

Sowa Magdalena, Pulnik Karolina, Jurkiewicz Beata. Opinions on the impact of studying/working remotely on vision impairment and the use of eye hygiene principles. *Journal of Education, Health and Sport*. 2022;12(8):257-264. eISSN 2391-8306. DOI <http://dx.doi.org/10.12775/JEHS.2022.12.08.025> <https://apcz.umk.pl/JEHS/article/view/JEHS.2022.12.08.025> <https://zenodo.org/record/6954437>

The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of December 21, 2021. No. The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of December 21, 2021. No. 32343. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical Culture Sciences (Field of Medical sciences and health sciences); Health Sciences (Field of Medical Sciences and Health Sciences).

Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 21 grudnia 2021 r. Lp. 32343. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przystosowane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).

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The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 17.07.2022. Revised: 27.07.2022. Accepted: 02.08.2022.

## Opinions on the impact of studying/working remotely on vision impairment and the use of eye hygiene principles

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### Abstract

**Introduction.** The COVID-19 pandemic has forced the introduction of remote learning and working. Symptoms of digital eye fatigue are increasingly reducing the quality of life.

The aim of the study was to collect opinions on the impact of studying/working remotely on vision impairment and to find out the eye hygiene methods used by the respondents.

**Material and methods.** An original questionnaire consisting of 20 closed-ended questions was used for the study. The form was filled out by 194 people aged 18-55 years (mean: 23.15 ± 6.91 years) who were studying or working at least partially remotely.

**Results.** Respondents working remotely were most likely to spend more than 8 hours a day in front of the computer (49.02%), those working hybrid most often marked 5-6 hours (38.04%). Less than half - 44.85% - had a subjective feeling that their eyesight had deteriorated since they started learning/working remotely, and 19.07% declared that the deterioration of their eyesight had been confirmed by an examination with a specialist. Since starting to study/work online, respondents most often complained of eye fatigue (52.58%), dry eyes (34.54%), and sore/burning eyeballs (25.78%). Among eye hygiene rules, the largest percentage declared using a matte screen (48.97%), using "night mode" on an electronic device after dark (51.55%), sleeping for 7-9 hours (45.36%), and taking a break from the screen by blinking (41.24%). Few people are familiar with and use the exercise of closing and shading their eyes (6.70%) the 20-20-20 rule (4.12%), and do not use a smartphone/computer immediately before bed (2.58%).

Conclusions. Most of the respondents stated subjectively, or confirmed by a specialist, that their eyesight had deteriorated, and they associate this with learning/working remotely. The most common ocular symptom in the surveyed group was eye fatigue. There is a large deficit in the knowledge and application of eye hygiene principles that can benefit the organ of vision.

Keywords: remote work, hybrid work, remote learning, COVID-19, decreased vision, Computer Vision Syndrome

## **INTRODUCTION**

Nowadays, people statistically spend many hours a day using electronic devices, and the global epidemiological situation has further contributed to this. The COVID-19 pandemic has forced the introduction of remote learning in all types of schools from March 2020 to early June 2021 (with a short break in September 2020) [1].

Extended hours of working, studying and spending leisure time on electronic screens can lead to an increased incidence of computer vision syndrome (CVS), known as digital eye fatigue. The American Optometric Association defines CVS as "a group of vision and eye problems that result from prolonged computer, tablet, e-reader and cell phone use" [2]. The most common symptoms of CVS are eye fatigue, headache, blurred vision, dry eyes and neck and shoulder pain. In addition, improper lighting, inadequate viewing distance and poor sitting posture can aggravate and worsen these symptoms [3].

Researchers emphasize that the lockdown associated with the COVID-19 pandemic has significantly impeded access to eye care, which is bound to have negative consequences for many patients [4]. Virtual assessments of the eye, introduced during the COVID-19 pandemic, provided the ability to triage the patients. Virtual assessments have the potential to reduce in-person visits, but care must be taken not to overlook sight-threatening conditions [5].

This article focuses on showing the impact of remote studying and working on the subjective deterioration of users' eyesight.

## **MATERIAL AND METHODS**

The study was conducted by a diagnostic survey method using the author's survey questionnaire. Implementation period: February-April 2022. The survey was conducted through social media using the Google Forms platform. The link to the survey was made available on groups for residents of Tarnów and the region.

The inclusion criteria were: minimum age of 18 years, study/work at least partly in remote form, consent to participate in the study, correctly completed survey questionnaire. The survey contained 20 questions, mostly single-choice.

A total of 202 people participated in the survey, ranging in age from 18 to 55. 194 correctly completed forms were qualified for analysis.

Calculations were performed using Excel and Statistica. Relationships between variables were tested using the chi<sup>2</sup> test and ANOVA. The statistical analyses assumed a significance level of  $p = 0.05$ .

The study was conducted in accordance with ethical principles (including adherence to the principles of the Declaration of Helsinki).

## RESULTS

The study group was dominated by women (80.41% vs. 19.59%), those living in the city (54.12% vs. 45.88%) and those with a secondary education (67.18%). The vast majority were studying remotely at the time of the survey (78.46%), while the rest were working (13.33%) and studying while working (8.21%) - Table 1.

Table 1. Socio-demographic data of respondents

Variables	n	%
<b>Age</b> [mean 23.15 ± 6.91 years; min. 18; max. 55]		
<b>Sex</b>		
Female	156	80.41
Male	38	19.59
<b>Place of residence</b>		
urban	89	54.12
rural	105	45.88
<b>Education</b>		
primary	23	11.86
vocational	6	3.08
secondary	131	67.18
higher	35	17.95
<b>Remote work/study</b>		
working	26	13.33
studying	153	78.46
working and studying	16	8.21

Working/studying remotely was declared by 53.09% of respondents at the time of the survey (n=103), while hybrid was used by the remaining 46.91% (n=91).

It was shown that remote and hybrid workers differed in terms of time spent in front of the computer per day. Those working remotely were most likely to spend more than 8 hours in front of the computer per day (n=50; 49.02%), while those working hybrid were most likely to mark 5-6 hours (n=35; 38.04%) - Table 2.

Table 2. Form of work vs. number of hours spent in front of a computer/laptop/smartphone per day

Hybrid work (remote and onsite)	N=92	%	Chi2
Up to 2 hours	4	4.35	Chi2=38.2396 . p < 0.00001
3-4 hours	12	13.04	
5-6 hours	35	38.04	
6-8 hours	26	28.26	
Over 8 hours	15	16.30	
<b>Remote work</b>	<b>N=102</b>	<b>%</b>	
Up to 2 hours	1	0.98	
3-4 hours	7	6.86	
5-6 hours	9	8.82	

6-8 hours	35	34.31	
Over 8 hours	50	49.02	

The vast majority, 88.66% (n=172) responded that they take breaks from the device while studying/working in front of a computer, tablet, smartphone. The remaining 11.34% (n=22) answered in the negative.

Respondents take breaks from 0 to 20 times while working/studying remotely, an average of 3.92 times ( $\pm 2.31$ ). The respondents' declarations showed that a single break lasted from 0 to 60 minutes, averaging 15.10 minutes ( $\pm 10.79$ ). Analysis by ANOVA test showed no statistically significant difference in the number and duration of breaks among those working/studying remotely and hybrid ( $p > 0.05$ ).

Respondents were asked whether they had experienced any of the following symptoms before starting to study/work remotely: eyeball pain/burning, dry eyes, eye fatigue, blurred vision when looking at a screen, blurred vision when looking at a distance, double vision, sensitivity to bright light, myopia. Only 12.37% (n=24) declared that they had not previously experienced any of the aforementioned symptoms. At the same time, 52.58% (n=102) of the respondents said they had not been diagnosed with a visual defect before starting online studying/working, while the others had been diagnosed with myopia (n=62; 31.96%), astigmatism (n=14; 7.22%), farsightedness (n=12; 6.19%) or another visual defect (n=4; 2.06%).

Of the respondents, 36.08% (n=70) felt that their eyesight had not deteriorated since they started studying/working online during the pandemic, while 44.85% (n=87) had a subjective feeling that their eyesight had deteriorated, and the remaining 19.07% (n=37) declared that the deterioration of their eyesight had been confirmed by an examination at a specialist. There was no relationship between time spent in front of a computer per day and vision deterioration (subjective and confirmed by examination) since starting online studying/working ( $p > 0.05$ ).

Since starting online studying/working, respondents most often complained of eye fatigue (n=102; 52.58%), dry eyes (n=67; 34.54%), and eyeball pain/burning (n=50; 25.78%). Only 5.03% (n=9) had not experienced any bothersome eye symptoms since starting online studying/working.

Respondents were asked to indicate which elements of eye hygiene they use when studying/working remotely. In case of unfamiliarity with any of the listed examples, respondents were encouraged to find out and try it out in practice. The highest percentage of respondents declared using a matte screen (n=95; 48.97%), using "night mode" on an electronic device after dark (n=100; 51.55%), sleeping for 7-9 hours (n=88; 45.36%), and taking a break from the screen by blinking (n=80; 41.24%) - Table 3.

Table 3. Use of eye hygiene rules by respondents

Elements of eye hygiene	n	%*
Matte screen/monitor overlay	95	48.97
Lighting in the room that does not cause glare on the monitor	63	32.47
Computer glasses, with coating: anti-reflective, Blue Control, anti-electrostatic	51	26.29
Moisturizing eye drops	63	32.47
Enlarge the font on the monitor	43	22.16
Blue light reduction applications/filters	43	22.16
Using "night mode" at dusk	100	51.55
Position about half a meter from the screen, eyes slightly below the monitor	62	31.96
Brightness of the screen matched to the brightness of a white sheet of paper placed near the monitor	16	8.25
Exercise: Closing and shading the eyes (like the famous monkey emoji 🙈)	13	6.70
Exercise: Every 20 minutes, looking at an object about 6 meters away for 20 seconds	8	4.12
Taking a break from the screen by blinking	80	41.24
Diet for the eyes: water, fish, nuts and seeds, vegetables	17	8.76
Not using computer, smartphone right before bedtime	5	2.58
Sleep lasting 7-9 hours each night	88	45.36

\* percentages do not add up to 100% - multiple response survey

## DISCUSSION

Symptoms of digital eye fatigue, such as dryness, eye irritation, blurred vision, neck and back pain and headaches, are increasingly reducing our quality of life. As many as 73% of people in their 20s and 60% of people over 40 report digital eye fatigue [6]. The results of a number of studies, including the author's study, confirmed that the above negative phenomenon intensified during the COVID-19 pandemic. In this study, almost half, 44.85%, of the respondents had a subjective feeling that their eyesight had deteriorated since they started studying/working online, and 19.07% declared that the deterioration of their vision had been confirmed by an examination with a specialist. Also, other authors report that more than 83% of e-learning learners have some kind of ophthalmic problem, because the electronic device emits electromagnetic light that adversely affects vision [7].

Since starting to study/work online, respondents of this study most often complained of eye fatigue (52.58%), dry eyes (34.54%), and eyeball pain/burning (25.78%). Wangsan et al. conducted a study on the symptoms of computer syndrome among the students. The most common symptom in CVS patients was eye pain (96.5%), and the most intense symptom was a feeling of decreased vision (15.9%). Factors associated with CVS were distance from the display < 20 cm ( $p = 0.023$ ), the presence of glare on the screen ( $p < 0.001$ ), low screen brightness ( $p = 0.045$ ), sleep time ( $p = 0.030$ ), insufficient break time between classes ( $p < 0.001$ ) and longer screen time spent online ( $p < 0.001$ ) [8]. Noreen et al. showed that 71% of medical students had ocular symptoms: eye irritation (7.7%), blurred vision (6.4%), eye redness (4.3%), eye fatigue (5.2%), excessive tearing (2.1%), and increased sensitivity to light (1.5%) [9]. In contrast, Almousa et al. examined patterns of electronic device use before and during the COVID-19 pandemic among medical students. They showed that risk factors for three or more CVS symptoms were common among students who used electronic devices for

longer periods of time (6.8 hours  $\pm$ 2.8) during COVID-19. The longer the duration of use of the aforementioned devices, the more severe and frequent the symptoms [3].

All About Vision, an eye care website, surveyed 1,000 Americans, one-third of whom worked hybrid, one-third of whom worked remotely, and one-third of whom worked stationary. On average, 68% of remote workers said they had noticed new eye problems since working from home. Remote workers spent an average of 13 hours a day in front of a screen, compared to stationary workers who spent 11 hours in front of a screen. As many as 83% of those who used blue-light lenses reported good or excellent sleep, compared to 63% of users of lenses that do not emit blue light. In view of the above results, the following eye protection measures were recommended: the 20-20-20 rule, which means 20-second breaks every 20 minutes to look at an object 20 feet (about 6 meters) away; the use of glasses that block blue light; turning on night mode on devices and not using them immediately before bedtime [10]. In this study, only 26.29% of respondents declared using glasses with the following coatings: anti-reflective, Blue Control, anti-electrostatic. Knowledge and use of the 20-20-20 rule was one of the least frequently marked responses (4.12%). Night mode on devices was used by 51.55%, and only 2.58% indicated that they do not use electronic devices immediately before bedtime. Noren et al. showed, in turn, that the most common ergonomic practices among medical students were controlling lighting and glare, controlling brightness and contrast, and maintaining background light in rooms. A small percentage knew and applied the 20-20-20 rule and observed the appropriate distance from the screen [9].

The results of a study by Logaraj et al. showed that more than 4 hours of digital device use was associated with an increased risk of computer vision syndrome symptoms [11]. Studies by various authors confirm a significant association between time spent using a digital device and CVS symptoms [9, 12]. However, an analysis of our study found no association between time spent in front of a computer per day and visual deterioration (subjective and confirmed by testing) since the start of online studying/working. Similarly, Abudawood et al. describe that CVS symptoms were not significantly associated with increased time spent using a digital device in the students examined [13].

Based on an analysis of the subject, it is concluded that it is necessary to promote eye hygiene by taking regular breaks from remote work/study. It is helpful to follow - as it turns out - a little-known rule: 20/20/20, as well as reminding patients to have regular eye exams to ensure an up-to-date and accurate eyeglass lens prescription. Having lenses optimized for visual requirements ensures visual comfort, protection and performance [14].

## CONCLUSIONS

- The majority of respondents stated subjectively, or confirmed by a specialist, that their eyesight has deteriorated and they associate this with studying/working remotely.
- The most common ocular symptom in the study group was eye fatigue.
- There is a large deficit in the knowledge and application of eye hygiene principles that can benefit the organ of vision.
- It is advisable to conduct educational activities in the school environment and by the employer regarding the principles of eye hygiene. In case of alarming symptoms, a visit to a specialist should not be delayed, as early intervention will help inhibit existing defects.

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