



Impact of Excessive Screen Time and the Mediating Effect of Physical Exercise on Sleep in Physiotherapy Students During Covid-19

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Abstract

Aim: The science of today is the technology of tomorrow. The 21st century has witnessed a great development in the field of technology. Whether we love it or loathe it, technology affects everything we do today and influences almost everything we plan for our tomorrow. It has advanced everywhere making people access various types of devices. Sleep is fundamental to optimal functioning including health and behavior. This paper describes the interrelations between sleep and screen use. The purpose of this study was to identify technology use hence exploring the screen time of the individual and its impact on sleep and the mediating effect of physical exercise. **Method:** A representative sample of 150 Physiotherapy students was surveyed using an online questionnaire to analyze their technology use and sleep patterns. **Results:** A total number of 150 completed forms were analyzed. 94.7% students screen time use had increased during the lockdown. 43.3% of student participants spent more than 6 hours on digital devices on a daily basis. 73.3% of the population agreed that screen time did affect their sleeping pattern in the lockdown. 64% students encountered sleeping problems. 52% people admitted that excessive screen use has affected their sleep quality. 65.3% of the students have been taking part in physical exercises regularly, out of which 65.27 % reported decreased sleeping complaints. **Conclusion:** This study shows that use of screen based digital devices and media use has significantly increased during COVID-19 pandemic lock down in Physiotherapy students and provides scientific evidence for its negative impact on sleep. Physical exercises were associated with a positive effect on sleep disorders.

Keywords: COVID-19 pandemic; Lockdown; Screen use; Sleep; Exercise; Physiotherapy students.

1. Introduction

Technology today is an integral part of everyday life. Rapid advancements in the field has increased the pace of life, effectively coordinating reality with imagination. In other words, we virtually move with our thoughts and as we look ahead today's technology becomes outdated tomorrow. Smart phones were designed to make us more productive and our lives easier. They are designed to entertain us and provide information. But when it's time to turn off the lights and go to sleep, the last thing our brain needs is more information and more entertainment. The increasing use of and dependence on the internet brought to the surface a new public health concern near the start of the century "Internet Addiction Disorder," which was eventually included in the Diagnostic and Statistical Manual of diseases (DSM-5) under conditions for further study [1, 2]. It is associated with poor physical health, poor academic performance, and interpersonal problems even often begins during adolescence. The close association between the internet and the smartphone led to the introduction of a new condition called "Smartphone Addiction," and has become a more serious problem Griffiths [3]. Reported in other terms like "Problematic Smartphone Use" and "Smartphone Use Disorder", this is a behavioral addiction characterized by the presence of symptoms of tolerance, salience, mood changes, and dependence on smartphones.

2019 International Journal of Environmental Research and Public Health study found college-age individuals already spend an average of between eight and 10 hours a day on smartphones alone [4]. A recent Deloitte study found that 60 percent of U.S. adults ages 18-34 admitted to smartphone overuse [5] Recent studies have revealed a high prevalence of smartphone addiction in university students, ranging from 34% to 40% in medical students in various states of India [6-11]. With screen usage increasing as time progresses, students have begun spending more and more time focusing their attention on screens [12]. This time spent sitting and viewing a screen has been linked to sleep disorders [12, 13]. Lifestyle influences from increasing access and use of screen-based media devices have been shown to contribute heavily to the detrimental sleep hygiene of individuals of any age group. Screen time use prior to bedtime or even after lights-out is a common habit among many young adults. However, this unhealthy habit

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may lead to delayed bedtime, sleep loss, irregular sleep-wake patterns, poor sleep quality, and increased tiredness during the day. In addition, media content or games might induce pre-sleep hyperarousal [14].

The research shows that it actually wakes you up, making you feel more alert, less sleepy, and more likely to delay even trying to go to sleep. You know that delicious feeling you get when you're reading a book in bed, and your eyes start to droop, and then you reach over and turn out the light to go to sleep? Looking at a screen at night will cause the reverse. You'll get more awake, stay up later, and kick yourself for doing it the next morning when you wake up exhausted.

Assessment of sleep quality and sleep hygiene has been an active area of research for a long time. Researchers have found an association between smartphone use and poor sleep quality, triggered by receiving text messages and phone calls, exposure to blue light from phone screens while surfing on the Internet or social media, listening to music, presence of violence and sexual content in the media, etc. [15].

Checking the phone stimulates our brain so we are more active and awake. Even just a quick check can engage our brain and prolong sleep. What can make this habit even worse is feeling the need to constantly be connected and available. There seems to be a constant idea that we have to immediately answer, respond, post or scroll. The smartphone era has forced us to feel like we can never really log off, even when we're sleeping. Sleep is not just 'time out' from our busy routine. Sleep is a biological imperative critical to the maintenance of mental and physical health. It is a state of lessened consciousness and decreased physical activity during which the organism slows down and repairs itself [16].

Epidemiological studies have demonstrated the high prevalence of sleep complaints in adults with as much as one third of the population reports difficulty sleeping [17]. Medical students may not consider sleep as a top priority in the context of their academic requirements as they reduce their sleeping time to have extra hours for studying and workload. Poor sleep quality, sleep related problems and abnormal sleep habits have been reported in medical students with a prevalence ranging from 37% to 59%. [18-21]. Recent data have suggested that sleep is important for cognitive processes such as memory consolidation and learning [22] and sleep deprivation results in sleepiness and impaired neurocognitive and psychomotor performance [23]. Educators have started exploring an important relationship between sleep patterns with learning abilities and consequent academic performance [24-26]. Since sleep plays a significant role in the cognitive processes as well as physical and mental health [27, 28], sleep deprivation can affect the academic performance of medical students as reported in recent literature [29-31].

It has been demonstrated that the metabolic activity of the brain decreases significantly after 24 hours of sustained wakefulness [32]. The main effects of sleep deprivation include physical effects (sleepiness, fatigue, hypertension) cognitive impairment (deterioration of performance, attention and motivation; diminishment of mental concentration and intellectual capacity and increase of the likelihood of accidents at work and during driving) and mental health complications. Inadequate rest impairs the ability to think, to handle stress, to maintain a healthy immune system, and to moderate emotions. Medium- and long-term effects of sleep disturbance (by disorders and/or by stressors) on the health of adults were reported in a WHO technical meeting on sleep and health. The consequences of insomnia can be behavioral manifesting in poor performance at work, fatigue, memory difficulties, concentration problems, car accidents, psychiatric problems - depression, anxiety conditions, alcohol and other substance abuse, medical - cardiovascular, respiratory, renal, gastrointestinal, musculoskeletal disorders, impaired immune system function and an increased risk of mortality.

1.1. Context and relevance of the Study

Confined in homes during COVID-19 lock down, we are living through a period where technology is in many regards the only connection to normalcy. Preliminary reports indicate increased statistics surrounding screen time during the COVID-19 pandemic as more people are confined to their home and using technology to proceed with life [4]. Also due to significant disruption in routine, nocturnal media use has been increased.

Over the last 3 months of the COVID-19 pandemic sleep changes are just one of the innumerable daily activities that have been impacted by the virus. In a report from late March 2020, by the makers of Fitbit (TM), they found that their sleep tracker app was reporting major changes in sleep patterns of millions of adults globally [33]. The sleep foundation states [33] that, millions of people suffered from insomnia before the coronavirus, and unfortunately, the pandemic creates a host of new challenges even for people who previously had no sleeping problems. Researchers have begun to study other more ominous changes in sleep patterns. Various sleep study centers around the world reported increasingly strange and vivid dreams from those who entered their second month of stay-at-home orders. They reported: *"A growing group is experiencing insomnia, an inability to fall asleep. Both seem to be symptoms of stress, part of the shared anxiety surrounding the COVID-19 pandemic. These are typical anxiety dreams and it's acted out with vivid imagination in dreams."* This is of concern, since sufficient sleep is crucial for healthy somatic, cognitive and psychological well-being.

The explosion of technology and excessive screenification in this unprecedented situation has many apprehensions about the pandemic's negative impact on this vulnerable population of young adults. Problematic screen time refers to online consumption patterns which are accompanied by symptoms of excessive exposure to screen [34]. A core component of problematic use of any screen media is that use must cause dysfunction in a person's life [35]. For university students, a key area of functioning is their academic performance. Sleep, learning capacity and mental well-being can be postulated to be affected by media use and can in turn lead to poor academics. From the educator's perspective, this study aims to investigate the effects of excessive mobile-phone use and screen time on new occurrence of sleep problems in university students during COVID-19 pandemic lock down.

Although the associations between electronic media use and sleeping problems seem quite consistent in the literature, the mediating effect of physical activity has not been well studied in this context. Thus, another purpose

of this study is to determine if physical exercises have a positive effect on sleep disorders which have occurred during CoVID-19 lockdown. **The specific objectives outlined in the study are**

1. To analyze the pattern of digital device use during lockdown
2. To analyze the effects of excessive screen time on sleep
3. To determine if physical exercises have a positive effect on sleep disorders.

2. Methodology

It was a cross-sectional qualitative study conducted during COVID-19 lock down period (April to June 2020). Ethical clearance was obtained from the institutional review board of K.J. Somaiya college of Physiotherapy, India. All the undergraduate (I –IV year) students, interns, postgraduate Physiotherapy students enrolled at the academic institute - K J Somaiya College of Physiotherapy, Mumbai, India were invited to participate in an online survey. The participants were also informed about the voluntary nature of participation and that non-participation would not bear any academic consequences. An electronic consent was obtained from the students for participation. Participants were excluded if (i) they refused to participate in the study; (ii) had any health problem that temporarily or permanently prevented participation in physical activity; (iii) used any type of medication that could induce changes in the study variables (e.g., opioids or antidepressants). The target population was recruited by a non-randomized convenient sampling method and is representative of students available on social media platforms. Sample size was not estimated prior to the study. However, a maximum number of participants was desirable as well as anticipated in view of relevance of this topic to students in the current situation; and the beneficial use of social media as a method of data collection.

A questionnaire was developed by de-novo as a part of this study. The questionnaire includes student’s academic profile details and other sociodemographic and behavioral characteristics of including age, sex, etc. Students self-reported their usage pattern of any screen-based mobile device (mobile phone, tablet, laptop, television etc.). Sleep variables were derived from self-reported sleep patterns pertaining to sleep latency, sleep duration, use of sleeping medication, daytime dysfunction, and quality of sleep. Sleep quality was assessed using four standardized dimensions from the Swiss Health Survey: difficulty falling asleep, sleeping restlessly, waking up several times during the night and waking up too early in the morning. Students were asked how often they have encountered these sleep quality problems during the last 2 months using a four-point Likert scale (*Never, Rarely, Sometimes, and Often*). Students were also asked about their physical activity during the lockdown. This included what type of exercises they did and how it affected their sleep pattern and sleep quality.

The questionnaire is self-administered and in English language. It is semi-structured with a combination of open and close ended-questions (includes multiple choice and ranking Likert-scale style questions). Content validity of the questionnaire was established from two experienced Physiotherapy teachers. The questionnaire was distributed to the participants as Google forms via social media on Whatsapp; and was emailed, if requested by them. Link to the forms was available to them for a period of one week. Reminders were sent to ensure maximum participation. Data thus collected was subjected to analysis. Data reported in this study were a part of a wider project designed with multiple purposes regarding the impact of screen time in Physiotherapy students, and other data with different purposes will be presented elsewhere.

3. Data Analysis and Results

All the responses obtained via Google-forms were screened. Inaccurate or incomplete responses were discarded from the analysis. The close-ended data was analyzed automatically using Google spread- sheet and descriptive statistics using percentage and frequency distribution was performed. The open-ended questions were analyzed using categorization and thematic analysis.

Approximately one third of the invited participants completed the survey. A total number of 150 completed forms were analyzed. This study sample is representative of students from all academic years from I B.P.Th. to IV B.P.Th., interns and postgraduate students with majority being from the II B.P.Th. The mean age of the participants was 20 years (SD) and 92% were females.

3.1. Screen Time Use in the Time of COVID-19

Screen time is the amount of time that is spent using a device such as a smartphone, computer, television, tablet, iPhone, laptop, or video game console [36] Table 1 and accompanying pie charts (figure 1 and 2) show the usage pattern of digital devices during the lockdown by study participants.

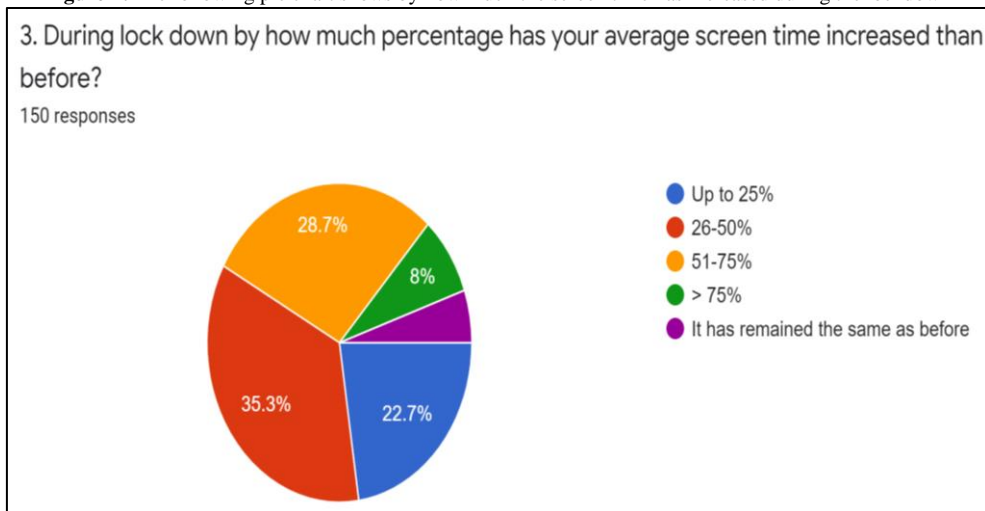
Table-1. Usage pattern of digital devices in the lockdown by the participants

Mobile phone	Tablet	Laptop	Computer	Video game console	Television
98%	7.3%	28%	3.3%	1.3%	48.7%

Figure-1. The following pie chart depicts the number of hours spent on the digital devices by the participants



Figure-2. The following pie chart shows by how much the screen time has increased during the lockdown



All the participants reported using at least one screen based mobile device, smartphone being the commonest device followed by television and other portable digital devices. It can be seen that with the evolution of mobile phones to smartphones and by encompassing all of the internet features and mobile applications, the technological usage discussed above have been shifting gradually to smartphones. Multiple device use in varied combinations is also reported by the participants.

For 94.7% students screen time use had increased during the lockdown, the extent of increase being moderate or high for nearly two thirds of the population. 43.3% of student participants spent more than 6 hours on digital devices on a daily basis. Due to significant disruption in routine during lock down, nocturnal media use has been increased. The vast majority of students have access to the internet, and many have social media profiles. Participants reported using screen time for activities ranging from entertainment (40%), educational purposes (34%) and social networking and communication (30.6%).

These findings are in accordance with some preliminary reports suggesting that during the pandemic Tech use has increased tremendously among the younger generation and students. With more people having to stay at home, people's use of the internet for entertainment and social networking accelerate globally as evident from the statistical metrics published by various commercial media agencies such as YouTube, Zoom, Amazon, Netflix, Facebook, digital game distributors, etc. and other national broadband networks and mobile applications [37-39]. In the current situation of social distancing, we can harness our capacity to interact socially online to enable social support and social connectedness, and tackle loneliness, whilst physically distancing ourselves from others. Research shows that social media and video games provide temporary escape from real life and offer valuable social engagement. Along with these purposes, use of screen time for various personal and professional skill development activities reported by 34% of the students is a promising behavior towards their education.

3.2. Nocturnal Use of Digital Device

Due to significant disruption in routine during lock down, nocturnal media use has been increased [33]. While describing the pattern of nocturnal use of digital devices, 29.3% mentioned that they switch off or use their devices in flight mode during night; whereas 66% use it within the hour they go to sleep and an additional 20.7% compromise their sleep to use their electronic devices. When asked about measures taken by them to avoid the ill-effects of excessive nocturnal screen time, 28.7% used applications that filter out blue light; 22.7% used their

devices in a well lit room, and a few reported use of 'dark mode' so as to avoid damage to the eyes. 42.7% of the population used their devices in a dark room and an additional 4.7% did not consider taking any precautionary measures.

3.3. Effect on Sleep Pattern (Table 2)

Majority of the students reported a change in their sleeping hours, 53.3% reported increased whereas 4.7% reported decreased sleeping hours during lockdown. As per the hours of sleep recommended for young adults by the National sleep foundation, the number of sleeping hours was less than recommended (less than 6 hours) for 10%, normal (6-8 hours) for 44.7% and at the other end it was more than recommended (11 hours) for 45.3% of the surveyed population. 57.6% also revealed a shift in the sleep-wake cycle while 30.7% of the population disclosed that their sleep-wake cycle has been irregular on a day to day basis. These findings are similar to a survey [40, 41], conducted at the University of Basel, Switzerland, and the university's Psychiatric Hospital during the Covid-19 lockdown. Out of the 435 individuals surveyed; most reported sleeping more regularly and 15 minutes longer on average while sleep quality deteriorated.

3.4. Sleep Quality (Table 2)

The present survey revealed that around 64% students encountered sleeping problems in the lock down with 16.7% students having experienced it often, 30% of them having experienced it sometimes and 17.3% of them rarely experiencing it. Majority of the student participants reported a change in their sleeping pattern and quality; and also, encountered various sleeping problems as summarized in table 2. When faced with anxiety or stress, 40% reported decreased sleeping hours, 33.3% sleep less and 1.4% of the population experience irregular sleeping patterns. Around 52% people admitted that excessive screen use has affected their sleep quality and linked it to sleeping problems such as reduced sleep durations with mobile phone use-awakenings. Some students even said if they woke up during the night they would check their devices before going back to sleep. Our findings can be supported by an article published by Harvard medical school which states that The National Sleep Foundation's most recent Sleep Health Index found that people who used technology such as phones, tablets, or computers in bed before they went to sleep scored lower on measures of sleep quality than those who did not [42]. Nearly 50% of American adults polled said they used technology in bed at least once a week, and nearly 30% said they did so every day. The National Sleep Foundation says to ensure the best sleep quality, it's best to leave digital distractions for the daytime hours and keep them out of bed.

Table-2. Sleep problems during the lockdown reported by the participants

Sleep problems	Percentage of Participants
Sleep more	53.3%
Sleep less	4.7%
Altered sleep-wake cycle	56.7%
Irregular sleep-wake cycle	30.7%
Problems to fall asleep	31.3%
Restless sleep	16.7%
Involuntary awakenings during night	12%
Too early morning awakenings	8.7%
Awake from sleep with palpitations in chest feeling heart pound or beat irregularly	4.7%
Need to take medication for sleeping	1.3%

White *et al.* indicated that "Mobile Phone Problem Use Scale" is related to poor sleep quality, but not sleep length in American college students [43]. Young Swedish adults surfing the internet, texting and calling through smartphones had an increased risk of developing sleep disturbance. However, a Chinese study on 791 secondary school adolescents showed a weak correlation between screen time duration with sleep quality, duration, and daytime sleepiness [44].

It has been found that the use of screen time affects sleep through several mechanisms. The following hypotheses and studies explain the association of media use and sleep affection.

3.5. Time Displacement of Sleep

This time-displacement mechanism is particularly powerful when screens are used at night, when sleep is most likely the activity being directly offset [45, 46]. Electronic media use might displace sleep, since there is no fixed start or end time to electronic use and with the convenience of using a smartphone in bed, the time may fly without noticing. According to Lemola *et al.*, adolescents who owned smartphones were more likely to go to bed later, with the sleep duration not being affected [44]. Screen media use can lead to behavioral bedtime delay, as individuals can postpone bedtime to prolong screen entertainment and displace the time that would otherwise have been spent sleeping [47].

3.6. Nocturnal media Use and Sleep [48]

Sleep quality can be negatively affected by engaging with smartphones before bed [49] and using digital media close to bedtime has been shown to negatively impact both quality and quantity of sleep [48]. A longer duration of digital media use was associated with reduced total sleep time and later bedtime, while greater diversity of digital media use was associated with increased total sleep time and earlier bedtime. Analysis of activities in the last hour before bedtime indicated that activity type plays a role in digital media's effect on sleep, with computer work, surfing the Internet, and listening to music showing the strongest relationship to multiple sleep variables.

3.7. Psychological Stimulation From Media Use Disrupting Sleep

Research has found mixed results regarding the effect of screen media use before bed on psychological, emotional, and/or physiological arousal, but this relationship likely mediates some effect of screen media use on sleep. The positive or negative health effects of screen time are influenced by levels and content of exposure. Generally a linear relationship with detrimental effects on sleep pattern and general health with increasing media use has been reported. There is no consensus on the safe amount of screen time for adults. Ideally, adults should limit their screen time similar to children and only use screens for about two hours a day.

There are several studies suggesting that smartphone use at night is associated with altered sleep patterns and sleep disturbances are associated with frequent smartphone use among adolescents [50]. Excessive mobile phone use has been linked to sleeping problems such as reduced sleep durations with mobile phone use-awakenings (at least once per month) associated with more exhaustibility and daytime tiredness reported by 20.1% to 43.3% adolescents [51]. In yet another study [52], night-time screen based mobile device use was associated with a high risk of poor health related quality of life and sleep outcomes. The magnitude of these associations was stronger when its use occurred in darkness [51]. Many of us now live in a world where we have access to electricity 24 hours a day. However, a growing body of research indicates that exposure to light rich in blue wavelengths during evening hours can be detrimental to sleep quality.

In adolescents' studies, it's been observed that the screen content impacts sleep as well. Content that stirs emotions has been linked with a delay in the onset of sleep. Impaired sleep quality is a result of psychological and somatic arousal; and cognitive over-activation through the media content.

Most studies have focused on the quantity of screen time, rather than taking a more nuanced approach to various different types of screen-based activity [53]. There are mixed results regarding whether the type, size, or interactivity level of the screen affects sleep outcomes. The rise in interactive media options may increase the impact of media use on sleep, as some studies have found that interactive screen media use (e.g. video games and mobile devices) may have a greater impact on sleep than passive use, such as watching television. Video games, particularly violent games, are often thrilling for enthusiasts, typically simulating life-or-death experiences requiring players' full attention to succeed. Violent videogame play before bed increases arousal compared to nonviolent gameplay. In another controlled experiment, playing an "exciting" video game was associated with increased heart rate, slightly delayed sleep-onset, and decreased REM sleep, further suggesting that the effect of screen use on sleep is mediated via arousal. However, some studies have shown that arousal is a likely mediator of sleep problems even in non-violent media use.

These findings suggest that modifying media content may be another effective means of protecting sleep. A change in the media exposure away from violent and towards educational and prosocial content would be beneficial for overall outcome.

3.8. Exposure to Bright Light of Electronic Media

Most smartphones, televisions, computers, and increasingly, domestic light bulbs, are lit by light emitting diodes (LED) sources that are enriched in short-wavelength light of ~460 nm [54]. This bright light from screens suppresses melatonin production, altering aspects of the circadian cycle and increasing mental and physiological arousal. Exposure to artificial light in the evening, when our circadian timing system is most vulnerable to light, has the capacity to modify rhythms and thus sleep and neurobehavioral function. Recent work has demonstrated that evening exposure to LED-backlit computers and self-luminous personal devices such as tablets can suppress and delay melatonin secretion, decrease sleepiness, prolong sleep initiation, and worsen sleep quality [55]. The use of personal light-emitting electronic devices is nearly ubiquitous, with most students reporting continued use within the hour before bedtime. Thus, poor sleep and insomnia can be attributed to light emissions of screens from electronic media and especially their nocturnal use and without precautionary measures as discussed previously.

3.9. Factors Affecting Sleep Pattern During Lockdown

When asked about the factors affecting sleep, participants could identify some internal and external factors. When asked specifically if screen use is affecting their sleep pattern, 52% agreed for excessive screen time and mobile phone use during bedtime, late night use causing sleep problems.

In addition, during lock down, with disruption in the routine and other lifestyle changes such as sedentary behavior, consequent changes in circadian rhythm may have occurred. As a consequence, the natural day-night rhythm could have shifted towards later bedtimes and morning awakenings, resulting in a social jetlag. Due to relaxation in social rhythms the sleep-wake patterns are guided by internal biological signals rather than social rhythms. Changed routine was the frequently listed factor reported by 48%, described in other words as relaxed social rhythm, freedom of time and activity schedule with no obligations, untimely naps, along with laziness and

lethargy, etc. P17: “Because there is no motive or basically a rush for tomorrow work, it has changed my sleeping pattern”

Usually, we would expect a decrease in social jetlag to be associated with improved sleep quality, however experts from neurosciences and psychology believe that the self-perceived burden, which substantially increased during this unprecedented COVID-19 lockdown, may have outweighed the otherwise beneficial effects of a reduced social jetlag. While sleep-affecting stress could be caused by something as simple as our ever-changing routines as we work from home, anxiety about the virus and economic woes can also be affecting our sleep.

“Psychologically, it is believed that nightmares are dreams that pertain to stressful issues that we have not been able to resolve [56]. During the COVID-19 pandemic, many people are experiencing vivid dreams and nightmares as they face fear and uncertainty about the future. This is a normal human reaction.”

As well as negatively impacting the adult sleep cycle, using screens can also affect one's mental and physical health. These mental health issues (20%) including lack of motivation and academic pressure (6%). According to our study, 87.3% participants reported one or more health symptoms as shown in table 3. 48% of the students believe that excessive hours spent in front of the screen has affected their physical well-being. If someone does not get an adequate amount of sleep, it can affect their behavior and performance for the day. Feeling of tiredness (44%), exhaustibility (26%), lack of energy (42%) along with less motivation (65.3%) as reported by the student participants could be interfering not only with their normal daily activities but with academic performance as well. Previous studies have shown that there is a negative relationship between screen usage, sleep and academic performance [15, 49]

Sedentary behavior and lack of physical exertion was reported by 17%, changed eating habits by 12.2%, which all play a role in the quality of sleep.

P141: “Our daily routine normally involves a lot of physical as well as mental activity and lots of alertness throughout the day which has decreased drastically now and so lack of tiredness ...we need less rest now”

27% of students could not identify any cause for their sleep alteration. There are few more factors that may be changing the sleep we are getting (not reported by any study participants). Spending too much time inside can mean missing out on the environmental cues that help us to reset our biological clock. Often these cues are light based, known as zeitgebers, and the loss can be more pronounced if the environment of the individual does not have a lot of access to natural light.

According to this survey, on an average 97% of the students have had no exposure to alcohol, smoking / second hand smoking or any kind of medication or drug consumption that affects one's sleep quality. However, 39.3% of the students have had regular exposure to caffeine and this could have acted as a confounding factor for this part of the sample.

Table-3. General health problems reported by students

Symptom	Percentage of Participants
Lack of concentration	60.7
Tiredness	44
Lack of energy	42
Eye strain	32
Headache	31.3
Weight gain	29.3
Exhaustion	26
Body pain	22.7
None	12.7

3.10. Physical Exercises

Many of the concerns around screen use relate to sedentary (or inactive) behavior. The idea being that time spent in front a screen is time that is not spent exercising or doing other forms of physical activity. Sedentary behavior may be associated with poorer physical health, wellbeing, and mental health.

65.3% of the students have been taking part in physical exercises regularly (minimum 3-5 days a week). The type of physical exercises performed by the students included aerobic exercises - 44%, Yogasana - 27.3%, Pranayama - 18.7 %, Resistance training - 23.4%, indoor walking - 2.6%

The study throws light on the fact that physical exercises could be a mediating factor for effect on sleep pattern. According to the study, the majority of the exercising participants experienced beneficial effects due to performance of physical exercises. 65.27 % reported decreased sleeping complaints, 44.3% participants reported better sleep quality on the day they exercise and 19.5% noticed that working out in the evening helped them sleep better at night. On the other hand, 7.4% participants felt more tired and needed to increase sleep time in order to exercise while 2% tended to skip exercises on the day if they didn't get adequate hours of sleep at night. 29.7% participants found no difference in their sleep quality due to exercises.

Exercise has long been associated with better sleep, and evidence is accumulating on the efficacy of exercise as a nonpharmacologic treatment option for disturbed sleep.

With poor sleep and physical inactivity each recognized as key public health priorities, additional research into the bidirectional relationship between exercise and sleep has significant implications for facilitating greater exercise adherence and improving sleep in society [57].

The National Sleep Foundation states that regular exercise, particularly in the morning or afternoon, can impact our sleep quality by raising our body temperature a few degrees. Later in the day, when our internal thermostat drops back to its normal range, this can trigger feelings of drowsiness and help us drop off to sleep. Also, if we exercise outdoors, we will be exposed to natural light, an important element in helping our body establish a good sleep-wake cycle [58].

A recent meta-analysis of six studies found that exercise training resulted in modest improvements in subjective sleep quality in middle- to older-aged adults with sleep problems. As a prominent example, Reid and colleagues found that 4 months of aerobic exercise training in a sample of older adults with insomnia significantly improved sleep quality while also reducing daytime sleepiness [59]. Thus, exercise may hold the most promise for those with more severe or more chronic sleep disturbance.

Research from 2017 indicates that active technologies, such as app notifications, emails, and wearable technologies that promote exercise may reduce short-term sedentary behavior. This could help people set healthful patterns and become more physically active. During the lockdown, mobile-based health and fitness apps for helping exercise and stay active indoors have seen a massive surge in downloads. According to the App Annie report, the downloads of fitness apps went up to 45% globally, between March 22 and 28 compared to the weekly average in January and February [60]. Interestingly in India, the number of consumers spent on fitness apps jumped 60%, the most anywhere in the world. Such a commercial promotion of applications for health benefits with digital workouts could be attracting the young adults to indulge in fitness behaviors. However, their potentially influential effect was not considered in the present study.

4. Discussion

This is one of the few cross sectional studies on electronic media use and sleep which included smartphone use. As an asset of this design, we were able to explore different exposure-response relationships to draw inferences from electronic media use to sleep problems. The present study contributes to the growing literature highlighting the associations between screen use, in particular to sleep outcomes. In addition, this study also attempts to determine the mediating effect of physical exercise on ill effects of screen use. To our knowledge, this is the first study which has explored the impact of technology use on university students in the context of this pandemic lock down.

Majority of the students reported screen time to have increased during lock down and to have affected their sleep pattern and sleep quality along with a new occurrence of sleep problems in lock down. Also, mental and physical health issues have been reported. Along with changes in circadian rhythm, lifestyle influences from increasing access

The identified research indicates that screen time has affected sleep in a particular population of university students and exercise is beneficial for sleep quality. In agreement with previous studies, the relationship between screen-time behaviors and physical activity is complex and not always consistent, which could be attributed to the implication of other uses of the smartphone and other related outcomes (e.g., sleep patterns or other sedentary behaviors). It is clear that additional research is necessary particularly because of the variance of these findings between study populations and to further explore the benefits pertaining to different types of exercise interventions.

However, we acknowledge several limitations of the study. Particularly, the lack of objective screen time data is of concern. Students self-reported information on media use and sleep variables might generally be biased by recall and subjectivity. In addition, the assessment of the sleep quality via a four item self-reported questionnaire is limited although the scales are commonly used. Adequate sleep duration varies greatly individually, and the subjective time-related measures of problems falling asleep and waking up too early might consider this factor. A promising approach for future epidemiological research might be the assessment of sleep duration and quality, as well as mobile phone use via mobile applications. Also, uncertainty due to various psychosocial factors arising during this pandemic situation has resulted in various mental health issues in the general population. Owing to the cross-sectional nature of this study and to the dynamic and complex interaction of the multiple factors viz. screen time, sleep, mental health and physical health we cannot separate the individual contribution of each factor. Excessive screen time as a contributor to sleep problems and other issues thus needs to be interpreted in a broader context. Future longitudinal studies are recommended to further explore this relationship.

5. Conclusion

Overall, this study shows that use of screen based digital devices and media use has significantly increased during COVID-19 pandemic lock down in Physiotherapy students and provides scientific evidence for its negative impact on sleep. These findings are useful, not only for exploratory purposes, but also for information on behavior patterns that may contribute to establishing recommendations about the timing and duration of the screen media usage in physiotherapy students and the appropriate sleep time needed to maintain good mental and physical health and to meet academic demands successfully. In addition, these findings may contribute to improving interventions targeted to affect behavior change. This study also found the mediating effect of physical activity as physical exercises were associated with a positive effect on sleep disorders which have occurred during CoVID-19 lockdown.

6. Implications

Students obligated to view screens for a means of studies may not be able to use screen time less than recommended, but there are other recommendations that help mitigate negative health effects. Instead, we encourage smart use of technology that takes advantage of its conveniences and counteracts the side effects caused by overuse. Through these study findings, we aim to implement better and healthier practices by sensitizing students about the

negative effects, encouraging better bedtime routines, and limiting the device use for academic purposes with alternative sources and strategies. At the same time they could be educated about the positive effect and importance of physical activity in the lockdown.

We would like to conclude with a statement by a participant

P35: "Some entertainment with learning should be promoted. For being mentally healthy and studying at the same time, especially during this crisis".

We recommend students to utilize the screen time productively!

Declaration Statements

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Conflict of Interest

Authors declare no conflict of interest.

Availability of Data and Material

Data is available from the corresponding author upon request via email.

Authors' Contributions

All the authors have contributed in the design and conduct of study; and in writing this manuscript.

Ethics Approval

Institute review board approved the study.

Consent to Participate

An informed consent was obtained from all the participants before their participation in the study.

Consent for Publication

All the authors have given their consent for publication of this article.

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