

DELETERIOUS EFFECT OF INCREASED SCREEN TIME AMONG PROFESSIONALS DURING THE COVID-19 PANDEMIC IN INDIA

Clinical Research

Dr. Dwajani. S*	Associate Professor, Rajarajeswari medical college and hospital, Kambipura, Mysore Road, Bangalore, Karnataka. *Corresponding Author
Lavanya Ravi	4 th year medical students, Rajarajeswari medical college and hospital, Kambipura, Mysore Road, Bangalore, Karnataka.
Abhishek Ram S	4 th year medical students, Rajarajeswari medical college and hospital, Kambipura, Mysore Road, Bangalore, Karnataka.
A S Praveena	Department of studies in Statistics, University of Mysore, Manasagangotri, Mysore-570006.
Dr. Allen. P. U	Associate Professor of Practice, Indian Institute of Management Bangalore (IIMB), Bangalore – 560076.

ABSTRACT

Covid-19 pandemic made the government to impose lockdown restricting the movement of the population. Staying at homes throughout the day has led to increased screentime among all the ages of the population considerably. However, our study was conducted to investigate the effect of increased screen time on sleep wake pattern, mental health and overall health and well-being of adults during COVID-19 lockdown. An electronic questionnaire was circulated among the general public and results were obtained through google forms. Questions regarding sleep pattern, depression, screen time were included in the E-questionnaire. The analysis of the data was done using proportion test and Chi-square test. Statistically significant results were also obtained using cluster analysis and represented with the aid of a dendrogram. We found that there exists an association between increased screen time of adults during the lockdown with their sleep pattern, mental health and overall well-being. Adults with increased screen time have experienced mood swings, hazardous effects like eye pain, headache, watering eyes, etc.

KEYWORDS

sleep, screen-time, lockdown, mental health

INTRODUCTION

The WHO declared the outbreak of COVID-19, a public health emergency of international concern on January 30 2020. Indian government eventually called for a complete lockdown in the month of March 2020 due to the increasing cases. Such restrictive lockdown had put an end to social life of everyone and pushed the adults to work from home. Adults working from home inevitably relied on the electronic gadgets like laptops, cell phones etc. As a result, during the lockdown, the screen-time drastically increased.

In this era of competition and work-based life, we are all subjected to various disorders and stress which we may or may not foresee. In a study conducted by K.C Madhav et.al, there was a strong association between screen time with moderate or severe depression among US adults. The findings of that study suggested that screen time is a significant risk factor or a marker of mental disorders among US adults¹. Also, there have been studies that suggest that increased screentime affects sleep. In a study conducted by Matthew A. Christensen² they have found that longer average screen-time was associated with shorter sleep duration and worse sleep-efficiency. During this pandemic as there is increased screentime, we aim to study the sleep pattern, mental health and well-being, and other hazardous effects caused by the same.

Objectives Of The Study:

The primary objective of the study was to find the association between screen time and various attributes like sleep wake pattern, depression, anxiety, productivity, hazardous effects etc during the COVID-19

lockdown in 2020.

Materials And Methods:

The data was collected in google forms which was circulated to our contacts (friends and family) and the respondents included people between the age group 25-75 who work in various sectors. The data was collected through snowball sampling. The questionnaire was circulated between 23 march 2020 through various platforms like WhatsApp, Instagram, E-mail. Total of 162 responded to the questionnaire. Only completed questionnaire was considered for further analysis.

RESULTS:

Total of 162 adults from age 25 and above participated in the study. 45.06% of the respondents were females and 54.93% males. 72.2% agreed that they were using phone way too much during the lockdown. 59.2% experienced hazardous effects of phones (teary eyes, burning eyes, headache, blurred vision). 53% have felt depressed during the lockdown.

The data was analysed using z-test for two proportions. A z-test for two proportions is a hypothesis test that attempts to make a claim about the population proportion P_1 and P_2 . The null hypothesis is a statement about the population parameter which indicates no effect, and the alternative hypothesis is the complementary hypothesis to the null hypothesis.³

We find that the null hypothesis $P_1=P_2$ is rejected at 1% level of significance against the alternative hypothesis $P_1>P_2$ since the p-value is less than 0.01, for the following pairs of proportions (P_1 , P_2). [Table 1]

Table 1: Statistically Significant Results Of Proportion Test

Sl.no	P1	P2
1.	Proportion of adults going to bed after 11 pm during the lockdown (51.2%, n=83)	Proportion of adults going to bed after 11 pm before the lockdown (32.7%, n=53)
2.	Proportion of adults waking up after 8 am during lockdown (24.07%, n=39)	Proportion of adults waking up after 8 am before lockdown. (8.02%, n=13)
	There is enough evidence that population proportion of adults waking up after 8 am during lockdown is greater than the proportion of those waking up at the same time before lockdown. This means people woke up later than normal because of lockdown	
3.	Proportion of adults who have agreed their screen time has increased during lockdown. (72.2%, n=117)	Proportion of adults who have disagreed their screen time has increased during lockdown. (8.64%, n=14)
	There is enough evidence that the population proportion of adults who have agreed their screen time has increased during lockdown is greater than the proportion of those who disagreed	
4.	Proportion of adults using screen for more than 5 hours during lockdown. (59.8%, n=97)	Proportion of adults using screen for more than 5 hours before lockdown. (35.1%, n=51)

	There is enough evidence that population proportion of adults using screen for more than 5 hours during lockdown is greater than the proportion of those using screen for more than 5 hours before lockdown. This means that adults are using more screen during lockdown than earlier.	
5.	Proportion of adults experiencing hazardous effects of phones (headache, burning eyes etc). (59.8%, n=97)	Proportion of adults using screened devices for academic purposes for 2 hours before lockdown. (40.7%%, n=66)
	There is enough evidence that the population proportion of adults experiencing hazardous effects of phones (headache, burning eyes etc) is greater than the proportion of those who do not experience any.	
6.	Proportion of adults felling stressed as compared to before lockdown. (48.7%, n=79)	Proportion of adults who do not experience hazardous effects of phones (headache, burning eyes etc). (29.6%, n=48)
	There is enough evidence that the population proportion of adults felling stressed during the lockdown as compared to before the lockdown is greater than the proportion of those who did not feel stressed during the lockdown.	
7.	Proportion of adults who lose 'track of time' by using screened devices. (61.1%, n=99)	Proportion of adults who do not feel anxious or nervous as compared to before lockdown. (38.8%, n=63)
	There is enough evidence that the population proportion of adults who lost 'track of time' by using screened devices is greater than the proportion of those who do not lose track of time.	

Table 2: Results Of Chi Square Test Showing Association Between Attributes A and B

A	B	Chi-square with Yates correction	p-value
Using screen time for at least 5 hours during the lockdown.	Experiencing hazardous effect of screen time such as eye pain, teary eyes, headache, blurry eyes.	5.2425	0.022042
Using screen time for at least 5 hours during the lockdown.	Experiencing mood swings at least once a week.	5.3199	0.021084
Using screen time for at least 5 hours during the lockdown.	Going to sleep after 11 pm during the lockdown.	14.9161	0.000112

Table 3:

		Cluster 1	Cluster 2	Cluster 3	Cluster 4	P-value
Size		37	50	38	37	--
Age (average)		27.35	35.3	45.74	57.92	<0.0001
Gender (Male) (%)		51.35	38.0	55.26	81.08	0.00103
What are the Occupation	Buisness, self-employed House wife, unemployed Doctorate, Professor Employed Retired person Students (UG & PG)	8.11 18.92 0.00 54.05 0.00 18.92	6.00 20.00 6.00 54.00 0.00 14.00	7.89 13.16 2.63 50.00 0.00 26.32	5.41 8.11 8.11 59.46 8.11 10.81	0.3271
No. of devices used. (Mobile phone, Laptop/Desktop, Kindle, Tablet/iPad TV) (%)	1 2 3 4 5	16.22 40.54 35.14 8.11 0.00	14.00 42.00 36.00 8.00 0.00	13.16 44.74 34.21 7.89 0.00	5.41 37.84 48.65 5.41 2.70	0.8402
During this lockdown what time do you usually go to sleep?	Before 9 pm 9 pm - 10 pm 10 pm - 11 pm 11 pm - 12 am 12 am - 1 am 1 am - 2 am 2 am - 3 am 3 am - 4 am	2.70 13.51 29.73 18.92 13.51 16.22 5.41 0.00	2.00 14.00 34.00 32.00 8.00 4.00 4.00 2.00	0.00 7.89 39.47 31.58 15.79 5.26 0.00 0.00	2.70 13.51 35.14 43.24 2.70 2.70 0.00 0.00	0.3954
Before this lockdown, what time would you usually go to sleep?	Before 9 pm 9 pm - 10 pm 10 pm - 11 pm 11 pm - 12am 12 am - 1 am 1 am - 2 am	0.00 13.51 40.54 24.32 18.92 2.70	0.00 28.00 50.00 18.00 2.00 2.00	0.00 18.42 47.37 26.32 7.89 0.00	2.70 24.32 40.54 32.43 0.00 0.00	0.0991
During this lockdown, what time do you usually wake up? [Fig 1]	4 am - 6 am 6 am - 8 am 8 am - 10 am 10 am - 12 pm After 12 pm	8.11 45.95 37.84 5.41 2.70	8.00 66.00 26.00 0.00 0.00	31.58 50.00 15.79 2.63 0.00	45.95 48.65 5.41 0.00 0.00	0.00013
Before this lockdown, what time would you usually wake up? [Fig 1]	4 am - 6 am 6 am - 8 am 8 am - 10 am	13.51 64.86 21.62	28.00 68.00 4.00	39.47 55.26 5.26	54.05 43.24 2.70	0.00058
Do you think you are using phone and other screened devices way too much during this lockdown?	Strongly agree Agree Neutral Disagree Strongly disagree	24.32 37.84 24.32 10.81 2.70	32.00 34.00 22.00 12.00 0.00	47.37 42.11 10.53 0.00 0.00	29.73 43.24 18.92 5.41 2.70	0.3324

How long do you think, you are using your phone and other screened devices during this lockdown?	< 1 hour a day 1 - 2 hours 3 - 4 hours 5 - 6 hours 7 - 8 hours 9 - 10 hours	2.70 2.70 35.14 18.92 18.92 21.62	4.00 18.00 28.00 28.00 6.00 16.00	2.63 13.16 13.16 26.32 21.05 23.68	0.00 10.81 27.03 29.73 13.51 18.92	0.4243
On typical day, how long do you think you used your phone and other screened devices before this lockdown?	< 1 hour a day 1 to 2 hours 3 to 4 hours 5 to 6 hours More than 6 hours	2.70 27.03 29.73 16.22 24.32	12.00 40.00 26.00 4.00 18.00	13.16 26.32 28.95 18.42 13.16	13.51 21.62 29.73 16.22 18.92	0.4726
Do you use your phone in the night after you go to bed? If yes, how long do you use your phone and other screened devices in the bed before you fall asleep? [Fig 2]	Never < 1 hour 1 to 2 hours 3 to 4 hours	5.41 45.95 32.43 16.22	24.00 56.00 16.00 4.00	34.21 47.37 15.79 2.63	37.84 56.76 5.41 0.00	0.00079
How long do you think you spend time on studying and doing other academic activities (Assignments, presentations, etc) / work and related activities during this lockdown?	Not a student < 1 hour a day 2 to 3 hours 4 to 5 hours 5 to 6 hours > 6 hours Working 8 hrs	0.00 29.73 24.32 10.81 24.32 10.81 0.00	4.00 48.00 30.00 8.00 0.00 8.00 2.00	0.00 31.58 26.32 7.89 15.79 18.42 0.00	2.70 37.84 29.73 13.51 2.70 13.51 0.00	0.0856
How long do you think you spent time on studying and doing other academic activities (Assignments, Presentations, etc) / work and related activities before this lockdown?	Not a student < 1 hour a day 2 to 3 hours 3 to 4 hours 5 to 6 hours > 6 hours	8.11 27.03 21.62 8.11 13.51 21.62	12.00 44.00 18.00 16.00 6.00 4.00	0.00 36.84 23.68 15.79 13.16 10.53	13.51 27.03 29.73 8.11 8.11 13.51	0.2425
How long do you think you are using your phone and other devices for your college or work or study related activities during this lockdown?	<1 hour a day 1 to 2 hours 3 to 4 hours 5 to 6 hours > 6 hours	24.32 24.32 21.62 18.92 10.81	42.00 28.00 16.00 6.00 8.00	23.68 34.21 18.42 7.89 15.79	27.03 32.43 18.92 8.11 13.51	0.6285
How long do you think you used phone and other screened devices for college or work or study related activities before this lockdown?	<1 hour a day 1 to 2 hours 3 to 4 hours 5 to 6 hours > 6 hours	29.73 29.73 10.81 18.92 10.81	46.00 36.00 6.00 4.00 8.00	44.74 26.32 15.79 5.26 7.89	48.65 13.51 13.51 13.51 10.81	0.2636
Do you experience any of these after using phone and other screened devices for a long time? (multiple options can be selected) (Burning eyes, teary eyes, pain in the eyes, dry eyes, tired eyes, blurred vision, head ache, shoulder pain, back pain, lower back ache, tired and irritated, sleeplessness, increased iop)	No. of symptoms None 1 2 3 4	72.97 24.32 0.00 0.00 2.70	70.00 22.00 0.00 4.00 4.00	65.79 26.32 5.26 0.00 2.63	89.19 8.11 2.70 0.00 0.00	0.2216
Have you been feeling stressed out or strained easily? (As compared to before the lockdown)[Fig 3]	Never Less than once a week Few times a week Almost everyday	24.32 27.03 37.84 10.81	20.00 18.00 32.00 30.00	23.68 28.95 26.32 21.05	54.05 13.51 24.32 8.11	0.0122
Have you been feeling anxious / nervous lately? (as compared to before lockdown)	Never < once a week Few times in a week Almost everyday	59.46 24.32 13.51 2.70	38.00 28.00 24.00 10.00	39.47 31.58 18.42 10.53	51.35 27.03 13.51 8.11	0.6615
Have you ever lost sense / track of time by using phone and screened devices (by binge watching and other activities)?	Never Few times Many times Yes , all the time	32.43 43.24 16.22 8.11	28.00 58.00 6.00 8.00	42.11 34.21 21.05 2.63	56.76 27.03 10.81 5.41	0.0634
Do u feel sad or depressed often (as compared to before the lockdown)?	Never Less than once a week Sometimes a week Yes, Almost everyday	45.95 24.32 24.32 5.41	36.00 26.00 34.00 4.00	50.00 21.05 23.68 5.26	59.46 27.03 10.81 2.70	0.5255
Have you observed mood swings in yourself during lockdown (change in emotions between extremes of sadness and happiness)?	Never Less than once a week Sometimes in a week Almost everyday	51.35 10.81 35.14 2.70	32.00 28.00 28.00 12.00	42.11 28.95 18.42 10.53	59.46 16.22 21.62 2.70	0.0938
Have you been feeling irritated or annoyed quite often (as compared to before lockdown)?	Never Less than once in a week Few times in a week Yes almost everyday	40.54 18.92 35.14 5.41	24.00 24.00 42.00 10.00	36.84 26.32 28.95 7.89	45.95 21.62 24.32 8.11	0.6788

Have you ever thought of reducing time spent on phone and other screened devices in a day?	No, I never had that thought Not an option as I attend online classes daily since a year Absolutely no, No other way to conduct work related activities Yes, but couldn't reduce the time spent on them I know that it will come down after this crisis ends Yes, I have successfully reduced the time spent on them	35.14 0.00 0.00 29.73 0.00 35.14	10.00 0.00 0.00 46.00 0.00 44.00	10.53 0.00 0.00 63.16 0.00 26.32	35.14 2.70 2.70 27.03 2.70 29.73	0.0075
--	---	---	---	---	---	--------

A Chi-square test was performed using the Chi-square calculator⁷ to examine the association between the attributes A and B. The following table gives significant results. Chi square test for independence is a test used for categorical attributes in order to assess the degree of association between the two attributes. Null hypothesis is that the two attributes are independent⁸. Chi-square test with Yates correction was used. [Table 2]

Relevant Graphs:

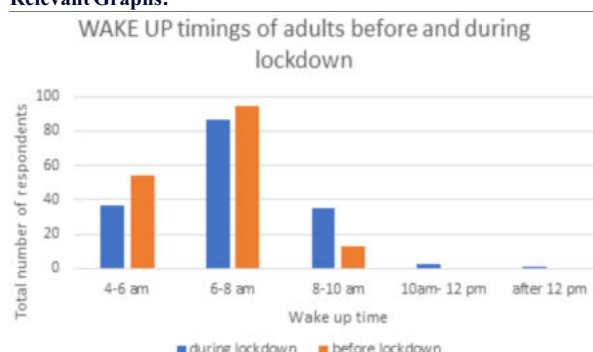


Fig 1: Waking Up Timings Of Adults Before And During Lockdown

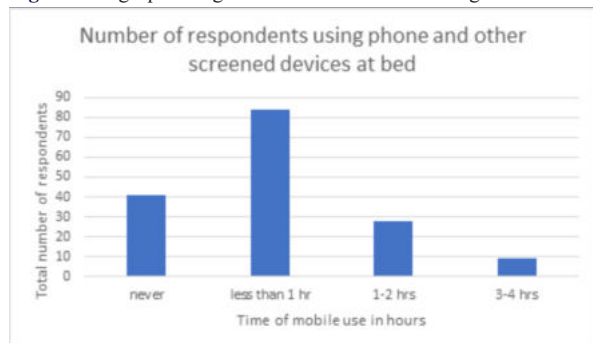


Fig 2: Number Of Adults Using Phone And Other Screened Devices At Bed

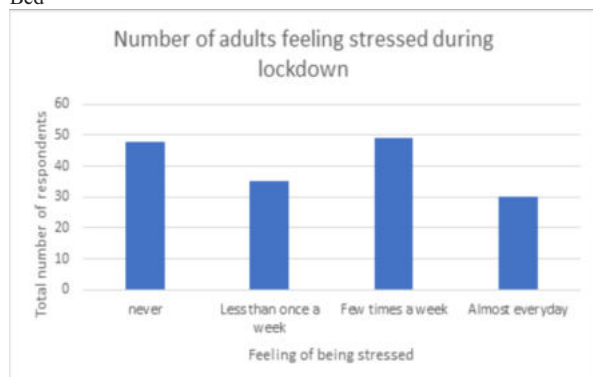


Fig 3: Adults Who Have Been Feeling Stressed During The Lockdown

Cluster Analysis:

R version 4.0.4 is used to perform cluster analysis. Cluster analysis is performed for all 162 individuals and results are given. Since variables are measured on different scales, data is standardized using medians.

Ward's minimum-variance hierarchical clustering method was performed using an agglomerative (bottom-up) approach and a dendrogram was generated [Fig 4], to estimate the number of likely clusters within the studied population. Four distinct clusters were identified of size 37,50,38,37 respectively. Once clusters were formed, there was no inter-cluster switching. This estimate was pre specified in k-means cluster analysis that was used as the principal clustering technique. K-means clustering method was used by taking the centroids as seeds of the clusters obtained.

To compare the differences between clusters, Kruskal-Wallis test for the variable "Age", since in this study only age is the continuous variable and chi-square test for categorical variables is used. P-values in the Table 3 is given from the Kruskal-Wallis test and Chi-square analysis between four clusters. Significant values are given in bold (that is, p-value < 0.05).

Cluster 1 (size 37) is equally dominated by males and females. Most of the respondents belonging to this cluster are youngsters with average age of 27 years. Most of the persons belonging to this cluster usually sleep late and wake-up late that is after 8 am (before and during lockdown). Highest percentage of people that is around 60 percent of them never felt anxious or nervous during lockdown.

Cluster 2 (size 50) is the largest among the four clusters and is dominated by females. Highest no. of housewives belong to this cluster. Highest percentage of people could successfully reduce the time spent on screening devices. Around 80 percent of people were stressed or strained easily during lockdown as compared to before lockdown.

Cluster 3 (size 37) is dominated by students. Most number of persons belonging to this cluster want to reduce the screening time but they couldn't reduce the time and least no. of people succeeded in reducing screening time as compared to other clusters. Persons belonging to this cluster they agree that they are using too much screening devices during the lockdown, only few remain neutral and none of them disagree.

Cluster 4 (size 38) is male dominant cluster. This cluster contains highest average age that is 58 years and all retired persons belong to this cluster. Almost all participants of this cluster sleep before 12 am and wake-up before 8 am (before and during lockdown). More than 50 percent of persons belonging this cluster never felt stressed out/strained easily during lockdown.

Clusters significantly differ with respect to age, gender, wake-up time during and before lockdown, usage of phone in the night after going to bed, feeling stressed out or strained easily as compared to before lockdown and thought of reducing time spent on phone and other screened devices. Clusters do not differ significantly with respect to remaining variables.

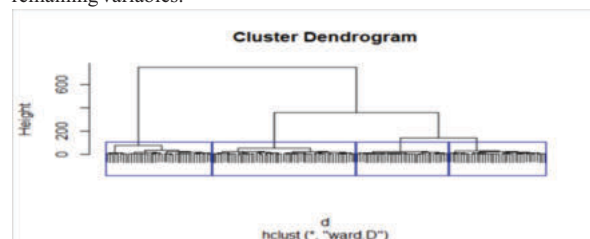


Fig4: Dendrogram For Ward's Minimum-variance Hierarchical Clustering Method

DISCUSSION:

In a study conducted by Brooke E. Wagner et.al⁶, the aim of the study was to quantify and describe changes in recreational screen time from 2018 to 2020 among a diverse sample of emerging adults. They have found out that weekly recreational time increased from 25.9 ± 11.9 h in 2018 to 28.5 ± 11.6 h during COVID-19. Also, the findings in this research suggests that screen time and mental health may be intertwined during the pandemic as it may lead to poorer mental health for some. Similarly, in our research the connection with the increased screen time and signs of depression has been seen. A clear increase in the screen time from before the pandemic and during the pandemic is established.

In a study conducted by Lee Smith et.al⁷, the aim was to study the association between the screen time and mental health during the covid 19 pandemic. It was established that mean number of hours of screen time per day was 7.2 in the overall population and this was higher in younger adults aged 18–34 years versus 5.2 hours in those aged ≥ 65 years. It is important to note that positive association between screen time per day in hours and poor mental health. Comparing this to our study, 53% of the adults were depressed during the lockdown while significant percentage of them experienced hazardous effect of increased screen time like teary eyes, burning eyes, headache etc.

A research study conducted by Fayiqah Ahmed Bahkir and Srinivasan Subramanian Grandee⁸, aimed on studying the impact of the covid 19 lockdown on digital device-related ocular health. In their study 93.6% of respondents reported an increase in their screen time since the lockdown. Sleep disturbances have been reported by 62.4% of people. Typically, 95.8% of respondents had experienced at least one symptom related to digital device usage, while considering our research, 72.2% of adults agreed that they were using phone way too much during the lockdown and 59.2% experienced hazardous effects of phones (headache, teary eyes, burning eyes, etc)

In a study conducted by Federico Salfi et.al⁹, they aimed to study on the changes of evening exposure to electronic devices during the COVID-19 lockdown, affect the time course of sleep disturbances. They demonstrated a strong association between screen time modifications in the hours before falling asleep, development and exacerbation of sleep disturbances, and changes of sleep/wake patterns during home confinement due to the COVID-19 pandemic. And also, they have noted that there is reduced sleep duration, prolonged sleep onset latency, and delayed bedtime and rising time in the study group. In our study we have found that there is a significant relation between the adults whose screen time is more than 5 hours and going to bed after 11pm which says adults with screen time of 5 hours or more are likely to go to bed late. The same individuals are more likely to have experienced mood swings in the pandemic.

In a study Conducted by K.C. Madhav et.al¹⁰, the aim was to study the association between screentime and depression among the US adults. In this study they noted that depression was found to be significantly higher among females. Results showed that moderate or severe depression level was associated with higher time spent on TV watching and use of computer. While this study was conducted before the pandemic the facts associating the depression and screen time is still true. As the screentime has increased significantly during pandemic from our study we know that 53 percent of the adult respondents have felt depressed during the lockdown. In addition to the fact that our research was conducted during the pandemic lockdown, we have used proportion test and have proven how several important effects are true for the whole population. Chi square and cluster analysis have helped strengthen our study

CONCLUSION:

Increased screen time has significantly affected the sleep pattern, mental health, overall health and well-being of adults during lockdown. Increased screen time has an association with deleterious effects like eye pain, watering eyes, headache etc. Its also directly correlates with the mood swings that the adults experienced during the lockdown. Emphasis should be given on decreasing the screen time and adapt a healthy sleep schedule with promotion of health and well-being.

Acknowledgements:

We, the authors, acknowledge Dr.S.Ravi, Professor, Department of Studies in Statistics, University of Mysore, Manasagangothri, Mysore

for contributing to this manuscript with his valuable suggestions. We also thank all the students who willingly participated in the study.

REFERENCES:

1. Madhav KC, Sherchand SP, Sherchan S. Association between screen time and depression among US adults. *Prev Med Rep.* 2017; 8:67-71.
2. Christensen MA, Bettencourt L, Kaye L, et al. Direct Measurements of Smartphone Screen-Time: Relationships with Demographics and Sleep. *PLoS One.* 2016;11(11).
3. <https://mathcracker.com/z-test-for-two-proportions>. Accessed on 20-11-2021 at 15:30pm
4. <https://www.socscistatistics.com/tests/chisquare/> Accessed on 25-11-2021 at 15:15 pm
5. <https://mathcracker.com/chi-square-test-of-independence>. Accessed on 12-12-2021 at 16:40 pm
6. Wagner, B.E.; Folk, A.L.; Hahn, S.L.; Barr-Anderson, D.J.; Larson, N.; Neumark-Sztainer, D. Recreational Screen Time Behaviors during the COVID-19 Pandemic in the U.S.: A Mixed-Methods Study among a Diverse Population-Based Sample of Emerging Adults. *Int. J. Environ. Res. Public Health* **2021**, *18*, 4613.
7. Smith L, Jacob L, Trott M, et al. The association between screen time and mental health during COVID-19: A cross sectional study. *Psychiatry Res.* 2020.
8. Bahkir FA, Grandee SS. Impact of the COVID-19 lockdown on digital device-related ocular health. *Indian J Ophthalmol.* 2020;68(11):2378-2383
9. Federico Salfi, Giulia Amicucci, Domenico Corigliano, Aurora D'Atri, Lorenzo Viselli, Daniela Tempesta, Michele Ferrara, Changes of evening exposure to electronic devices during the COVID-19 lockdown affect the time course of sleep disturbances, *Sleep*.2021(9)
10. Madhav KC, Sherchand SP, Sherchan S. Association between screen time and depression among US adults. *Prev Med Rep.* 2017; 8:67-71.