

Tracking Screen Time Among Students During Covid-19 and its Association with Eye Strain, Headache & Sleep Disturbances



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Abstract

Background: Lockdown measures during the COVID-19 pandemic led to an increased reliance on screens. This study aimed to assess screen usage before and after the pandemic and to determine the association of this increased screen time with the frequency of headaches, digital eye strain (DES), and sleep disturbances among undergraduate students.

Methodology: An analytical cross-sectional study using a convenience non-probability sampling technique was conducted over five months among 413 university students in the twin cities attending online classes. Individuals with preexisting visual problems, headaches, or sleep disorders were excluded. The study tool was a pretested, self-developed semi-structured questionnaire shared online via Google Forms. Descriptive analysis using SPSS 23.0 included percentages, frequencies, means, and standard deviations.

Results: An increase in post-pandemic screen time of 4.34 hours was observed. There was a 56% increase in the number of students reporting eye complaints compared to before the pandemic, with 15.7% reporting symptoms immediately following online classes. Additionally, 72% of students reported headaches, with 8.7% experiencing them immediately after online classes. Over 69.5% of students agreed that increased screen time affected their sleep quality. The association between increased screen time and DES, headaches, and sleep disturbances was significant, with p-values of 0.045, 0.003, and <0.001, respectively.

Conclusion: This study concludes that there was a significant increase in screen time due to the implementation of online classes during the pandemic. A significant association exists between increased screen time and the frequency of headaches, DES, and sleep disturbances.

Keywords: COVID-19; screen time; headache; sleep; eye strain

How to cite this article: Fazal M, Irshad A, Maryam A, Ashraf M, Qureshi MA, Khan R. Tracking Screen Time Among Students During Covid-19 and its Association with Eye Strain, Headache & Sleep Disturbances. Pak J Public Health 2024 Jun. 28;14(2):64-9.

Available from: <https://pjph.org/pjph/article/view/1206> DOI: <https://doi.org/10.32413/pjph.v14i1.1206>

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Submitted: 17-04-2022

Revised: 18-03-2024,
26-03-2024

Accepted: 22-04-2024

Published: 28-06-2024

Introduction

The COVID-19 outbreak, first case of which was reported in November 2019 was deemed a global pandemic by the World Health Organization on March 11, 2020 (1). This pandemic has set a new precedent in critically impacting both physical and mental health globally in a very short span of time (2). Between the adoption of a host of disease controlling strategies including the implementation of lockdowns, universal face masking and spatial distancing, the latter became one of the more commonly practiced ones around the globe. The basic idea involved establishing and maintaining secure social distances, ultimately isolating the world from shared spaces and public areas (3).

Online meetings, audio and video conferencing, and other forms of virtual human interaction have replaced traditional forms of social interaction causing every aspect of human life to rapidly become more digitalized (4). This has led to an increase in the amount of time people

spend in front of video display terminals (VDTs) such as desktops, laptops, smartphones, and e-readers (5). Due to these unprecedented circumstances, using telehealth services, working from home, and taking classes online has become standard procedure, further increasing humankind's reliance on technology. Institutions have adopted Microsoft Teams, Google meet, Edmodo, Moodle, Zoom and Skype to conduct online assessments and classrooms (6). The rapidly increasing time spent using VDTs for such purposes has led to concerns about the potential harmful effects of excessive screen time in the scientific community (7).

An increase in screen time has already been linked to eye issues such as dry eyes, eye strain, and blurred vision (8) in addition to headaches (9). It has also been demonstrated that high screen time contributes to sleep disruptions such as worse sleep quality, shorter sleep duration, and delayed sleep onset/latency (10). While the precise mechanisms underlying these associations are not yet fully understood, it is clear that the impact of excessive

screen time on health warrants further investigation. To study this correlation between increased screen time and increased incidence of headaches, eye strain and sleep disturbances, we decided to assess the current data available on screen time and design a cross sectional study on its association with above mentioned symptoms.

The American optometric association (AOA) on the basis of 16 eye related signs and symptoms, defines computer vision syndrome, also referred to as digital eye strain (DES), as a group of eye and vision-related problems that result from prolonged computer, tablet, e-reader and cell phone use (8). According to a meta-analysis conducted during pre-pandemic times, the overall prevalence of DES in children was reportedly 19.7% (11) and in another study from the private schools of west India it was 17.9% (12). However few studies have been conducted since then to evaluate how the pandemic has affected this. A recently published study conducted on the medical students in Rawalpindi concluded that ocular health had deteriorated significantly due to the excessive use of digital devices during ongoing pandemic (13). However this study presented data only from the early pandemic era and did not evaluate factors such as the severity and duration of symptoms.

The correlation between screen time and headaches has already been proven to be significant with one study reporting 51% of people suffering a headache following 2.5 hours of active screen time (9). While there have been studies relating headaches and eye symptoms such as lacrimal tearing and photophobia to excessive screen time (9), there exist few pandemic specific studies relating screentime to an increase in frequency, length, severity and use of medication to resolve such symptoms.

Screen viewing time (SVT) or digital/screen exposure is the total time spent by an individual in viewing or using any digital or electronic device such as television (TV), smart phones, tablets, or computers (14). A systematic review of screen time and sleep among school-age children and adolescents in 90% of published studies indicated that increased SVT is associated with adverse sleep outcomes (15). The use of screen-based devices (particularly at night) exposes children to blue light, which delays sleep onset and reduces sleep quality (16). The artificial blue light of these devices is known to suppress/delay the endogenous release of melatonin which leads to an increase in evening alertness and sleep latency by shifting the circadian rhythm and inhibiting the sleep promoting neurons (17).

Due to the massive increase in digitalization that has occurred during this pandemic, millions of people worldwide are now more likely to experience headaches and sleep disorders in addition to DES. Because the pandemic spread so quickly, there was little time for planning and other mitigation techniques and in such unanticipated circumstances, excessive screen time-related health issues may emerge as a public health concern that burdens our country's already fragile economy. What's worse, these negative effects might persist even after the pandemic has passed.

Methodology

This was an analytical cross-sectional study carried out in the twin cities of Islamabad and Rawalpindi between April and August 2021. Using WHO steps Sample Size Calculator, the sample size of this study was calculated to be 375 at 95% confidence level, 5% margin of error, and 42.1% prevalence of the factor under study according to a recent article. The sample size became 413 accounting for the 10% inflation (18). Our target population included college and university students from the twin cities taking online classes. Individuals having underlying diagnosed visual problems, sleep disorders or chronic headaches before the start of the study were excluded.

A self-developed questionnaire in English was shared with students via google forms, making use of the researcher's social media networks. The questionnaire inquired about their approximate hours of screen time in addition to any new episodes of headache, disturbed sleep and eye strain that they have experienced during lockdown. It comprised of five separate sections; section A including demographic details and consent form while section B, C, D and E pertained to screen time, visual symptoms, headache and sleep disturbance respectively. Section C was adopted from previously conducted research by Segui et al (17) and some parts of section D were modified HALT index questions (19). Section E was based on a Likert scale and assessed sleep pattern, quality of sleep and the effects of exposure to screens late at night including daytime somnolence and excessive napping. Both frequency and severity were assessed in case of development of headache and visual symptoms.

The questionnaire was validated by a public health scientist, an ophthalmologist and a neurologist. The questionnaire was pretested on five individuals belonging to different age groups and education levels to assess their understanding and changes were made accordingly. Convenience non-probability sampling was used to collect this data from the study population.

SPSS software version 23.0 was used to analyze all findings of the questionnaire. Descriptive analysis was done through percentage, frequencies, means and standard deviation calculation. Inferential analysis was done using the Chi square test and the results were demonstrated using different graphs and charts.

After approval of the research proposal from IRB FMC data collection and manuscript writing was commenced. Before filling out the form, students were given a brief description of the study's purpose, objectives, and instructions for completing the questionnaire. All the data was collected after acquiring the participant's informed consent through consent form attached at the beginning of the questionnaire. They were also informed about their right to withdraw from the research any time and the maintenance of their confidentiality.

Results

There were a total of 413 study participants, aged 22 on average, majority (60.5%) of which were female. Most (94.2%) of the participants did not report any pre-existing co-morbidity (such as heart disease, cancer, chronic liver disease, stroke, chronic kidney disease, diabetes).

When it came to screen time before and after the pandemic, the association was significant with a P-value of <0.001. The average number of hours spent on digital devices increased from 5 hours before the pandemic to about 9.34 hours during the pandemic.

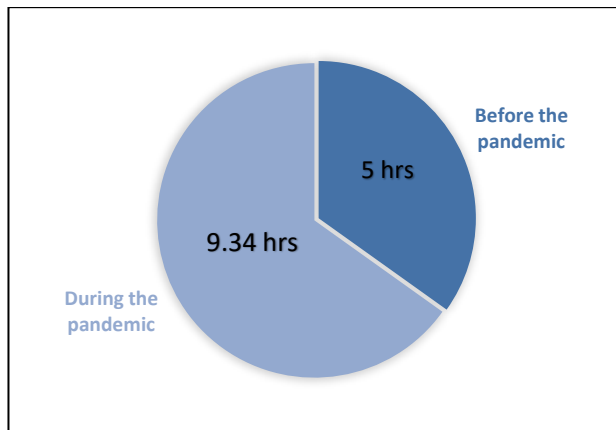


Figure 1. Average hours spent on digital devices before and during the pandemic

Table 1. Paired sample T test statistics of avg. hours spent using devices before vs during the pandemic

	Mean and Std. Deviation	Std. Error Mean	Difference of Mean (CI)	P-value
Average hours spent using devices before the pandemic	4.9685 ±2.47050	0.12157	4.3487 (4.0792 - 4.6181)	<0.001
Average hours spent using devices during the pandemic	9.3172 ±3.16820	0.15590		

Ninety-eight out of 413 students were suffering from a pre-existing eye condition from before the pandemic whereas 331 complained of new symptoms (an increase of 56%) during the pandemic. Allergic symptoms were the most prevalent complaint (32.6%) followed by inflammation (18.9%), refractive errors (17.6%), and dryness (13.5%). Majority (42%) of these students experienced symptoms once a week, most (56.8%) of which were reportedly mild, lasting only a few minutes for most (48.6%) students. Two hundred and sixty nine (81.3%) students reported an increase in frequency of symptoms since the start of online classes, with around one fifth requiring medication. Over three quarters of the study population admitted to an increase in the frequency of these symptoms with an increase in screen time due to online classes, the association being significant with a P-value of 0.045.

There were 68 students out of 413 who were suffering from a pre-existing headache disorder from before the pandemic, whereas 295 (71.4%) students started experiencing headaches during the pandemic. One third of these students experienced headaches once a week, with only 36 students reporting symptoms immediately following online classes. Of those that did develop a headache, most (54.2%) were of a moderate intensity however around ten percent developed severe disabling headaches that affected their normal lifestyle significantly. This explains why nearly half of the study population admitted to taking medication for their symptoms. There were 179 students out of 295 who experienced headaches for a few hours and only 4 experienced an un-resolving headache. We found that an average screen time use of 3.3 hours (standard deviation of 3.6hrs) led to the development of a headache. Over all 224 out of 295 students admitted to an increase in frequency of these symptoms with an increase in screen time since the start of online classes, the correlation being significant with a P-value of 0.003.

Table 2. Comparison between eye symptoms and headache in terms of frequency, severity and duration

Symptom	Headache	Eye
Pre-existing condition	16%	24%
Frequency of symptoms	During online class	9%
	Once a week	33%
	2-3 times a week	18%
	Daily	12%
Severity	Mild	35.3%
	Moderate	54.2%
	Severe	10.5%
Duration	Resolves spontaneously	9%
	Few minutes	29%
	Few hours	61%
	Does not resolve	1%
Medication used for relief	48.1%	19.6%

Fifty-four out of 413 students were suffering from a pre-existing sleep disorder. More than half of the students reported getting less than 7 hours of sleep since the start of online classes during the pandemic. More quarters of the study population either agreed or strongly agreed that their sleep pattern had changed since the start of online classes, their sleep quality had been affected due to increased screen time and that they were exposed to screens late at night to due educational activities. Despite the number of students partaking in mid-day napping rising only by a mere four percent, around eighty percent students felt sleepy/drowsy during the day due to inadequate sleep at night with more than one third directly blaming increased screen time as a result of online classes responsible for their day time napping and drowsiness. Two hundred and eighty seven students out of 413 either agreed or strongly agreed that an increase in screen time during the pandemic had affected the quality of their sleep, the correlation being significant with a P-value of less than 0.001.

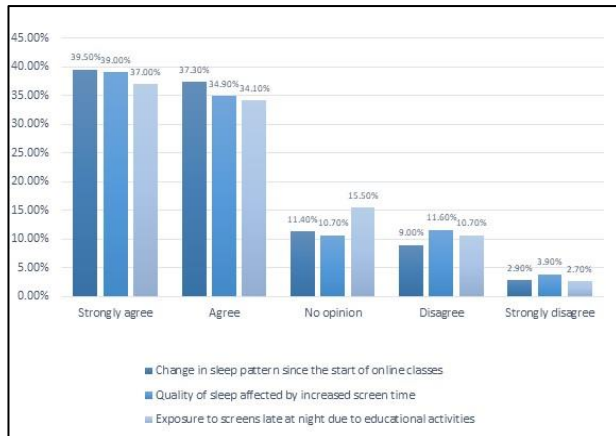


Figure 2. Likert scale responses regarding sleep pattern, quality of sleep and exposure to screens late at night

Discussion

Our study concluded that at least 331 of the respondents experienced at least one symptom associated with digital device use, and that for 257 (77.6%) of the 331 students, the frequency of eye symptoms increased with increased screen time due to online classes. This figure is higher than that reported by previous studies, including one on medical students in Karachi, where a DES prevalence of 67% (20) was discovered, and another on university students in the UAE, where a prevalence of 72% was observed (21). However, a few studies, including one conducted in Malaysia, found an even higher percentage prevalence of DES, calculated at 89.9% (22). A cross-sectional survey of India's general adult population was conducted to assess digital eye strain in relation to an increase in average screen time during the pandemic, and a positive relationship was discovered between the two main variables tested (23). However, the study's limitations included being unable to reach a clinical diagnosis of DES and not taking into account any preexisting ophthalmological disorders. In our study, we considered both of these factors by distributing an ophthalmologist-validated questionnaire and excluding the 23% of the study population that suffered from any known preexisting eye disorder.

Another Indian study evaluated the prevalence of DES and identified its risk factors in students, teachers and the general public (24). DES was found to be higher among students taking online classes and an overall increase in the average screen time during pandemic was observed. Our study revealed similar results. Some of the recommendations of the study included requesting institutes to limit online classes to four hours a day while emphasizing the 20-20-20 rule as well as encouraging people to follow ergonomic practices and limit use of other digital devices.

In our study, allergic symptoms were the most common accounting for 32% of all sixteen symptoms. Shant Kumara et al. found that headache and burning sensation were the most common symptoms among schoolchildren who used digital devices in 53.3 % and 54.8 % of instances, respectively (21). DES symptoms were observed to be more common in females with 211 out of 250 (84.4%) reporting them. This can be attributed to the higher incidence of dry

eye in females, preponderance of autoimmune conditions associated with dry eyes among females and make up related ocular health issues (25, 26). Headache disorders are also more commonly seen in females (27) and may account for a few of the symptoms such as sensitivity to light, headache, glare, blurring of vision.

Even before the pandemic, increased screen time was well documented to be linked to headache incidence. A study conducted by King Abdul-Aziz University in Jeddah, Saudi Arabia, found that 51.1% of 421 volunteers aged 13-30 years experienced headaches after an average of 2.55 ± 1.785 hours of active screen time (9). In our study, 295 students (71.4%) reported headaches after an average of 3.3 hours. When comparing the time between online classes and headache onset, 8.7% of students reported symptoms immediately after classes. The same study from Saudi Arabia found that the majority of headaches tended to be a migraine and that in those suffering from headache, symptoms such as lacrimal tearing, photophobia, phonophobia, nausea and vomiting were found in relation to days and duration of active screen time. Another study by Michelle K. Xavier on the prevalence of headache in adolescents and its association with computer use, found that excessive use (>4 hours/day) of electronic devices was associated with the presence of a headache (28). Out of the aforementioned 295 students, 75.9% related the increase in screen time with an increase in frequency of headaches. The association was found to be very significant with a P-value of 0.003. Similar findings were published in Annals of the Indian Academy of Neurology comparing electronic screen exposure and headache in children by Caksen H. found that there existed a statistically significant ($P < 0.05$) association of excessive use of electronic devices and the presence of headache especially migraines in adolescents (29).

According to a survey conducted in India on undergraduate students taking online classes from home about their screen time exposure and its effects, the use of cell phones/tablets/laptops increased among students and young children, reducing their physical activity and presumably affecting their mental and physical well-being, resulting in disrupted sleep duration, delayed early bedtime, and increased daytime somnolence (30). Our study found similar results, with 287 (69.5%) of 413 students agreeing or strongly agreeing that increased screen time during the pandemic affected their sleep quality. The same study showed that 87.4% and 70.4% of students who faced difficulty falling asleep and difficulty in maintaining sleep were having a screen time of more than 2 hours during lockdown period. As compared to this in our study it was found that out of 413 students, 317 (76.8%), 305 (73.8%) either agreed or strongly agreed that their sleep pattern had changed since the start of online classes and that their sleep quality had been affected due to increased screen time respectively. Students were also asked about their frequency of day time naps, screen time and sleep problems before and during lockdown days. It concluded that students taking naps during usual college days were 73.6% which increased to 85.9% during the pandemic. Additionally, 56.6% students reported that they faced sleep disturbances during this same time frame (30). In our study 294 (71.2%) respondents agreed that they were exposed to screens late at night due to educational activities which led to excessive

daytime napping and daytime drowsiness. It was found that among the 90% of students that finding difficulty in sleep latency and duration spent more than 2 hours daily exposed to the screen. The study therefore proved that increased exposure to screens among students can lead them to face problems in falling and maintaining sleep (31). In our study this association was highly significant with a P-value of less than 0.001.

A study conducted in Singapore found an inverse relationship between time spent on academic activities and sleep duration in children (32). Our findings supported this, with 212 of 413 (51.3%) reporting less than 7 hours of sleep during the pandemic. A recent study has shown that bad sleep quality and persisting mental health issues even after school reopened could be due to changes in school schedules (e.g., need to wake up earlier to attend classes) and daily commutes, which may decrease sleep hours and be detrimental for students whose endogenous circadian cycles trend towards later awakening (33).

A major limitation of this study is the fact that our results cannot be extrapolated onto the general population. This was because of the lockdown situation which meant that most schools and colleges were closed forcing researchers were forced to use social media to gain responses. This may have led to a slight selection bias as the respondents self-selected themselves into the study. While the study was open to students attending school in the twin cities of Islamabad and Rawalpindi, majority of the participants were from Air University and Fazaia Medical College due to the same reason.

Conclusion

The results of this study indicate that the introduction of online classes contributed to a notable rise in screen time prior to the pandemic and that there is a correlation between this higher screen time and an increased risk of headache, DES, and sleep disruption.

We recommend that in order to minimize the adverse effects, screen time should be prioritized for educational and necessary purposes only with a set schedule and breaks in between. Online classes and educational activities should be developed with increased screen time in mind and should not extend into or require students to work late at night. Institutions should arrange awareness sessions for students about how increased screen time affects holistic health and how they can set consistent limits to develop healthy habits so as not to compromise on education, sleep, eye and mental health.

Acknowledgment:

The authors gratefully acknowledge the contributions of Zarafshan Nasir and Noor Ul Huda to this research project.

Ethical Approval:

This study was approved by IRB of Fazaia Medical College, Islamabad

Ref. No. IBD/FMC/1341/IRB/1 Date: 25-08-2021

Financial support and sponsorship: None

Conflict of interest: None declared.

Authors' Contribution:

MF: Concept and design of the study, data acquisition and analysis, major part of manuscript drafting and major revision of the intellectual content

AI & AM: Concept and design of the study, data acquisition and analysis, manuscript drafting and minor revision of the intellectual content

MA: Concept and design of the study, data acquisition, analysis, and minor role in manuscript drafting

RK: Concept and design of the study, data acquisition and analysis

MAK: Data acquisition and analysis, minor role in manuscript drafting

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