartphones, where only 13.70% of Indonesians use desk computers while laptop users are 22.52%, and smartphone users are 66.3%.⁽²⁾ Various computer-based electronic devices include desk computers, laptops, tablets, e-readers and smartphones. Smartphones are

preferred compared to other devices because of their small size and ease of carrying everywhere.⁽²⁾

Electronic devices, especially smartphones, are now a modern human lifestyle. Many advantages are obtained from these electronic devices, including as a means of communication, browsing, uploading and downloading materials, streaming videos and music, reading e-books, playing online games, transacting online, Global Positioning System (GPS) navigation, making computer programs (coding) or surfing social media.⁽²⁾ Although there are so many advantages to using this electronic device, it turns out that there are also many negative impacts that it produces. Health problems that have been reported are sleep disturbances,⁽³⁻⁵⁾ headaches, leukaemia and even brain tumors,⁽⁶⁾ neck and upper extremity

pain,⁽⁷⁾ smartphone 'addiction/addiction',^(8,9) emotional changes,⁽¹⁰⁾ decline in academic grades, relationships with parents and friends become inharmonious and even try to commit suicide.⁽¹¹⁾ It is also reported that there is impaired body function due to prolonged sitting in front of the computer, stiffness in the neck or shoulders⁽⁷⁾ and tinnitus.⁽¹²⁾

In addition to the complaints mentioned above, the negative impact of this electronic device also occurs on the eyes. Symptoms caused by excessive use of electronic devices are often called Computer Vision Syndrome (CVS). According to the American Optometric Association, CVS is a collection of symptoms consisting of complaints in the eyes and complaints outside the eyes related to excessive computer use without pause.⁽¹³⁾ In general, CVS sufferers have various complaints, such as dry eyes, heat, tiredness, gritty, itching, red eyes and blurry vision, and pain in the shoulder and neck area.⁽¹³⁻¹⁵⁾ Some literature reports symptoms of asthenopia,^(16,17) lacrimal hypofunction and dry eye,⁽¹⁸⁾ increased intraocular pressure,⁽¹⁹⁾ esotropia,^(20,21) and blockage of the retinal artery branch due to continuous neck extension while using a smartphone.⁽²²⁾ Many factors are thought to be the cause of CVS, such as the blue light effect from a computer monitor screen,^(4,23) reduced reflexes,⁽²⁴⁾ blinking,⁽²⁵⁾ uncorrected refractive error,⁽¹⁴⁾ font size,⁽²⁵⁾ tear film stability,^(26,27) Meibomian gland dysfunction,⁽²⁸⁾ and also external factors such as room lighting, air that is too drying or air-conditioned room.^(14,26,29)

Complaints of CVS have been found before the Covid19 pandemic. Research on health workers in Spain in 2017-2018 found that the prevalence of CVS was almost 60%, with nurses as the profession experiencing the most CVS.⁽³⁰⁾ In Sri Lanka, the prevalence of CVS reached 67.4%, with the most sufferers being female.⁽³¹⁾ Research in Riyadh, Saudi Arabia, the prevalence of CVS occurred in 45.1% of subjects over 40 years.⁽³²⁾ A study of 520 office workers in New York showed that 32% experienced complaints of dry eye and eye discomfort.⁽¹⁵⁾

In the midst of the current Covid19 pandemic, where Work From Home (WFH) regulations are enforced, all learning and working activities from home, using electronic devices such as laptops, computers or smartphones, have

led to an increase in the frequency and duration of using electronic devices. Many research related to CVS on electronic device users during the Covid-19 pandemic have been carried out. However, there is still little research on Indonesia, which has different working conditions. This study was conducted to look at the relationship between CVS risk factors and CVS complaints in employees who use electronic devices while working in educational institutions.

METHODS

This study is a population study with a cross-sectional approach carried out in February – March 2021. The study population was the employees of FK Usakti, the sample was taken consecutively, and after meeting the inclusion and exclusion criteria, a brief interview will be conducted with research subjects and eye examination. The inclusion criteria were FK Usakti employees aged 25-60 who used electronic devices and were willing to participate in this study by signing informed consent. Exclusion criteria for this study were subjects with anatomical abnormalities in their eyes, a history of diabetes or hypertension, a history of intraocular surgery, a vision of less than 6/60 and a history of using steroid eye drops regularly. The questions posed to the research subjects included the type of electronic device used, whether they used 1 type or more than 1 type of electronic device and how many hours of use in 1 day, as well as the CVS complaints they felt when using the electronic device.

Eye examination consisted of anterior segment examination and visual examination. For examination of the anterior segment, used a loupe and flashlight, while the examination of vision used a Snellen chart. Anterior segment examination was carried out to see if there were abnormalities in the eyes of the research subjects, which was a requirement for exclusion criteria. While the visual examination was carried out by means of the subject reading the letters on the Snellen chart from a distance of 6 meters. An examination was carried out on each eye, and the visual acuity was recorded in the right eye, left eye and both eyes. If the vision in both eyes can reach 6/6 on the Snellen chart without glasses, the subject is said to have normal vision.

All data were analyzed using Microsoft Office Excel 2010 and GraphPad Prism Version 9.00 (GraphPad Software Inc.). All bivariate data were analyzed using Fisher's exact test. Results will be considered significant at $p < 0.05$ with a 95% confidence interval. The data on the characteristics of the research subjects included gender, age, type and number of electronic devices used, how many hours of using electronic devices per day and complaints when using electronic devices. In this study, data analysis on visual acuity was only done by assessing both eyes, not each eye. So that the visual acuity of the research subjects is said to be good if the visual acuity of both eyes or the visual acuity of the *Oculi Dextra Sinistra* (ODS) is 6/6, whereas if the visual acuity of the ODS is less than 6/6 or if one eye has a visual acuity of less than 6/6 then the visual acuity of the research subject is said to be not good.

This study uses a method approved by the Ethics Commission of the Faculty of Medicine, Universitas Trisakti, Jakarta, with the number 171/KER/FK/XII/2020.

RESULTS

A total of 59 research subjects were willing to take part in this study. Still, six

subjects had to be excluded because two people had anatomical abnormalities in their eyes, two people had vision less than 6/60, and 2 more were not willing to continue the study, so the number of research subjects was 53. Table 1 shows the distribution of research subjects based on gender, age, visual acuity, type of electronic device used, how many hours of use of the electronic device in one day and complaints when using electronic devices, as well as subject's visual acuity. The distribution of research subjects was based on gender; most were women (54.7%). As many as 56.6% of the research subjects were more than 40 years old, and of all research subjects, 49.1% had ODS vision less than 6/6.

The electronic devices used are limited to 4 types: smartphones, laptops, tablets and desk computers (PCs). All research subjects (100%) own smartphones for daily activities. In addition to smartphones, laptops are the most used electronic devices with 67.9%. The number of electronic devices used by research subjects varied; 52.8% of subjects used 3-4 electronic devices. Based on the duration of electronic devices in a day, 56.6% of the research subjects used electronic devices for more than 6 hours. Based on interviews with research subjects, data were obtained that nine

Table 1. Demographic characteristics of research subjects (n=53)

Characteristic	Frequency (%)
Gender (%)	
Male	24 (45.3)
Female	29 (54.7)
Age Classification (year)	
25 - 40	23 (43.4)
> 40 - 60	30 (56.6)
Visual Acuity ODS	
6/6	27 (50.9)
< 6/6	26 (49.1)
Types of Electronic Devices Used *	
Smartphone	53 (100)
Laptop	36 (67.9)
Tablet	6 (11.3)
Personal Computer	28 (52.8)
Number of Electronic Devices Used	
1-2	25 (47.2)
3-4	28 (52.8)
Duration of Use of Electronic Devices	
≤ 6 hours per day	23 (43.4)
> 6 hours per day	30 (56.6)
There are complaints when using electronic devices	
Yes	44 (52.83)
No	9 (16.9)
Types of complaints when using electronic devices**	
Eyes feel tired	38 (71.7)
Blurred vision	24 (45.3)
Eyes feel dry	18 (33.9)

* Subjects use more than one electronic device

** Complaints that are felt are multiple symptoms

Table 2. Distribution of CVS Complaints based on Various Risk Factors of Research Subjects

Characteristic	CVS Complaints		P value
	Yes n (%)	No n (%)	
Gender (%)			
Male	17 (32.08)	7 (13.20)	0.0623
Female	27 (50.94)	2 (3.78)	
Age classification (year)			
25 – 40	19 (35.85)	5 (9.43)	0.7153
>40 – 60	25 (47.17)	4 (7.55)	
Number of Devices Used			
1–2	23 (43.40)	7 (13.20)	0.2699
3–4	21 (39.62)	2 (3.78)	
Duration of Use of Electronic Devices			
≤6 hours	17 (32.08)	6 (11.32)	0.1537
>6 hours	27 (50.94)	3 (5.66)	
Visual Acuity			
6/6	16 (30.19)	6 (11.32)	0.1396
<6/6	28 (52.83)	3 (5.66)	

people (16.9%) claimed not to feel complaints when using electronic devices. In contrast, those who felt CVS complaints when using electronic devices claimed to feel complaints of more than one symptom. Tired eyes were the most common complaint at 71.7%, followed by blurry vision at 45.3% and dry eyes at 33.9%.

The Relationship between Risk Factors and CVS Complaints

Data on the distribution of CVS complaints based on various risk factors such as gender, age, number of devices used and duration of use of electronic devices, as well as visual acuity, are summarized in table 2. In our study, research subjects who used 3-4 electronic devices were more numerous than those who used 1-2. However, CVS complaints are often found in users of 1-2 devices. Meanwhile, based on the duration of the use of electronic devices, it turns out that more than 50% of the subjects used electronic devices for more than 6 hours every day, and 5.66% of them admitted that they did not feel CVS complaints even though they used electronic devices for more than 6 hours. Visual acuity of subjects less than 6/6 was found in more than 50% of research subjects. CVS complaints were experienced by most of the research subjects, both those with visual acuity of 6/6 and those with visual acuity of less than 6/6.

There was no significant relationship between CVS complaints and various risk factors such as gender (p value=0.0623), age (p value= 0.7153), number of devices used (p

value=0.2699), duration of daily use of electronic devices (p value=0.1537), and visual acuity (p value=0.1396).

DISCUSSION

Symptoms of Computer Vision Syndrome (CVS) in the eyes are dry, hot, tired eyes, such as gritty, itching, red eyes and blurry vision. Usually, people with CVS experience more than 1 CVS symptom. However, in our study, eye fatigue was the most common complaint (71.7%), which is in accordance with many works of literature stating that this complaint is the dominant complaint in CVS..^{(8,15,29,33)-}

More than 50% of our subjects use electronic devices more than 6 hours a day, but there is no significant relationship between the length of use of electronic devices and CVS complaints. This is not in accordance with some studies, such as the Kokab study, which states that the length of daily use of electronic devices is the main factor causing CVS.⁽³⁴⁾ Meanwhile, research by the office worker community in New Delhi shows a significant relationship between computer use for more than 6 hours and eye complaints. Such as eye strain, itching, burning, or burning sensation around the eyes.⁽³⁵⁾ During the lockdown due to Covid19, the results of a study in Thailand showed that the prevalence of asthenopia increased with increasing duration of electronic device use.⁽³⁶⁾

The number of electronic devices used in this study was not associated with the incidence of CVS complaints. However, in much of the

literature, there is also no discussion of the number of electronic devices used. Perhaps this is because various electronic devices of any type will still cause complaints, so research is more focused on the duration of the use of electronic devices.

The decrease in visual acuity in our study was suffered by more than 50% of the subjects. Still, this decrease in visual acuity was not associated with CVS complaints experienced by the study subjects. This is not in accordance with a research in Al-Ahsa, Saudi Arabia, which found a significant relationship between complaints of blurred vision and CVS.⁽³⁷⁾ Other studies stated a relationship between the use of electronic devices and the incidence of decreased visual acuity, such as double vision, blurry vision or disability for details.^(33,35-38) Astigmatism is a refractive error that is often associated with asthenopia, according to a study of 1109 people of the Zulu ethnic group, Africa.⁽³⁵⁾

Meanwhile, the study whose results were almost in line with ours was a study in Italy, which stated that there was no significant relationship between eye fatigue and visual acuity even though the researcher admitted that the length of use of electronic devices was the cause of eye fatigue.⁽³⁹⁾ Refractive disorders experienced by the subjects In our research, it is not known whether it stems from excessive use of electronic devices or has previously suffered from refractive errors. However, from the interviews we conducted, it was known that during the Covid19 pandemic, with the use of electronic devices more and more frequently and for a longer period, CVS complaints became more pronounced, such as tired eyes and blurry vision. This is in accordance with research which states that uncorrected refractive errors will increase CVS complaints such as eye discomfort and blurry vision.⁽¹⁵⁾

CONCLUSION

Users of electronic devices often feel various complaints when using these devices, especially when using them for a long time. A good work system is needed so that the negative impact of using electronic devices in the workplace does not interfere with the health of its users, which in turn can interfere with the work performance and productivity of employees and the company.

The limitation of this study is that there are

too few research subjects, and the data collection is only once using the cross-sectional study method, so it can only assess the relationship between CVS complaints and predetermined risk factors. Further research is needed with a larger number of subjects and a prospective follow-up study method with several periodic data collections so that CVS risk factors can be identified as the cause of CVS complaints.

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AUTHORS CONTRIBUTION

NP conceptualizes the research theme, conducts eye examinations and prepares the initial draft of the publication. MDH drafted the research theme and revised the publication draft. AA performs an eye exam. JS revises the publication draft.

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CONFLICT OF INTEREST

The researcher declares that there is no conflict of interest between the researchers in producing this publication.

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ABSTRACT

BACKGROUND

The frequency and duration of using electronic devices have increased rapidly due to working from home during the Covid19 pandemic. This causes many complaints of vision such as tired eyes, heat, blur, foreign body sensation in the eyes and various other symptoms. All of these are known as Computer Vision Syndrome (CVS) symptoms, which could happen in and/or outside the eye. This study aims to analyze the relationship between the use of electronic devices with CVS symptoms felt by employees of the Faculty of Medicine, Universitas Trisakti, Jakarta.

METHODS

Fifty-three employees aged 25-60; were recruited for this cross-sectional study. A complete questionnaire consisting of several questions, including the type and number of electronic devices used, how many hours of use in a day, and complaints felt when using electronic devices, was applied to determine the CVS symptoms. In addition, a visual inspection was conducted to determine the visual acuity. Fisher's exact test was used for analyzing the statistics.

RESULTS

More than half of the subjects (52.8%) used 3-4 electronic devices for more than 6 hours daily (56.6%). Multiple CVS symptoms were complaint by 52.83% of subjects, such as tired eyes, blurred vision, and dry eyes observed in 71.7%, 45.3%, and 33.9% of subjects, respectively. Bivariate analysis using Fisher's exact test assessed the relationship between risk factors, such as the use of electronic devices, gender, age, number of electronic devices used, duration of usage in a day, visual acuity, and the incidence of CVS complaints. There was no significant relationship between the various risk factors with CVS complaints, indicated by $p > 0.05$ in all variables.

CONCLUSION

Users of electronic devices often feel various complaints in their eyes when using these devices. Although there was no association between the risk factors studied and complaints of CVS, it is still critical to investigate other factors that may be associated with the incidence of CVS due to its multifactorial pathogenesis.

KEYWORDS: Computer Vision Syndrom, CVS, Electronic Devices, Vision

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ABSTRAK

Karakteristik dan Hubungan Faktor Risiko Computer Vision Syndrome (CVS) dengan Keluhan CVS pada Pekerja Bidang Pendidikan
LATAR BELAKANG

Frekuensi dan durasi penggunaan perangkat elektronik meningkat pesat akibat *Work From Home* (WFH) selama pandemi Covid19. Hal tersebut banyak menimbulkan keluhan pada penglihatan seperti mata lelah, panas, buram, sensasi benda asing di matanya dan berbagai gejala lainnya. Semua ini dikenal sebagai gejala *Computer Vision Syndrome* (CVS) dimana gejala CVS meliputi gejala pada mata dan diluar mata. Penelitian ini bertujuan untuk menganalisa hubungan penggunaan perangkat elektronik dengan gejala CVS yang dirasakan oleh karyawan Fakultas Kedokteran Universitas Trisakti, Jakarta.

METODE

Sebanyak 53 orang karyawan berumur 25-60 tahun berpartisipasi dalam penelitian *cross-sectional* ini. Wawancara tentang jenis dan jumlah perangkat elektronik yang digunakan, berapa jam penggunaannya dalam sehari serta keluhan yang dirasakan saat menggunakan perangkat elektronik. Sedangkan pemeriksaan visual acuity dilakukan untuk mengetahui berapa visual acuity subyek penelitian. Uji *Fisher* dengan nilai $p < 0.05$ digunakan dalam analisis statistik.

HASIL

Sebanyak 52.8% subyek menggunakan 3-4 perangkat elektronik dengan durasi lebih dari 6 jam setiap hari (56.6%). Keluhan CVS dialami oleh 52.83% subyek penelitian, dan keluhan yang dirasakan merupakan keluhan *multiple symptom*, keluhan terbanyak adalah mata lelah sebanyak 71.7%, penglihatan buram sebanyak 45.3% dan keluhan mata kering sebanyak 33.9%. Analisis bivariat dengan uji *Fisher* menilai hubungan antara faktor risiko penggunaan perangkat elektronik seperti jenis kelamin, umur, jumlah perangkat elektronik yang digunakan, durasi penggunaannya dalam sehari serta visual acuity dengan timbulnya keluhan CVS. Tidak terdapat hubungan yang bermakna antara berbagai faktor resiko tersebut dengan keluhan CVS, ditunjukkan dengan nilai $p > 0.05$ pada semua variabel.

KESIMPULAN

Pengguna perangkat elektronik sering merasakan berbagai keluhan di matanya saat menggunakan perangkat tersebut. Walaupun pada penelitian ini tidak ditemukan kaitan antara faktor risiko yang diteliti dengan keluhan CVS, namun karena CVS adalah penyakit multifaktorial sehingga masih perlu diteliti faktor-faktor lain yang mungkin berhubungan dengan kejadian CVS.

KATA KUNCI: *Computer Vision Syndrome*, CVS, Perangkat Elektronik, Visual acuity

INTRODUCTION

The development of digital technology has been very rapid in the last few decades, including the development of computer technology. The number of computer users is increasing day by day. In 1997 it was reported that 18% of Americans used computers, then in 2009, it increased to 68.7% and in 2013 to 83.8%.⁽¹⁾ A survey conducted by the Indonesian Ministry of Communication and Informatics in 2017 obtained data that there are far fewer personal computer users than laptops or smartphones, where only 13.70% of Indonesians use desk computers while laptop users are 22.52%, and smartphone users 66.3%.⁽²⁾ Various computer-based electronic devices include desk computers, laptops, tablets, e-readers and smartphones. Smartphones are

preferred compared to other devices because of their small size and ease of carrying everywhere.⁽²⁾

Electronic devices, especially smartphones, are now a modern human lifestyle. Many advantages are obtained from these electronic devices, including as a means of communication, browsing, uploading and downloading materials, streaming videos and music, reading e-books, playing online games, transacting online, Global Positioning System (GPS) navigation, making computer programs (coding) or surfing social media.⁽²⁾ Although there are so many advantages to using this electronic device, it turns out that there are also many negative impacts that it produces. Health problems that have been reported are sleep disturbances,⁽³⁻⁵⁾ headaches, leukaemia and even brain tumors,⁽⁶⁾ neck and upper extremity

pain,⁽⁷⁾ smartphone 'addiction/addiction',^(8,9) emotional changes,⁽¹⁰⁾ decline in academic grades, relationships with parents and friends become inharmonious and even try to commit suicide.⁽¹¹⁾ It is also reported that there is impaired body function due to prolonged sitting in front of the computer, stiffness in the neck or shoulders⁽⁷⁾ and tinnitus.⁽¹²⁾

In addition to the complaints mentioned above, the negative impact of this electronic device also occurs on the eyes. Symptoms caused by excessive use of electronic devices are often called Computer Vision Syndrome (CVS). According to the American Optometric Association, CVS is a collection of symptoms consisting of complaints in the eyes and complaints outside the eyes related to excessive computer use without pause.⁽¹³⁾ In general, CVS sufferers have various complaints, such as dry eyes, heat, tiredness, gritty, itching, red eyes and blurry vision, and pain in the shoulder and neck area.⁽¹³⁻¹⁵⁾ Some literature reports symptoms of asthenopia,^(16,17) lacrimal hypofunction and dry eye,⁽¹⁸⁾ increased intraocular pressure,⁽¹⁹⁾ esotropia,^(20,21) and blockage of the retinal artery branch due to continuous neck extension while using a smartphone.⁽²²⁾ Many factors are thought to be the cause of CVS, such as the blue light effect from a computer monitor screen,^(4,23) reduced reflexes,⁽²⁴⁾ blinking,⁽²⁵⁾ uncorrected refractive error,⁽¹⁴⁾ font size,⁽²⁵⁾ tear film stability,^(26,27) Meibomian gland dysfunction,⁽²⁸⁾ and also external factors such as room lighting, air that is too drying or air-conditioned room.^(14,26,29)

Complaints of CVS have been found before the Covid19 pandemic. Research on health workers in Spain in 2017-2018 found that the prevalence of CVS was almost 60%, with nurses as the profession experiencing the most CVS.⁽³⁰⁾ In Sri Lanka, the prevalence of CVS reached 67.4%, with the most sufferers being female.⁽³¹⁾ Research in Riyadh, Saudi Arabia, the prevalence of CVS occurred in 45.1% of subjects over 40 years.⁽³²⁾ A study of 520 office workers in New York showed that 32% experienced complaints of dry eye and eye discomfort.⁽¹⁵⁾

In the midst of the current Covid19 pandemic, where Work From Home (WFH) regulations are enforced, all learning and working activities from home, using electronic devices such as laptops, computers or smartphones, have

led to an increase in the frequency and duration of using electronic devices. Many research related to CVS on electronic device users during the Covid-19 pandemic have been carried out. However, there is still little research on Indonesia, which has different working conditions. This study was conducted to look at the relationship between CVS risk factors and CVS complaints in employees who use electronic devices while working in educational institutions.

METHODS

This study is a population study with a cross-sectional approach carried out in February – March 2021. The study population was the employees of FK Usakti, the sample was taken consecutively, and after meeting the inclusion and exclusion criteria, a brief interview will be conducted with research subjects and eye examination. The inclusion criteria were FK Usakti employees aged 25-60 who used electronic devices and were willing to participate in this study by signing informed consent. Exclusion criteria for this study were subjects with anatomical abnormalities in their eyes, a history of diabetes or hypertension, a history of intraocular surgery, a vision of less than 6/60 and a history of using steroid eye drops regularly. The questions posed to the research subjects included the type of electronic device used, whether they used 1 type or more than 1 type of electronic device and how many hours of use in 1 day, as well as the CVS complaints they felt when using the electronic device.

Eye examination consisted of anterior segment examination and visual examination. For examination of the anterior segment, used a loupe and flashlight, while the examination of vision used a Snellen chart. Anterior segment examination was carried out to see if there were abnormalities in the eyes of the research subjects, which was a requirement for exclusion criteria. While the visual examination was carried out by means of the subject reading the letters on the Snellen chart from a distance of 6 meters. An examination was carried out on each eye, and the visual acuity was recorded in the right eye, left eye and both eyes. If the vision in both eyes can reach 6/6 on the Snellen chart without glasses, the subject is said to have normal vision.

All data were analyzed using Microsoft Office Excel 2010 and GraphPad Prism Version 9.00 (GraphPad Software Inc.). All bivariate data were analyzed using Fisher's exact test. Results will be considered significant at $p < 0.05$ with a 95% confidence interval. The data on the characteristics of the research subjects included gender, age, type and number of electronic devices used, how many hours of using electronic devices per day and complaints when using electronic devices. In this study, data analysis on visual acuity was only done by assessing both eyes, not each eye. So that the visual acuity of the research subjects is said to be good if the visual acuity of both eyes or the visual acuity of the *Oculi Dextra Sinistra* (ODS) is 6/6, whereas if the visual acuity of the ODS is less than 6/6 or if one eye has a visual acuity of less than 6/6 then the visual acuity of the research subject is said to be not good.

This study uses a method approved by the Ethics Commission of the Faculty of Medicine, Universitas Trisakti, Jakarta, with the number 171/KER/FK/XII/2020.

RESULTS

A total of 59 research subjects were willing to take part in this study. Still, six

subjects had to be excluded because two people had anatomical abnormalities in their eyes, two people had vision less than 6/60, and 2 more were not willing to continue the study, so the number of research subjects was 53. Table 1 shows the distribution of research subjects based on gender, age, visual acuity, type of electronic device used, how many hours of use of the electronic device in one day and complaints when using electronic devices, as well as subject's visual acuity. The distribution of research subjects was based on gender; most were women (54.7%). As many as 56.6% of the research subjects were more than 40 years old, and of all research subjects, 49.1% had ODS vision less than 6/6.

The electronic devices used are limited to 4 types: smartphones, laptops, tablets and desk computers (PCs). All research subjects (100%) own smartphones for daily activities. In addition to smartphones, laptops are the most used electronic devices with 67.9%. The number of electronic devices used by research subjects varied; 52.8% of subjects used 3-4 electronic devices. Based on the duration of electronic devices in a day, 56.6% of the research subjects used electronic devices for more than 6 hours. Based on interviews with research subjects, data were obtained that nine

Table 1. Demographic characteristics of research subjects (n=53)

Characteristic	Frequency (%)
Gender (%)	
Male	24 (45.3)
Female	29 (54.7)
Age Classification (year)	
25 - 40	23 (43.4)
> 40 - 60	30 (56.6)
Visual Acuity ODS	
6/6	27 (50.9)
< 6/6	26 (49.1)
Types of Electronic Devices Used *	
Smartphone	53 (100)
Laptop	36 (67.9)
Tablet	6 (11.3)
Personal Computer	28 (52.8)
Number of Electronic Devices Used	
1-2	25 (47.2)
3-4	28 (52.8)
Duration of Use of Electronic Devices	
≤ 6 hours per day	23 (43.4)
> 6 hours per day	30 (56.6)
There are complaints when using electronic devices	
Yes	44 (52.83)
No	9 (16.9)
Types of complaints when using electronic devices**	
Eyes feel tired	38 (71.7)
Blurred vision	24 (45.3)
Eyes feel dry	18 (33.9)

* Subjects use more than one electronic device

** Complaints that are felt are multiple symptoms

Table 2. Distribution of CVS Complaints based on Various Risk Factors of Research Subjects

Characteristic	CVS Complaints		P value
	Yes n (%)	No n (%)	
Gender (%)			
Male	17 (32.08)	7 (13.20)	0.0623
Female	27 (50.94)	2 (3.78)	
Age classification (year)			
25 – 40	19 (35.85)	5 (9.43)	0.7153
>40 – 60	25 (47.17)	4 (7.55)	
Number of Devices Used			
1–2	23 (43.40)	7 (13.20)	0.2699
3–4	21 (39.62)	2 (3.78)	
Duration of Use of Electronic Devices			
≤6 hours	17 (32.08)	6 (11.32)	0.1537
>6 hours	27 (50.94)	3 (5.66)	
Visual Acuity			
6/6	16 (30.19)	6 (11.32)	0.1396
<6/6	28 (52.83)	3 (5.66)	

people (16.9%) claimed not to feel complaints when using electronic devices. In contrast, those who felt CVS complaints when using electronic devices claimed to feel complaints of more than one symptom. Tired eyes were the most common complaint at 71.7%, followed by blurry vision at 45.3% and dry eyes at 33.9%.

The Relationship between Risk Factors and CVS Complaints

Data on the distribution of CVS complaints based on various risk factors such as gender, age, number of devices used and duration of use of electronic devices, as well as visual acuity, are summarized in table 2. In our study, research subjects who used 3-4 electronic devices were more numerous than those who used 1-2. However, CVS complaints are often found in users of 1-2 devices. Meanwhile, based on the duration of the use of electronic devices, it turns out that more than 50% of the subjects used electronic devices for more than 6 hours every day, and 5.66% of them admitted that they did not feel CVS complaints even though they used electronic devices for more than 6 hours. Visual acuity of subjects less than 6/6 was found in more than 50% of research subjects. CVS complaints were experienced by most of the research subjects, both those with visual acuity of 6/6 and those with visual acuity of less than 6/6.

There was no significant relationship between CVS complaints and various risk factors such as gender (p value=0.0623), age (p value= 0.7153), number of devices used (p

value=0.2699), duration of daily use of electronic devices (p value=0.1537), and visual acuity (p value=0.1396).

DISCUSSION

Symptoms of Computer Vision Syndrome (CVS) in the eyes are dry, hot, tired eyes, such as gritty, itching, red eyes and blurry vision. Usually, people with CVS experience more than 1 CVS symptom. However, in our study, eye fatigue was the most common complaint (71.7%), which is in accordance with many works of literature stating that this complaint is the dominant complaint in CVS.

More than 50% of our subjects use electronic devices more than 6 hours a day, but there is no significant relationship between the length of use of electronic devices and CVS complaints. This is not in accordance with some studies, such as the Kokab study, which states that the length of daily use of electronic devices is the main factor causing CVS. Meanwhile, research by the office worker community in New Delhi shows a significant relationship between computer use for more than 6 hours and eye complaints. Such as eye strain, itching, burning, or burning sensation around the eyes. During the lockdown due to Covid19, the results of a study in Thailand showed that the prevalence of asthenopia increased with increasing duration of electronic device use.

The number of electronic devices used in this study was not associated with the incidence of CVS complaints. However, in much of the

literature, there is also no discussion of the number of electronic devices used. Perhaps this is because various electronic devices of any type will still cause complaints, so research is more focused on the duration of the use of electronic devices.

The decrease in visual acuity in our study was suffered by more than 50% of the subjects. Still, this decrease in visual acuity was not associated with CVS complaints experienced by the study subjects. This is not in accordance with a research in Al-Ahsa, Saudi Arabia, which found a significant relationship between complaints of blurred vision and CVS.⁽³⁷⁾ Other studies stated a relationship between the use of electronic devices and the incidence of decreased visual acuity, such as double vision, blurry vision or disability for details.^(33,35-38) Astigmatism is a refractive error that is often associated with asthenopia, according to a study of 1109 people of the Zulu ethnic group, Africa.⁽³⁵⁾

Meanwhile, the study whose results were almost in line with ours was a study in Italy, which stated that there was no significant relationship between eye fatigue and visual acuity even though the researcher admitted that the length of use of electronic devices was the cause of eye fatigue.⁽³⁹⁾ Refractive disorders experienced by the subjects. In our research, it is not known whether it stems from excessive use of electronic devices or has previously suffered from refractive errors. However, from the interviews we conducted, it was known that during the Covid19 pandemic, with the use of electronic devices more and more frequently and for a longer period, CVS complaints became more pronounced, such as tired eyes and blurry vision. This is in accordance with research which states that uncorrected refractive errors will increase CVS complaints such as eye discomfort and blurry vision.⁽¹⁵⁾

CONCLUSION

Users of electronic devices often feel various complaints when using these devices, especially when using them for a long time. A good work system is needed so that the negative impact of using electronic devices in the workplace does not interfere with the health of its users, which in turn can interfere with the work performance and productivity of employees and the company.

The limitation of this study is that there are

too few research subjects, and the data collection is only once using the cross-sectional study method, so it can only assess the relationship between CVS complaints and predetermined risk factors. Further research is needed with a larger number of subjects and a prospective follow-up study method with several periodic data collections so that CVS risk factors can be identified as the cause of CVS complaints.

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AUTHORS CONTRIBUTION

NP conceptualizes the research theme, conducts eye examinations and prepares the initial draft of the publication. MDH drafted the research theme and revised the publication draft. AA performs an eye exam. JS revises the publication draft.

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CONFLICT OF INTEREST

The researcher declares that there is no conflict of interest between the researchers in producing this publication.

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CHARACTERISTICS AND RELATIONSHIP OF COMPUTER VISION SYNDROME (CVS) RISK FACTORS WITH CVS COMPLAINTS IN EDUCATION WORKERS

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