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Impact study of smartphones on the sleep cycle of students in Georgia

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Abstract

The dawn of the 21st century heralded a new era where the traditional desktop computers, and pagers, became obsolete and smartphones became ubiquitous around the world. Everybody jumped into the tech bandwagon and each one started to get one phone for themselves according to their predilections. The rise of YouTube, Facebook, WhatsApp, and later followed by TikTok, and Instagram all happened during this time. The internet suddenly boomed with various types of content and people began consuming it. This eventually led to the concomitant increase in screen time and desk-bound behaviour. Insomnia, Sleeplessness, and various other disorders have been on the rise. The goal of the study is to investigate how young people use technology, including how much time they spend using it, why they do it, and how it affects their lifestyle. The detrimental effects of blue light on our eyes and brain are what we are focusing on in this report. In this study, we have used non-probability sampling and distributed structured questionnaires to collate data on the deleterious impact of smartphones on the sleep cycle of students. The results are evaluated considering the most recent theories, and future implications are noted.

Keywords: Smart Phones, Sleep Quality, Pittsburgh Sleep Quality Index.

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Introduction

Sleep is one of the most sacrosanct elements in our lives which is responsible for the preservation of several physiological systems (Cox and Olatunji, 2016). Students especially undergrad students are often seen having insomnia, fatigue, tiredness, and lethargy due to lack of good sleep and rest. The abusive usage of smartphones has led to smartphone addiction at a rapidly alarming pace (Rideout & Robb, 2018). The much vaunted "Smartphones and Tech-Boom" is now posing a humongous threat to the very basic need of man which is a good night's sleep. The circadian rhythm—our body's natural internal clock—is being interfered with by the electromagnetic waves and blue light that cell phones emit (Crowley et al., 2015). Both non-REM and rapid eye movement (REM) sleep is affected.

According to a study by (Sharma et al., 2010), medical students had greater rates of smartphone addiction and worse sleep quality. Poor sleep quality has now emerged as a new public health problem around the world. The amount of people waking up refreshed is low. Almost everyone falls asleep watching either Instagram reels, TikTok, or YouTube shorts which is harming their health adversely. Smartphones have become double-edged swords empowering and equipping people with content and information on one hand and leaving people wanting in sleep on the other. The growing salience of sleep problems has had a significant impact on society. In our study, we are going to find the impact of smartphones on students in Georgia.

Materials and Methodology

We conducted a cross-sectional study with the students in Georgia. Questionnaires were sent out in April 2024 to conduct our study. We utilized Google Forms to deliver a 14-item questionnaire with the PSQI online for our study. Non-probability, convenience, and snowball sampling techniques were used. The Pittsburgh Sleep Quality Index (PSQI) was included in the questionnaire along with several questions about smartphone usage. The PSQI consists of seven distinct components that were collated initially and then summed to obtain the total PSQI Global score. The questionnaire was distributed with the requirement that it be completed just once to prevent duplicate answers. There were no rewards offered to the study participants. All our participants were anonymous because the survey processes were created keeping students' privacy in mind. Before the questionnaire was distributed to the students, it was created and tested. The PSQI provided the sleep-related questions. The seven factors were medication use, daytime dysfunction, habitual sleep efficiency, quality, latency, length, and disruptions in sleep. These numbers represent a graded score ranging from 0 to 3, and the global PSQI is the sum of these scores. A score of less than five denotes high-quality sleep. A value between 5 and 21 represents poor sleep quality. Inquiries about their smartphone kind, installed apps, and most-used apps were among the topics covered in the questionnaire. Inquiries about blue light filters in their glasses and blue light screen protection were also included. The demographics segment of the survey gathered information on the student's gender, age, nationality, year, and course of study. Incomplete responses were neglected. Every participant's consent was obtained before sending the questionnaire. Microsoft Excel, IBM's SPSS Software, and Google Sheets were utilized to identify the various relationships between the variables. Each variable's frequencies have been computed.

Review of Literature

A substantial number of studies have been done by scholars and researchers globally correlating the excessive overuse of smartphones and its adverse effect on the sleep cycle (Lund et al., 2021). Recent data indicates that 65% of people living in the United Arab Emirates (UAE) do not get enough sleep. Researchers believe that smartphones cause more disruptions to sleep than other types of media (Kim et al., 2020).“A systematic review and meta-analysis conducted by (Carter et al., 2016), reported a significant association between the use of screen media devices in the sleep environment and insufficient sleep quantity, poor sleep quality, and excessive daytime sleepiness.” A subsequent longitudinal study revealed that smartphone use negatively affected teenagers' sleep quality, especially on school days, corroborating this conclusion (Schweizer et al., 2017). A comparable study examining the effect of mobile phone use on sleep in Japanese adolescents discovered a correlation between increased use of mobile phones after lights out before sleep and reduced sleep length, quality, insomnia, and excessive daytime drowsiness (Munezawa et al., 2011). A second cross-sectional study was conducted at the Postgraduate Institute of Medical Education and Research in Chandigarh and the All-India Institute of Medical Sciences in New Delhi. Researchers discovered that 128 (22.61%) of the 566 participants had a PSQI of ≥5, indicating poor sleep quality as a result of excessive smartphone use (Sinha et al., 2022). A link between smartphone use and anxiety, depression, and sleep problems, was found among polytechnic students by (Kulkarni et al., 2020).

Results

Demographics of the study population: The following Table 1 elucidates the demographics of our sample population. Smartphone usage and types: -Android (63.6%) outpaced iPhone (34.1%) in terms of utilization with 2.3% using both.

Table 1. Demographics of sample population

Characteristic	Count	Percentage (%)
Total Participants	110	
Gender		
Female	66	60
Male	43	39.1
DK/NA	1	
Age Group		
18-20	22	20
21-23	61	55.5
24-26	26	23.6
DK/NA	1	0.9
Course		
Medicine	93	84.5
Others	14	15.5
Year		
3^{rd} year	51	46.4
4th year	20	18.2
Others	39	35.5
Nationality		
Indian	77	70
Others	33	30

Table 2. **Social media apps that you use more frequently, Purposes of Smartphone use**

Social media apps that you use more frequently	Percentage (%)
Tumblr	0.9%
Tiktok	9.1%
Whatsapp	20.9%
Instagram	42.7%
Youtube	25.5%
Purposes of Smartphone use	
For educational purposes	91 (82%)
For entertainment purposes (netflix, insta, etc)	98 (88.3%)
For communication (gmail, whatsapp, messenger, etc.,)	102 (91.9%)
Work	33 (29.7%)
Don’t know or refuse to answer	1 (0.9%)
PSQI Central Tendency	
Valid	110
Missing	1956
Mean	7.32
Median	7.00
Mode	4[a]
Std. deviation	3.558
Variance	12.659
Range	18
Minimum	1
Maximum	19

[a] Multiple modes exist. The smallest value is shown

Daily phone usage varied across participants; most used their phones for five to six hours (28.4%) or longer than 6 hours (32.1%). 80.0% didn't switch off their phone and 19.1% of people turned off their phones 30 mins before bed. Table 2 illustrates the apps that are used more frequently and the purposes of smartphone use. About half (48.2%) of the respondents used blue light filters on their screens whilst 36.4% did not. Among glass wearers (n = 59), 38 used blue light filters.

Over 40 participants reported eye pain after prolonged smartphone Analysis- The central tendency was computed for the global PSQI scores and its components (Tab 2, Fig. 1, Fig. 2). A simple linear regression test was used to check if the no. of hours of phone usage predicted the PSQI value (Fig 3). The fitted regression model was PSQI = 4.98 +0.45*(hours of phone usage). The overall regression was statistically significant ($R^2 = 0.071$, $F (1 – 108) = 8.28$, p-value = 0.004). It was found that the hours of phone usage impacted the PSQI ($\beta = 0.45$, $p = 0.004$). Another regression model in between switching off the phone 30 mins before sleeping and the PSQI (Fig 5.8, 5.9) showed a regression model (7.56 + (- 1.25)). The regression showed an R square value of 0.0199 and F (1 to 108) = 2.196, p-value = 0.14. The value of β=-1.25, p = 0.14. The linear regression between blue light and the PSQI (Fig 4) found a regression where PSQI= 8.170 +(- 1.576) (blue light filter). The R square value for the overall regression is 0.0433 and the F statistic (1 to 108) = 4.891, p-value = 0.02. The β = - 1.576 The linear regression between gender and PSQI (Fig 5) found the regression model PSQI = 7.068 +0.416(gender). For the overall regression, we have an R square value of 0.0033 and F statistic (1 to 108) = 0.359, p-value = 0.54. The β value = 0.416.

ANOVA Findings (Tab. 5): Every component (C1 – C7) has an F-value that is statistically significant ($p < 0.05$), meaning that there are noticeable differences between the groups for every aspect of sleep quality. A large amount of the diversity in total sleep quality is explained by group differences.

The R square value measures the variability in the dependent variable due to the independent variable and the differences in the R square values for the same regression analysis (Fig 1, Fig. 2) conducted between switching off the phone and PSQI is because one graph is a line graph, and the other is a scatter plot. The line graph may be exaggerating the R square value which has scope for future research.

Table 3. PSQI Frequency

		Frequency	Percent	Valid percent	Cumulative percent
Valid	1	1	.0	.9	.9
	2	4	.2	3.6	4.5
	3	10	.5	9.1	13.6
	4	14	.7	12.7	26.4
	5	14	.7	12.7	39.1
	6	9	.4	8.2	47.3
	7	7	.3	6.4	53.6
	8	8	.4	7.3	60.9
	9	12	.6	10.9	71.8
	10	12	.6	10.9	82.7
	11	7	.3	6.4	89.1
	12	2	.1	1.8	90.9
	13	3	.1	2.7	93.6
	14	5	.2	4.5	98.2
	16	1	.0	.9	99.1
	19	1	.0	.9	100
	Total	110	5.3	100	
Missing System		1956	94.7		
Total		2066	100		

Table 4 Central Tendency of PSQI Components

Statistics

		C1	C2	C3	C4	C5	C6	C7	PSQI
N	Valid	110	110	110	110	110	110	110	110
	Missing	2	2	2	2	2	2	2	2
Mean		1.29	1.31	1.28	.45	1.37	.18	1.34	7.32
Median		1.00	1.00	1.00	.00	1.00	.00	1.00	7.00
Mode		0	1	1	0	1	0	1	4[a]
Std. Deviation		1.214	1.011	.940	.874	.689	.578	.901	3.558
Variance		1.474	1.023	.883	.764	.474	.334	.812	12.659
Range		3	3	3	3	3	3	3	18
Minimum		0	0	0	0	0	0	0	1
Maximum		3	3	3	3	3	3	3	19

a. Multiple modes exist. The smallest value is shown

Table 5. ANOVA of PSQI components

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
C1	Between Groups	101.109	15	6.741	10.634	.000
	Within Groups	59.582	94	.634		
	Total	160.691	109			
C2	Between Groups	65.875	15	4.392	9.050	.000
	Within Groups	45.616	94	.485		
	Total	111.491	109			
C3	Between Groups	37.796	15	2.520	4.051	.000
	Within Groups	58.467	94	.622		
	Total	96.264	109			
C4	Between Groups	24.661	15	1.644	2.637	.002
	Within Groups	58.612	94	.624		
	Total	83.273	109			
C5	Between Groups	23.713	15	1.581	5.306	.000
	Within Groups	28.005	94	.298		
	Total	51.718	109			
C6	Between Groups	11.609	15	.774	2.939	.001
	Within Groups	24.755	94	.263		
	Total	36.364	109			
C7	Between Groups	33.911	15	2.261	3.889	.000
	Within Groups	54.644	94	.581		
	Total	88.555	109			

Fig 1. Fitted Line Plot

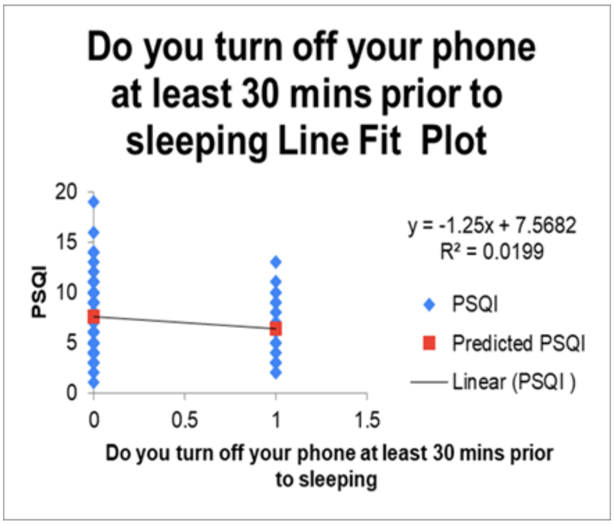


Fig 2. PSQI and switching off the phone line graph

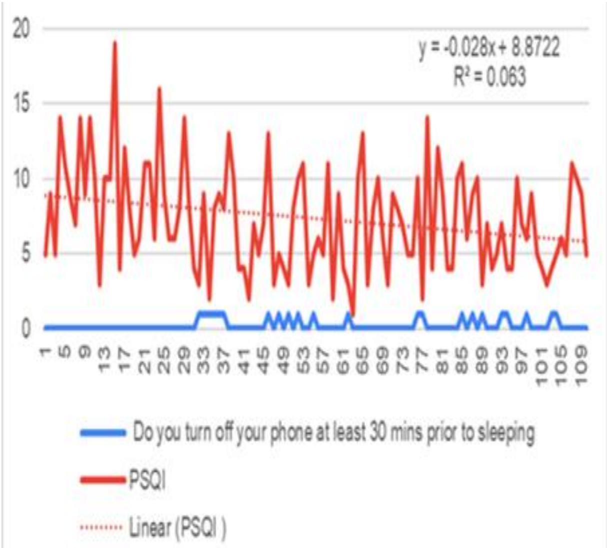


Fig 3. Regression between Phone usage hrs and PSQI.

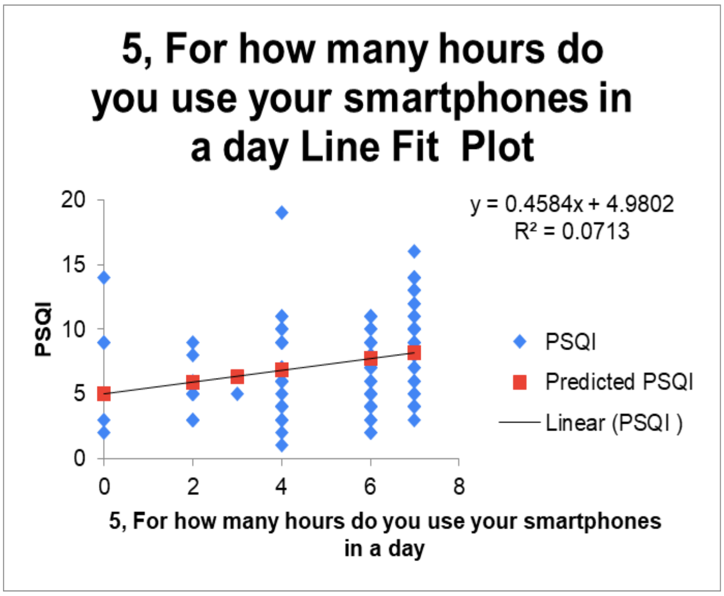


Fig 4. Blue light and PSQI (Regression)

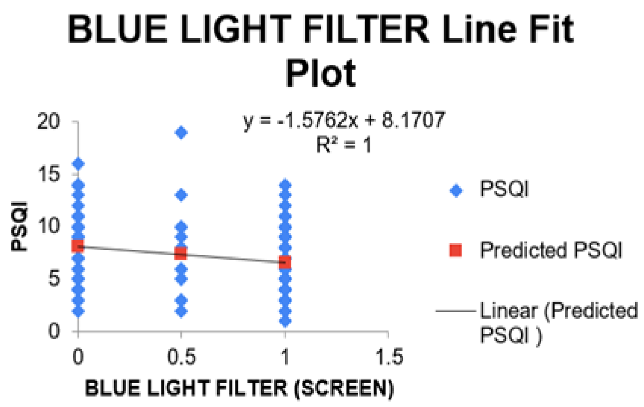


Fig 5. Gender & PSQI (Regression)

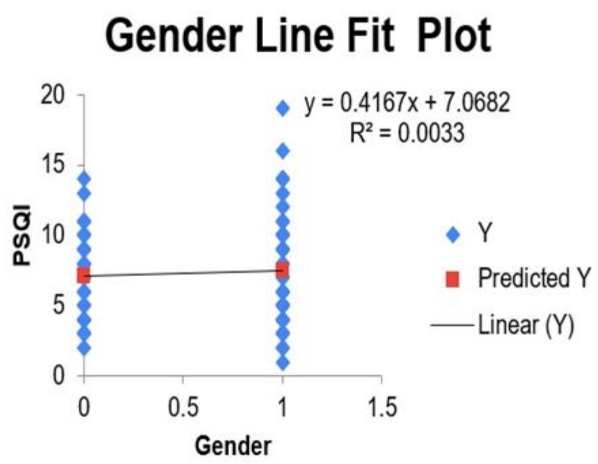
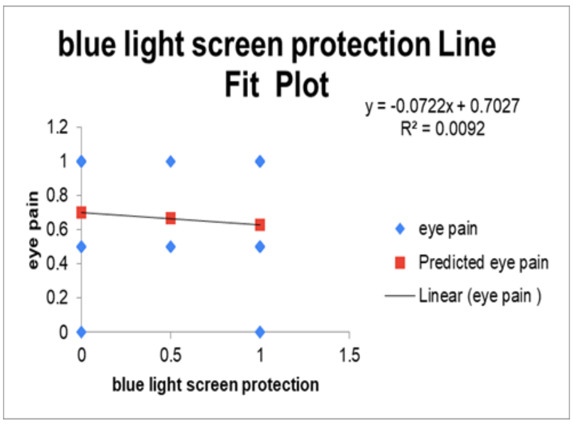


Fig 6. Blue light and eye pain (Regression)



PSQI and Phone Usage (Fig 3): PSQI increases by 0.45 units for every additional hour spent on a phone. The correlation is statistically significant ($p = 0.004$), yet phone usage only accounts for 7.1% of the variation in the PSQI.

Turning Off Phone Before Sleeping and PSQI (Fig 1, Fig. 2): There is a 1.25 unit drop in PSQI measurements when phones are turned off before bed, but there is no statistically significant correlation ($p = 0.14$).

Blue Light Filter and PSQI (Fig 4): The coefficient (-1.576) signifies that the PSQI score decreases by 1.576 points for every unit increase using blue light filters, this link is reinforced by the statistically significant p-value = 0.02.

Gender and PSQI (Fig 5): Women score roughly 0.416 units higher on the PSQI than men do.

Just over 0.33% of the PSQI variance can be explained by gender alone, and the model is not statistically significant (p = 0.54). The regression model (Fig 6) between the blue light filter (independent variable) and the occurrence of eye pain after prolonged use (dependent variable) showed eye pain = 0.702 +(- 0.072) (blue light screen protection), it showed an r square value of 0.0092 and F statistic (1 – 108) = 1. 0075, p-value = 0.31.

Discussion

Out of the sample taken we have arrived at some logical conclusions. Most of the people are suffering from poor sleep with a total PSQI range from 1 to 19.5 with the highest being 19.5 present in these students. This aligns with previous research highlighting the adverse effects of excessive smartphone usage on sleep patterns. Notably, our regression analyses demonstrated a positive correlation between increasing smartphone usage and PSQI scores, affirming the detrimental impact of prolonged screen exposure on sleep quality. The presence of blue light emitted from the phone is said to decrease the amount of melatonin produced in our body therefore decreasing the quality of sleep. Our results showed a concomitant increase in PSQI score in the absence of a blue light filter. This was consistent with earlier research that linked mobile phone use to sleep disruptions induced by light exposure and altered melatonin metabolism (Higuchi et al., 2003). While the correlation between these variables is weak it's better to be safe than sorry. The "always on," "24/7" character of society combined with easy access to media such as television, the Internet, and cell phones may have had a major role in young adults' poor sleep and sleep deprivation (Moulin et al., 2016). Prior research has indicated that using a phone close to bedtime, particularly before bed, impairs sleep quality as measured by the PSQI (Exelmans et al., 2016). In a cross-sectional study involving 9846 teenagers from Norway, 90% of the participants reported using their phones an hour before bed, and this was associated with self-reported sleep onset latency and sleep deficit (Hysing et al., 2015). The same has been shown here in this study, there has been an increased incidence of poor-quality sleep amongst those who fail to switch off their phone at least half an hour before sleeping. This is highly important as these nighttime habits of going through the phone are bad not only for our eyes but also for our bodies. There were a lot of sleep disturbances noticed amongst these people and in general there is a lack of motivation to engage in activities. The association of the blue light and eye pain showed that when there was an increase in the presence of the filter, there was a decrease in the incidence of pain albeit in our study this was not significant. There might be an intrinsic cause for eye pain as well, while that may be true from these findings it's better to take precautions for the better.

Limitations

While our study has covered some of the major topics that have been analysed deeply, we also encountered some limitations, like the sample size for our study is quite small compared to our population. Therefore, the results obtained from this study cannot be extrapolated to the public. Students from all the departments were included, although the majority were from medicine so the significance of the workload of each department on the students' sleep cycle couldn't be found. Since we used a convenience sampling method diminutive amount of bias might be there. Self-reporting bias can affect PSQI because it relies on the distribution of a questionnaire to assess a variety of characteristics in which respondents provide answers that are skewed due to their viewpoints, expectations, and beliefs (Sahin et al., 2015).

Conclusion

In summary, the purpose of our study was to demonstrate that certain people, particularly students in Georgia had poor sleep quality. The implications of our study underscore the importance of promoting awareness and implementing strategies to mitigate the adverse effects of smartphone usage on sleep quality, particularly among young adults. Future research could delve deeper into individual differences, explore the efficacy of interventions such as digital curfews or blue light filters, and investigate potential long-term consequences of chronic sleep disturbances associated with smartphone usage. The goal is to produce a youthful generation that is intelligent, capable, and aware of the positives of having a gadget-free time before sleep.

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