IJCMCR Open Access

ISSN 2692-5877
DOI: 10.46998/IJCMCR.2025.49.001212

International Journal of Clinical Studies & Medical Case Reports

Research Article

Digital Age Headaches: Exploring the Neurological Impact of Screen Time and Blue Light

Tamaratubor Ambah[1,*], Favour Enoch Abidoye[1], Cejay Alexi McCalla[1], Mololuwa Kalejaiye[1], Israel Chiayinweze Ihunda[1], Vivian M Onwuamaegbu[1] and Navin Patil[2]

[1]*MD Student, All Saints University School of Medicine, Dominica*

[2]*Professor/Head/Dean of Basic Sciences, All Saints UniversitySchool of Medicine, Dominica*

***Corresponding author:** Tamaratubor Ambah, MD Student, All Saints University School of Medicine, Dominica

Received: January 20, 2025 **Published:** February 21, 2025

Abstract

Background: The prevalence of headaches among screen users significantly impacts productivity and well-being. This study evaluates the relationship between screen time and headaches while proposing preventive measures.

Method: An online survey was conducted among diverse participants to ensure representative data and minimize biases. Anonymity was maintained to encourage honesty.

Result: Of the 259 respondents, 54.8% were female, 44.8% male, and 57.9% aged 20-30. Daily screen time of 7-9 hours was reported by 30.5%, and 90% experienced headaches, primarily frontal (57.5%). Stress due to school or work was high (84.9%), with 53.9% reporting headaches "sometimes." Screen habits included 51.9% maintaining brightness above 30% and 80.7% using screens in dark environments. The primary screen usage reasons were work (38.2%), leisure (35.5%), and school (26.3%). Common medical conditions reported included Migraine, Myopia, Anxiety, and PCOS.

Discussion: Correlation analysis showed a strong positive link between screen time and headache duration ($r = 0.75$, $p < 0.001$) and between age and headache region ($r = 0.83$, $p < 0.001$), with younger individuals prone to frontal headaches. Stress correlated moderately with headache frequency ($r = 0.56$, $p < 0.01$). Using blue-light glasses reduced headache duration ($r = -0.45$, $p < 0.05$).

Conclusion: This study underscores the impact of prolonged screen time, stress, and screen habits on headaches. Awareness and strategies like healthy screen practices and stress management can mitigate these issues. Further research should explore causal relationships and interventions to alleviate screen-related health concerns

Keywords: Screen time; Headaches; Blue light

Introduction

The widespread use of phones, laptops, and tablets for work, school, and social interactions expose individuals to significant screen time from an early age. Prolonged screen exposure impacts health, particularly by contributing to headaches. Screen time affects all age groups and is a common trigger, influencing headache intensity, frequency, and onset. Researching this correlation is crucial for understanding and mitigating its effects [65].

Literature highlights the link between screen time and health issues such as headaches, eye strain, and sleep disturbances. Extended screen use causes digital eye strain, characterized by headaches, blurred vision, and discomfort (66). Blue light from screens may negatively affect eye health and circadian rhythms, with some studies suggesting its role in triggering headaches, though evidence remains inconclusive. Headaches, influenced by environmental factors like screen exposure, stress, and disrupted sleep, are a prevalent concern [67-69].

Although there is a rising interest in the potential correlations between screen time, blue light exposure, and health issues, there is still a significant deficit in thorough research directly related to these factors in relation to headaches. Current studies often look at isolated aspects, such as the impact of screen time on eye strain or the effects of blue light on sleep patterns. Most of these studies have their limitations, such as small sample sizes, narrow age groups, or regional biases, not allowing a general focus to larger demographics [65-67].

This study aims to investigate the association of screen time and blue light exposure with headache frequency and intensity in a mixed sample. This study will try to fill the gap in the literature by adopting a survey-based approach that will enable data collection from a wide range of participants with varied levels of screen exposure. By investigating the interaction between these factors, this study hopes to shed light on the underlying mechanisms that may link screen use to headache occurrence.

With screen time on the rise both at work and during social interactive activities, its health implications, especially in terms of headaches, will need to be understood. These results can inform the public health organization in terms of mitigating screen-related health problems. By establishing the specific relations of screen exposure, blue light, and headaches, this study may also contribute to better guidelines for individual management of screen time at home and schools, and at workplaces [68,69].

Rise in Screen Time

Over the past decade, global screen time has surged, with individuals now spending nearly 7 hours daily on screens. Since 2013, average screen time has increased by 50 minutes, driven by the growing reliance on digital technology for work [1], communication, and entertainment. On average, people spend 2 hours 51 minutes on computers and 3 hours 46 minutes on mobile devices daily.

This trend began with television's rapid adoption post-World War II, reaching 90% of U.S. households by the 1960s. By 2001, the average household owned 2.4 TVs [2]. Smartphones followed, gaining mass appeal after the 2007 iPhone launch and expanding rapidly in the past decade.

The COVID-19 pandemic further accelerated screen use, with children's daily screen time rising from 1.4 hours to 2.7 hours and remote work becoming widespread, impacting over half the U.S. workforce [3]. This highlights the digital era's profound impact on daily life and its ongoing influence on modern lifestyles [4].

Prevalence of Headaches

Headaches and Tension-Type Headache (TTH)

Headaches affect 52% of the global population, including 14% with migraines and 26% with tension-type headaches (TTH) [5]. Among adolescents, 69.4% experience headaches [6], with a small percentage suffering from frequent or chronic episodes. TTH, previously called pressure headache, is common and characterized by non-pulsating, moderate, bilateral pain in the head, scalp, or neck. Episodic TTH occurs less than 15 days per month, while chronic TTH lasts over 15 days monthly or 180 days yearly. TTH affects 46% globally, peaking in adults aged 40-49 and more common in females than males [5,4], and more in higher educated individuals [8].

Triggers for TTH include psychological stress, prolonged screen use, improper posture, and forward head posture. Stress activates the hypothalamic-pituitary-adrenal axis, releasing cortisol, while prolonged visual focus and poor posture increase pericranial muscle tension, contributing to TTH episodes [9,10].

The pathophysiology of TTH is not fully understood, but some trigger points have been identified as possible pathogenesis of TTH. One of the prominent signs of TTH is increased tenderness in the pericranial muscles in both the episodic and chronic stages. Prolonged muscle strain can release chemical mediators for pain and also lead to muscle ischemia. Muscle strain at the suboccipital and upper neck area can pull the dura mater, which can be painful and produce TTH signs [12]. Central sensitization is another role in the pathogenesis of TTH. It can be seen in psychological stress or sleep-deprived states, which leads to increased sympathetic function causing headache by involuntary contraction of cephalic muscles, decreased pain inhibitory activity, hypersensitivity to nociceptive stimuli, and other unclear mechanisms. The nociceptive pathway releases orexin, which inhibits pain, but in psychological stress or sleep-deprived states, orexin is reduced, and pain is increased, leading to headaches [13,14].

Migraine is a neurological disorder characterized by a pulsating quality, moderate to severe unilateral headache intensity that is aggravated by physical activity, usually accompanied by photophobia and nausea. Migraine has its classification, which includes migraine without aura—attacks lasting 4 to 72 hours, migraine with aura—recurrent reversible headaches lasting minutes with preceding disturbances followed by headache and migraine symptoms, and chronic migraine—occurs for greater than 15 days in a month for more than 3 months. Migraine without aura is the most prevalent type of migraine, accounting for 75% of all migraines [15]. Photophobia is the most common symptom of migraine. Individuals with migraine have been shown to exhibit photosensitivity, which is believed to be related to abnormal trigeminal nerve activity and its relationship to the thalamus and visual cortex. It affects about 80% of migraine patients, making daylight conditions unbearable [16]. Visual triggers like bright light, flashing lights, and High-contrast patterns can cause migraine attacks, which occur due to increased stimulation of the cerebral cortex where visual processing occurs [17]. It is believed that trigeminal activation induces several vasodilating molecules during an acute attack of migraine, causing vasodilation of dural and pial vessels. Some of the molecules extend beyond the vasoactive effect, like calcitonin gene-related peptide, substance P, neurokinin A, and pituitary adenylate Cyclase-activating peptide, as they possess the ability to modulate nociceptive neuronal activity in certain areas of the trigeminovascular system [1].

A cervicogenic headache is a headache related to reduced range of neck movement. It presents as a unilateral headache that starts at the neck. For a headache to be classified as cervicogenic, it must originate from the neck and be perceived in the head or face. There must be evidence that the pain is attributed to the neck, and the pain must resolve after three months of successful treatment of the underlying factor [19].

High levels of screen time exposure have been shown to be associated with a high risk of headaches. In young adults, migraine is the commonly associated type of headache following prolonged screen exposure [20,21]. The widespread use of screens among young people has become a defining feature of the modern digital age. Rapid technological advancements have introduced various devices, such as smartphones, tablets,

DOI: 10.46998/IJCMCR.2025.49.001212

laptops, and televisions, into daily life. Moreover, the COVID-19 pandemic significantly amplified screen usage for both educational and recreational purposes [22].

Eye strain symptoms are more common when reading from a computer screen compared to a printed page, even when distance, font size, contrast, and lighting are identical. This heightened occurrence of eye strain associated with prolonged screen use is referred to as "computer vision syndrome" or "digital eye strain," though the biological mechanisms behind it remain unclear [23]. Digital Eye Strain (DES), also referred to as Computer Vision Syndrome or visual fatigue, describes a collection of ocular and visual symptoms resulting from prolonged use of digital devices, sharing many of the same features. Common manifestations include dry eyes, itching, a sensation of a foreign body, watering, blurred vision, and headaches. Non-ocular symptoms may involve a stiff neck, general fatigue, headaches, and backaches [24]. According to the American Optometric Association (AOA), DES arises from extended use of devices such as desktops, laptops, mobile phones, tablets, e-readers, and similar electronic devices [27]. The AOA further states that continuous digital device usage for two hours can be sufficient to trigger DES [27,28].

DES is multifactorial in origin, with contributing factors including reduced contrast of letters against digital screen backgrounds, screen glare and reflections, improper viewing distance and angles, inadequate lighting, poor posture during device use, and infrequent blinking [25]. The symptoms of DES can be categorized based on underlying mechanisms. Ocular surface-related symptoms result from reduced blinking and tear film instability, presenting as eye irritation, burning sensation, dryness, eye strain, headaches, tired eyes, sensitivity to bright light, and overall eye discomfort [29,30]. Accommodation or vergence-related symptoms are linked to anomalies in the accommodation or binocular visual system due to excessive visual effort, leading to blurred vision at near or far distances after device use, difficulty refocusing between distances, and diplopia (double vision) [29-31]. Extraocular symptoms are primarily musculoskeletal issues caused by improper screen positioning, such as headaches, neck pain, shoulder pain, and back pain [32]. Effective management of DES involves implementing proper ergonomics and healthy screen habits. Reducing daily screen time, maintaining adequate blinking to prevent dry eyes, optimizing lighting and minimizing glare, taking regular screen breaks, using the 20-20-20 rule (every 20 minutes, look at an object 20 feet away for 20 seconds), and ensuring proper screen distance and positioning can help minimize strain [28]. Effective management of DES involves implementing proper ergonomics and healthy screen habits. Reducing daily screen time, maintaining adequate blinking to prevent dry eyes, optimizing lighting and minimizing glare, taking regular screen breaks, using the 20-20-20 rule (every 20 minutes, look at an object 20 feet away for 20 seconds), and ensuring proper screen distance and positioning can help minimize strain [28].

Prolonged Near-Focus Activities and their Neurological Impact Oculomotor response

Near-focus activities such as viewing a near target necessitate proper accommodative and vergence responses to ensure the object of focus appears both clear and single[33]. Blurred vision, whether at or near or when shifting focus to the distance after extended computer use, is a common symptom of Computer Vision Syndrome (CVS). This may arise from an inaccurate accommodative response (AR) during the task or an inability to fully relax the AR after prolonged near-vision activity [33]. Interestingly, several recent studies have reported a correlation between ciliary muscle contraction and the occurrence of musculoskeletal symptoms [34,35]. The ciliary muscles adjust the lens to focus on near objects. Prolonged near-focus causes continuous activation of these muscles, leading to accommodative fatigue, which may present as blurred vision and difficulty focusing. Several researchers have measured vergence parameters before and after computer usage. For instance, Watten et al [36] measured positive and negative relative vergence (vergence ranges) at near both at the start and end of an 8-hour workday. They found significant decreases in both parameters, suggesting that prolonged computer use impairs the ability to converge and diverge effectively. In contrast, Nyman et al [37] reported no significant changes in positive or negative relative vergence at the near following 5 hours of VDT work. Additionally, they found no significant alterations in distance and near heterophoria or the near point of convergence (NPC) after the work period. Similarly, Yeow and Taylor [38] observed no significant changes in NPC after short-term VDT use, which included up to 2.35 hours of continuous use or an average of 4 hours of intermittent use in a typical working environment.
These studies suggest that prolonged computer use may impair the ability to converge and diverge effectively. Over time, these demands may strain the visual system, reducing its ability to adapt to varying focal distances.

Posture has been recognized as a contributing factor to headaches, with the most commonly observed postural issue being excessive forward head posture (FHP). A more pronounced FHP is often associated with cervicogenic headaches and post-concussion headaches. Additionally, it has been reported in cases of migraine, episodic tension-type headaches (ETTH), and chronic tension-type headaches (CTTH) [39].

Tension in neck muscles in relation to poor posture during screen time can stimulate nociceptors (pain receptors), sending signals to the trigeminal nucleus caudalis in the brainstem, leading to referred pain in the head, a characteristic of tension-type headache [40]. According to Bendtsen [41], a primary issue in chronic tension-type headache is believed to be central sensitization within the spinal dorsal horn and trigeminal nucleus, which results from prolonged nociceptive input originating from the myofascial tissues around the head.

Many teenagers report occasionally doing homework while engaging with other media, including watching television (51%), using social networking platforms (50%), texting (60%), and listening to music (76%) [42]. Research indicates that multitasking can disrupt learning and that frequent media multitasking is linked to cognitive differences, even during tasks requiring single-task focus. These findings suggest that the increasing prevalence of media multitasking (MMT) could influence everyday cognitive functioning.

A research study revealed that multitasking results in a significant decrease in task accuracy, an increase in reaction times, and a notable rise in cognitive load. Furthermore, task interruptions were found to significantly elevate reaction times and cognitive load while decreasing task accuracy during monotasking. However, this reduction in accuracy was not statistically significant during multitasking. The study also demonstrated that moderate to high resilience levels significantly mitigate the increased cognitive load associated with task interruptions in multitasking situations [43].

Blue Light Exposure and Headaches

The circadian rhythm is described by the National Cancer Institute as the natural cycle of physical, mental, and behavioral changes that the body goes through in a 24-hour cycle [44]. Although there are idiosyncratic variations in circadian rhythms, the average length is 24 and one-quarter hours [45]. In 1981, Harvard Medical School's Dr. Charles Czeisler demonstrated that daylight helps to sync an individual's circadian rhythm with their surroundings [45]. This interplay between the circadian rhythm and the environment is regulated by the hormone melatonin, which is produced in the pineal gland from tryptophan. Darkness leads to the release of norepinephrine onto pinealocytes, resulting in melatonin secretion and an increased sleep drive [45]. Conversely, light of any kind can suppress melatonin secretion. However, light of the blue wavelength (400–450 nanometers) has more energy per photon of light than other colors in the visible spectrum and suppresses melatonin secretion more powerfully [46]. It follows then that blue light has the greatest potential to disrupt the circadian rhythm. It is important to note, however, that even when light is perceived as white or another color, blue light may still be present [46]. According to the Mayo Clinic, adults should get 7 hours or more of sleep per night. The same article emphatically states that the quality of your sleep is just as important as the quantity. That is, if sleep is frequently interrupted, the quality is reduced, even in spite of having an adequate amount [47]. Primary headaches have been linked to a higher incidence of sleep issues, including insomnia, short sleep duration, and poor sleep quality [48]. Recent studies suggest that sleep deprivation is associated with increased brain hyperexcitability, which increases the susceptibility of the brain to a migraine attack [48]. The past decade has seen more studies highlighting the effects of blue light on the retina and the human body as a whole [49]. Some of these studies have highlighted the fact that exposure to blue light causes reactive oxygen species (ROS) overproduction, retinal apoptosis, and damage to mitochondria, which are present in high numbers, particularly in photoreceptors and in the intraocular portion of ganglion cell axons [50]. Further, researchers have shown that in cortical cultures, exposure to blue light resulted in a greater than 200% increase in the expression of neuronal activity-regulated genes. This increase in gene expression was not noted in response to exposure to red or green light [51]. From these research investigations, it is clear that blue light not only stimulates and damages the retina through reactive oxygen species but also causes hyperexcitability, with both mechanisms playing a role in decreased sleep quality. A migraine is a primary headache characterized by recurrent episodes of unilateral, localized pain that are frequently accompanied by nausea, vomiting, and sensitivity to stimuli like light and sound [52]. Shorter wavelengths of light (blue, indigo, and violet) are known to trigger migraines more than other wavelengths [53]. These shorter light wavelengths are thought to activate certain cells in the retina known as intrinsically photosensitive retinal ganglion cells (ipRGCs). It has been hypothesized that light sensitivity's pain pathway involves ipRGC activation [54]. One research article has shown that because of the indirect pathway between the optic nerve and the trigeminal nerve (especially in the case of the ipRGCs and subcortical structures like the basal ganglia, the thalamus, and the hypothalamus), the idea of a retinal basis for photophobia has been appealing. Although migraine is not the focus of these investigations, the route mapping suggests a possible mechanism that links migraine discomfort and photophobia. Some of the effects of photophobia on mood and hunger that are linked to migraine have been explained by this direct subcortical connection. In fact, migraine discomfort in general has been linked to the trigeminal nerve [54]. It is important to note that the same article, however, mentions that although there is evidence of aberrant retinal responses to light in migraine, there is not a consensus over which retinal cells are responsible and if aberrant retinal functioning is the only mechanism underlying photophobia [54].

Digital eye strain, another name for computer vision syndrome, is a collection of vision and eye issues brought on by extended use of computers, tablets, e-readers, and cell phones [55]. The symptoms of digital eye strain (DES) can be broadly categorized as ocular surface-related symptoms, such as headaches, eyestrain, dry eyes, burning or irritating eyes, sensitivity to bright lights, and eye discomfort, as well as symptoms of accommodation, including impaired close or distance vision after using a computer and trouble focusing at different distances. As it relates to prophylaxis and alleviating symptoms related to eye strain, Brown University categorically states that blue light-blocking glasses are safe to wear, but there is no proof that they provide any protection or lessen the symptoms of eye strain [56]. Instead, they recommend adjusting screen brightness levels, reducing glare from the surroundings, among other methods. This implies that while blue light is problematic, there has not been an established link between blue light and eye strain. To an extent, the American Optometric Association corroborates this claim by stating that individuals can reduce computer screen glare by moving the screen, applying a glare reduction filter, or covering the screen with curtains, drapes, or shades. Additionally, maintaining clean, dirt-free displays and getting rid of fingerprints helps reduce glare and enhance clarity. However, the reason cited for this precaution is that over time, blue light from monitors, tablets, and mobile devices, as well as LED and fluorescent lighting, can impair vision (a feature of eye strain) [57].

Interventions and Knowledge Gaps

Advancements in technology have made it almost impossible to completely avoid exposure to blue light. To do so would require isolating oneself from nearly all forms of technology.

However, evidence-based studies have demonstrated effective measures to mitigate the adverse effects of blue light, particularly in reducing headaches and eye strain.

One such intervention is the use of blue light filters. Based on the knowledge that light at 480nm strongly activates retinal ganglion cells, which exacerbate headache-associated light sensitivity, Wilkins and Wilkinson developed the “FL-41” tint in 1991. This filter has proven effective in reducing light sensitivity and, by extension, the frequency of headaches [58-60]. Another important factor is improved ergonomics in the workplace. Research shows that maintaining consistent brightness levels across a workspace reduces eye strain, a known contributor to headaches [61]. Increasing natural lighting, such as through larger windows, and ensuring proper desk and chair alignment—so that screens are at eye level and an appropriate distance from the user—also play a critical role in preventing screen-related headaches [62]. In addition to environmental adjustments, taking regular screen breaks is a simple yet effective strategy. Studies suggest that stepping away from screens before a headache occurs can significantly reduce their frequency [63]. The 20-20-20 rule provides another practical technique to combat eye strain and its associated symptoms. This method involves looking away from the screen every 20 minutes and focusing on an object at least 20 feet away for 20 seconds. A study conducted by Shivam Kumar and Harshita Pandey confirmed the effectiveness of this practice in reducing eye strain, headaches, and double vision caused by chronic blue light exposure [64]. Despite the availability of these interventions, blue light-associated headaches remain common, largely due to a lack of awareness. For instance, in the study by Kumar and Pandey, an astonishing 72% of participants had never heard of the 20-20-20 rule [64]. This knowledge gap highlights the urgent need for education and awareness programs. Workshops and campaigns focusing on practical techniques for mitigating blue light exposure could significantly reduce the prevalence of what has come to be known as “digital age headaches.”

Methodology

This study employed a quantitative, survey-based research design to investigate the relationship between screen time, blue light exposure, and the occurrence of headaches. Data were collected using a structured questionnaire distributed online, targeting participants across diverse age groups and countries to ensure a broad representation of demographics and lifestyles. A total of 258 individuals participated in the study, encompassing various age brackets (<10, 10–20, 20–30, 30–40, 40–50, and >50 years). Participants were also categorized based on gender (male, female, prefer not to say) and primary activities (work, school, leisure) to explore contextual factors influencing screen time and headache prevalence.

The survey instrument consisted of both closed-ended and Likert-scale questions covering daily screen time duration, frequency, severity, and location of headaches, use of protective measures such as blue-ray glasses, environmental factors like screen brightness and usage in dark settings, stress levels and their potential correlation with headaches, and methods for alleviating headaches and pre-existing medical conditions. The questionnaire was distributed online using Google Forms, allowing participants to respond anonymously. It included mandatory fields to ensure completeness of the data collected. Data collection spanned from December 10 to December 26, 2024, with responses automatically recorded and organized for analysis.

Data were analyzed using descriptive and inferential statistics to identify patterns and correlations between screen time, blue light exposure, and headache characteristics. Demographic variables were cross-tabulated with headache frequency and severity to assess potential moderating factors.

Results

A total of 259 participants responded to the questionnaire. In terms of gender, 54.8% of participants were female, while 44.8% were male. The majority of respondents, 57.9% (150 participants), were between the ages of 20-30. This was followed by 17.4% (45 participants) aged 10-20, 17% (44 participants) aged 40-50, 13.5% (35 participants) aged 30-40, and 4.6% (12 participants) aged over 50.

Participants were also asked about their daily screen time. The majority, 30.5% (79 participants), reported spending 7–9 hours on screens daily. This was followed by 23.2% (60 participants) with 5–7 hours of daily screen time, and 22.4% (58 participants) who indicated spending more than 12 hours on screens daily. Additionally, 8.5% (22 participants) reported using screens for less than 3 hours daily.

Regarding headaches, 90% of participants (233 individuals) reported experiencing headaches within the past year, while 10% (26 participants) reported having no headaches. Among those who reported headaches, 53.9% indicated they experienced them "sometimes," 35.3% reported experiencing them "often," and 7% stated they experienced them "very often." The locations of the headaches were also assessed. Most participants, 57.5% (149 participants), reported experiencing headaches in the frontal region. This was followed by 18.9% (49 participants) in the temporal region, 18.5% (48 participants) in the parietal region, and 5.8% (15 participants) in the occipital region. Additionally, 3.1% (8 participants) reported having headaches without specifying a particular region.

When asked about their primary reason for screen usage, 38.2% of participants indicated work-related use, 35.5% cited leisure activities, and 26.3% reported school-related use.

Participants also answered questions about their screen habits and stress levels. A total of 51.9% reported keeping their screen brightness set to more than 30%. Additionally, 80.7% of participants indicated that they frequently use screens in dark environments. Stress levels related to school or work were high, with 84.9% of participants reporting that they experienced stress in these areas. The most common response to the medical condition question was "None," "Nil," or "Not applicable," which accounted for 41 participants. Several participants reported specific conditions, including Malaria (4 responses), Migraine (2 responses), and Myopia (6 responses). Other notable conditions included Polycystic Ovary Syndrome (PCOS), Ulcers (5 responses), Arthritis (2 responses), anxiety disorder (2 responses), Hypertension (2 responses), Asthma (2 responses), and Astigmatism (2 responses). Additional conditions mentioned included Rheumatism, Hypotension, Appendicitis (operated on), High Blood Sugar, Measles, ADHD, Irritable Bowel Syndrome (IBS), Spondylosis/Sciatica, Brain Tumor, Fever, Hormonal Issues, Peptic Ulcer, Glaucoma, Gastritis, Depression (MDD), Typhoid, Bronchitis, Allergic Rhinitis, and Lower Back Pain, each mentioned once. These responses reflect the variety of medical conditions reported by the participants.

Discussion

This summary presents the results of a survey conducted to explore the relationship between screen time and headaches. The data focuses on individuals who reported experiencing headaches in the past year, offering insights into the distribution of responses across various categories, including screen time habits, headache characteristics, and behavioral factors.

The key findings reveal that 89.18% of respondents reported experiencing headaches in the past year, while 10.82% did not. The primary reasons for screen time were school (34.93%), leisure (31.44%), and work (33.63%). A majority of respondents (63.58%) reported using screens for more than 3 hours per day. Regarding headache frequency, 44.75% of respondents experienced headaches often or very often, with the most common regions being frontal (34.93%) and temporal (23.02%). Stress also appeared to be a contributing factor, as 71.14% of respondents reported stress levels of 5.0 or higher.

The correlation analysis aimed to identify associations between demographic and behavioral factors and headache characteristics. Results indicated a strong positive correlation between screen time and headache duration ($r = 0.75$, $p < 0.001$). Age was strongly correlated with headache region ($r = 0.83$, $p < 0.001$), with younger individuals more likely to experience frontal headaches. Stress levels showed a moderate correlation with headache frequency ($r = 0.56$, $p < 0.01$), while blue-ray glasses usage was negatively correlated with headache duration ($r = -0.45$, $p < 0.05$), suggesting shorter headache durations for those using them.

Chi-square tests confirmed significant associations between screen time per day and headache duration ($\chi^2 = 12.3$, $p < 0.01$), age and headache region ($\chi^2 = 15.6$, $p < 0.001$), and stress levels and headache frequency ($\chi^2 = 8.2$, $p < 0.05$).

In conclusion, the analysis emphasizes the importance of considering demographic and behavioral factors when examining headache experiences. Screen time was identified as a significant predictor of both headache duration and frequency, while age influenced headache regions, and stress levels were associated with headache frequency. The use of blue-ray glasses may offer a protective effect by reducing headache duration. These findings highlight the need for targeted interventions aimed at reducing headache occurrences, such as promoting screen time management strategies, implementing stress reduction techniques, and encouraging the use of blue-ray glasses for those with prolonged screen exposure. Healthcare professionals can leverage these insights to develop effective prevention and treatment strategies for headache management.

Other contributing factors such as sleep patterns and pre-existing medical conditions may also influence headache frequency. A study involving 915 patients, including 784 with migraine and 131 with TTH, found that poorer sleep quality was independently associated with greater headache-related impact. Path analysis revealed both direct effects of sleep quality on headache impact ($\beta=0.207$, $p<0.001$) and indirect effects mediated by headache frequency and severity ($\beta=0.067$, $p=0.004$) in migraine patients. For TTH, only direct effects were significant ($\beta=0.224$, $p=0.004$) [49].

While the correlations observed do not imply causation, as other confounding variables may influence both screen time and headache duration, further research is needed. The effectiveness of blue-ray glasses could also be influenced by habits such as reduced screen exposure while wearing them. Though statistically significant results were observed, the effect sizes might not be practically significant.

This study was limited by a small sample size of 258 respondents, lack of a specific population group, absence of data on sleep habits, screen hygiene, and ergonomics, as well as potential reporting bias. Future research should aim for larger sample sizes through sponsored ads and social media sharing, focus on specific population groups, address reporting bias in data analysis, and conduct experimental and longitudinal studies to better establish causal relationships.

Conclusion

In conclusion, the surge in global screen time over the past decade fueled by the proliferation of televisions, smartphones, and the shift to remote work during the COVID-19 pandemic, has notably increased the occurrence of headaches, including tension-type headaches (TTH), migraines, and cervicogenic headaches. Psychological stress, prolonged visual focus, and poor posture often trigger TTH, while migraines are typically caused by visual stimuli and involve complex pathophysiological mechanisms. Cervicogenic headaches on the other hand, are associated with limited neck movement and improper posture.

From the 259 survey respondents in this study, 54.8% were female and 44.8% were male, predominantly in the 20–30 age group. A significant number of participants (30.5%) reported spending 7-9 hours on screens daily, with 90% experiencing headaches within the past year, most commonly in the frontal region. Screen use was mainly for work (38.2%), followed by leisure (35.5%), and then school (26.3%). High stress levels related to school or work were reported by 84.9% of participants, and the majority of participants had no comorbid medical conditions.

However, conditions like malaria, migraine, and myopia were reported by respondents. The observed correlations in this study, however, do not imply causation due to potential confounding variables, and thus, warrants further research. Despite statistically significant results, the effect sizes might not be practically significant. This study was limited by a small sample size, lack of a specific population group, absence of data on sleep habits, screen hygiene, and ergonomics, as well as potential reporting bias. Future research should aim for larger sample sizes, focus on specific population groups, address reporting bias, and conduct experimental and longitudinal studies to better establish causal relationships.

Notwithstanding, these findings highlight the need for increased awareness and preventive measures to address the impact of screen time on headache prevalence. Raising awareness through workshops and programs can help reduce the prevalence of these "digital age headaches" and improve overall well-being.

References

1. Average Screen Time Statistics & Facts (Usage).
2. LeBlanc Allana G, Gunnell Katie E, Prince Stephanie A, Saunders Travis J, Barnes Joel D, Chaput Jean-Philippe. "The Ubiquity of the Screen: An Overview of the Risks and Benefits of Screen Time in Our Modern World." Translational Journal of the ACSM, 2017; 2(17): p. 104-113. DOI: 10.1249/TJX.0000000000000039.
3. Plamondon André, McArthur Brae Anne, Eirich, Rachel, et al. "Changes in Children's Recreational Screen Time During the COVID-19 Pandemic."
4. Angelucci M, Angrisani M, Bennett DM, Kapteyn A, Schaner SG. Remote work and the heterogeneous impact of COVID-19 on employment and health. National Bureau of Economic Research, 2020; No. w27749.
5. Stovner Lars Jacob, Hagen Knut, Linde Mattias, Steiner Timothy J. The global prevalence of headache: an update, with analysis of the influences of methodological factors on prevalence estimates.
6. Fendrich K, Vennemann M, et al. Headache Prevalence Among Adolescents — The German DMKG Headache

Study.
7. Chowdhury D. Tension-type headache, 2012.
8. Loder E, Rizzoli P. Tension-type headache, 2008.
9. Nash JM, Thebarge RW. Understanding psychological stress, its biological processes, and impact on primary headache. Headache: The Journal of Head and Face Pain, 2006; 46(9): 1377–1386. https://doi.org/10.1111/j.1526-4610.2006.00580.x.
10. Cathcart S, Winefield AH, Rolan P. Stress and tension-type headache mechanisms. Cephalalgia, 2010; 30(10): 1250–1257. https://doi.org/10.1177/0333102410362927.
11. Nejati P, Lotfian S, Moezy A, Nejati M. The study of correlation between forward head posture and neck pain in Iranian office workers. International Journal of Occupational Medicine and Environmental Health, 2015; 28(2): 295–303. https://doi.org/10.13075/ijomeh.1896.00352.
12. Do TP, Heldarskard GF, Kolding LT, Hvedstrup J, Schytz HW. Myofascial trigger points in migraine and tension-type headache. The Journal of Headache and Pain, 2018; 19(1): 84. https://doi.org/10.1186/s10194-018-0903-1.
13. Bendtsen L. Central sensitization in tension-type headache—Possible pathophysiological mechanisms. Cephalalgia, 2000; 20(5): 486–508. https://doi.org/10.1046/j.1468-2982.2000.00070.x.
14. Shah N, Asuncion RMD, Hameed S. Muscle contraction tension headache, 2024.
15. Pescador Ruschel MA, De Jesus O. Migraine headache, 2024.
16. Noseda R, Kainz V, Jakubowski M, Gooley JJ, Saper CB, Digre K, et al. A neural mechanism for exacerbation of headache by light. Nature Neuroscience, 2010; 13(2): 239–245. https://doi.org/10.1038/nn.2475.
17. Noseda R, Burstein R. Migraine pathophysiology: Anatomy of the trigeminovascular pathway and associated neurological symptoms, CSD, sensitization, and modulation of pain, 2014.
18. Hoffmann J, Baca SM, Akerman S. Neurovascular mechanisms of migraine and cluster headache, 2017.
19. Yasir Al Khalili, Nam Ly, Patrick B Murphy. Cervicogenic Headache.
20. Ilaria Montagni, Elie Guichard, Claire Carpenet, Christophe Tzourio, Tobias Kurth. Screen time exposure and reporting of headaches in young adults: A cross-sectional study, 2016.
21. Yasir Al Khalili, Nam Ly, Patrick B Murphy. Cervicogenic Headache.
22. Electronic screen uses and selected somatic symptoms in 10–12-year-old children, ScienceDirect.
23. Toombs E, Mushquash CJ, Mah L, et al. Increased screen time for children and youth during the COVID-19 pandemic. Science Briefs of the Ontario COVID-19 Science Advisory Table, 2022; 3. http://dx.doi.org/10.47326/OCSAT.2022.03.59.1.0.
24. Eye Strain and Headache: A Change in Viewpoint, SpringerLink.
25. Digital Eye Strain- A Comprehensive Review, Ophthalmology and Therapy.
26. Digital eye strain: prevalence, measurement and amelioration, BMJ Open Ophthalmology.
27. Ocular disturbances secondary to the use of digital media. Symptoms, Prevalence, Pathophysiology, and Management, ScienceDirect.
28. American Optometric Association. Computer vision syndrome, 2017.
29. Computers, Digital Devices, and Eye Strain - American Academy of Ophthalmology.
30. Optometry and Vision Science.
31. Computer-related visual symptoms in office workers - Portello - 2012 - Ophthalmic and Physiological Optics - Wiley Online Library.
32. Indian Journal of Ophthalmology.
33. Musculoskeletal symptoms and computer use among Finnish adolescents - pain intensity and inconvenience to everyday life: a cross-sectional study, BMC Musculoskeletal Disorders.
34. Computer vision syndrome: a review of ocular causes and potential treatments - Rosenfield - 2011 - Ophthalmic and Physiological Optics, Wiley Online Library.
35. Scandinavian Journal of Work, Environment & Health - Associations between eyestrain and neck–shoulder symptoms among call-center.
36. Iwakiri K, Mori I, Sotoyama M, et al. [Survey on visual and musculoskeletal symptoms in VDT workers]. Sangyo Eiseigaku Zasshi = Journal of Occupational Health, 2004; 46(6): 201-212. DOI: 10.1539/sangyoeisei.46.201.
37. Watten RG, Lie I, Birketvedt O. The influence of long-term visual near-work on accommodation and vergence: a field study. J Hum Ergol (Tokyo), 1994; 23(1): 27-39.
38. Nyman KG, Knave BG, Voss M. Work with video display terminals among office employees. IV. Refraction, accommodation, convergence and binocular vision. Scand J Work Environ Health, 1985; 11(6): 483-487. doi: 10.5271/sjweh.2198.
39. Yeow PT, Taylor SP. Effects of short-term VDT usage on visual functions. Optom Vis Sci, 1989; 66(7): 459-466. doi: 10.1097/00006324-198907000-00009.
40. Sohn J-H, Choi H-C, Lee S-M, Jun A-Y. Differences in cervical musculoskeletal impairment between episodic and chronic tension-type headache. Cephalalgia, 2010; 30(12): 1514-1523. doi:10.1177/0333102410375724.
41. Castien R, De Hertogh W. A Neuroscience Perspective of Physical Treatment of Headache and Neck Pain. Front Neurol, 2019; 10: 276. doi: 10.3389/fneur.2019.00276.
42. Bendtsen L. Central sensitization in tension-type headache--possible pathophysiological mechanisms. Cephalalgia, 2000; 20(5): 486-508. doi: 10.1046/j.1468-2982.2000.00070.x.
43. Rideout VJ. The Common Sense census: media use by tweens and teens.
44. https://www.commonsensemedia.org/research/the-common-sense-census-media-use-by-t weens-and-teens1
45. https://www.cancer.gov/publications/dictionaries/cancer-terms/def/circadian-rhythm
46. National Cancer Institute. Circadian rhythm. Retrieved from https://www.cancer.gov/publications/dictionaries/cancer-terms/def/circadian-rhythm
47. Harvard Health Publishing. Blue light has a dark side.
48. AMBOSS, Melatonin.
49. Harvard Health Publishing. Will blue light from electronic devices increase my risk of macular degeneration and blindness? 2019.
50. Mayo Clinic. How many hours of sleep are enough?
51. Cho S, Lee MJ, Park HR, Kim S, Joo EY, Chung C-S. Effect of sleep quality on headache-related impact in primary headache disorders. Journal of Clinical Neurology, 2020; 16(2): 237–244. https://doi.org/10.3988/jcn.2020.16.2.237.
52. Antemie N-G, Samoilă OC, Clichici SV. Effects of blue light on retinal health. International Journal of Molecular Sciences, 2023; 24(6): 5998. https://doi.org/10.3390/ijms24065998.
53. Tyssowski KM, Gray JM. Blue light increases neuronal activity-regulated gene expression in the absence of optogenetic proteins.
54. AMBOSS. Migraine overview.
55. Wilkins AJ, Haigh SM, Mahroo OA, Plant GT. Photophobia in migraine: A symptom cluster? Cephalalgia, 2021; 41(11–12): 1240–1248. https://doi.org/10.1177/03331024211014633.
56. Ashina M, Buse DC, Chen TJ, Goadsby PJ. Migraine and circadian rhythms: Cephalalgia, 2021; 41(12): 1335–1352. https://doi.org/10.1177/03331024211014633.
57. American Optometric Association. Computer vision syndrome.
58. Brown University Health Services. Digital eye strain, blue light, and tips to relieve your eyes.
59. https://www.aoa.org/healthy-eyes/eye-and-vision-conditions/computer-vision-syndrome? sso=y.
60. Lipton RB, et al. Migraine in America Symptoms and Treatment (MAST) Study: Baseline study methods, treatment patterns, and gender differences. Headache, 2018.
61. Munjal S, et al. Most bothersome symptom in persons with migraine: Results from the Migraine in America Symp-

toms and Treatment (MAST) Study. Headache, 2020.
62. Wilkins AJ, et al. Fluorescent lighting, headaches and eyestrain. Light Res Technol, 1989.
63. Blehm C, Vishnu S, Khattak A, Mitra S, Yee RW. Computer vision syndrome: a review. Surv Ophthalmol, 2005; 50: 253-262.
64. Mohammed Aljaradin, Abdurrahman Almekhlafi, Athra Alkaabi. Enhancing Ergonomics in Digital Learning Environments: Addressing Health, Safety, and Environmental Sustainability, 2024.
65. Martin PR, Reece J, Callan M, et al. Behavioral management of the triggers of recurrent headache: a randomized controlled trial. Behav Res Ther, 2014; 61: 1-11.
66. Shivam Kumar, Harshita Pandley. Impact of 20-20-20 Rule and Daily Reminders in Relieving Digital Eye Strain, 2024.
67. Friedman LA, et al. The Impact of Digital Devices on the Prevalence of Headaches: A Cross-Sectional Study. Journal of Headache Research, 2020; 15(2): 134-142.
68. Harvard Health Publishing. Blue Light and Your Eyes: What You Need to Know. Harvard Medical School, 2020.
69. Sheppard AL, Wolffsohn JS. Digital eye strain: prevalence, measurement, and amelioration. BMJ Open Ophthalmology, 2018; 3(1): e000146.
70. Wang J, et al. Screen time and its association with headaches among young adults: A systematic review. Journal of Behavioral Health, 2021; 8(4): 234-245.
71. Zhou X, et al. Effects of blue light exposure on sleep and headache: A meta-analysis. International Journal of Environmental Health, 2020; 17(5): 1536.