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Physical and psychological impact of smartphone usage during COVID lockdown: A survey review

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Abstract
The evolution of mobile phones just from a communication device to a device that supports multi-tasking is enormous. The recent technologies have contributed immensely to the development in the world of mobile phones. The features provided in the recent days have attracted the consumers to the extent of mobile addiction, which is a common problem today worldwide. The present study analyses the prevalence of smartphone usage and physical and psychological impacts in males and females on the basis of smartphone usage during the pandemic COVID-19 [6].

Keywords: COVID-19, lockdown, prevalence of smartphone usage, physical and psychological health, addiction

1. Introduction

Smartphone has brought out changes in the way of communication technology. It is estimated that in the next two years India's smartphone base would reach around 820 million. The usage of smartphones has been increased drastically among the urban as well as rural populations too, because of their amazing features which provide one stop solutions fulfilling the requirements. The impact of smartphones is such that they have created a greater business platform. It's just not about creating business platforms, but has led to a deadly cause of addiction [5, 7].

> "Addiction is a condition of being unable to stop using or doing something as a habit, especially something harmful [8]".

Excessive usage of smartphones than required along with other activities is a manifestation of addiction. This can have adverse effects on the wellbeing of a person, both mentally and physically.

The American Psychiatric Association (APA, 2013) first categorized a behaviour-gambling-as a non-substance-related addictive disorder and recommends further research on Internet gaming disorder. However, at this time, no mention has been made of smartphone addiction in either the DSM-5 or in the ICD-11's draft. Nevertheless, research on smartphone and mobile phone addiction has notably increased in recent years (Aljomaa, Mohammad, Albursan, Bakhiet, & Abduljabbar, 2016; Bian & Leung, 2015; Chiu, 2014; Darcin *et al.*, 2016; Demirci, Akgönül, & Akpinar, 2015; Fu Yuan, Chiu, & Huang, 2012; Haug *et al.*, 2015; Hawi & Samaha, 2016; Körmendi, Brutóczki, Végh, & Székely, 2016; Leung, 2007; Lin *et al.*, 2014; Lopez-Fernandez, 2015; Roberts, Pullig, & Manolis, 2015; Salehan & Negahban, 2013; Van Deursen, Bolle, Hegner, & Kommers, 2015) and there seems to be a rising tendency to label popular technological behaviours as addictive [4].

This pandemic-COVID-19, has bought in tremendous increase in the usage of smartphones for various purposes such as education, work, shopping, entertainment, health services, banking services, communication and so on.

2. Review of literature

Smartphone usage increased considerably during lockdown period. The daily use duration of a smartphone is one of the most significant indicators of its impact on physical and psychological health.

Apart from communication, entertainment, the online classes increased the duration of smartphone usage.

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The causes of smartphone use can be attributed to the technological and content-related features of a smartphone along with accessibility, portability, easiness of operation, connectedness [2, 12].

2.1 Impact on physical and psychological health
Physical impacts range from Eyestrain, eyestrain, blurring of vision sleeplessness, tiredness, body ache, neck and wrist pain to obesity, male infertility due to radiation, seizures, brain tumours etc.
Psychological impacts are anxiety, negative emotions, depression, lack of concentration, restlessness. [9, 13]
Problematic use can be assessed by the urge to check messages, activeness on social platforms, sleeping with smartphone under pillow and watching smartphone while eating [3,11]. It has also led to the interference with the daily activities and decreased productivity. [10]

Research question 1: What is the prevalence of smartphone usage in various age groups due to COVID lockdown?

Research question 2: Whether the high-risk group have more psychological and physical problems as compared with the normal user group?

3. Method
The study was conducted with the help of an online survey. Data was collected by a structured questionnaire which consisted of 27 questions focusing on all age groups.
Demographic variables were self-reported by participants and included age, sex, socioeconomic status, occupation, etc.

3.1 Instrument
Smartphone addiction questionnaire (SPAQ): This questionnaire was adopted and modified as per our needs from those in the article "Psychometric Properties of Smartphone Addiction Questionnaire (SPAQ) among Sultan Qaboos University Under graduate Students" published in journal of Educational and Psychological Studies- Sultan Qaboos University. Later the contents of the questionnaire were validated. The questionnaire was so framed to explore the level of smartphone addiction among various age groups through three parts [1]:
1. The level of smartphone usage.
2. The purpose of usage.
3. The level of physical and psychological symptoms experienced.

The scoring was done based on the 10 questions which were related to the behaviours associated with problematic smartphone usage. The scores 5 and 1 were given for the responses YES and NO respectively. Based on the above scoring the respondents were categorized to high risk and normal groups considering the cut off score as 40.
Later, the degree of negative impact of smartphone usage on one's daily routine, social life, productivity, sleeping patterns, feelings and physical health and impact of COVID lockdown on smartphone usage were assessed.

4. Data analysis
Of the 309 participants, 184 (59.5%) were identified as high-risk group for smartphone addiction and 125 (40.4%) were classified as a normal user group according to their scores.

Demographic variables of the study are as follows

Table 1: Smart phone usage in different age group

Sl. No.	Age Group	No's	Percentage
1.	1-10yrs	4	1.29%
2.	11-20yrs	96	31.06%
3.	21-30yrs	175	56.63%
4.	31-40yrs	17	5.50%
5.	41-50yrs	8	2.58%
6.	51-60yrs	4	1.29%
7.	above 60yrs	5	1.61%
	Total	309	100%

Smart phone usage was seen more among 21-30 years of age group [56.60%] followed by 11-20 years [31.10%]. In other age groups the usage was minimal.
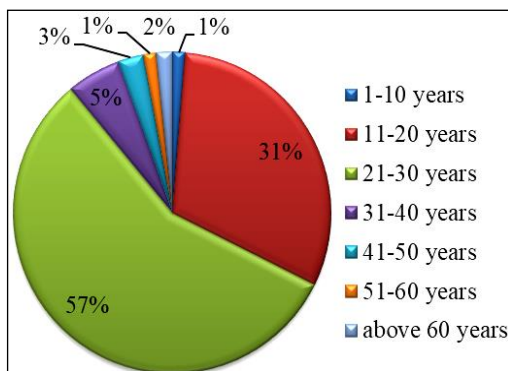

Fig 1: Smart phone usage in different age group

Table 2: Gender differences in smart phone usage

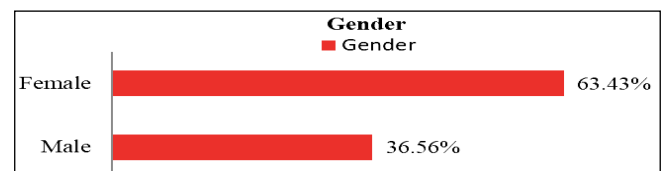| Sl. No.	Gender	No's	Percentage
1.	Male	113	36.56%
2.	Female	196	63.43%
	Total	309	100%

Fig 2: Gender differences in smart phone usage

Table 3: Smart phone usage in various economic status

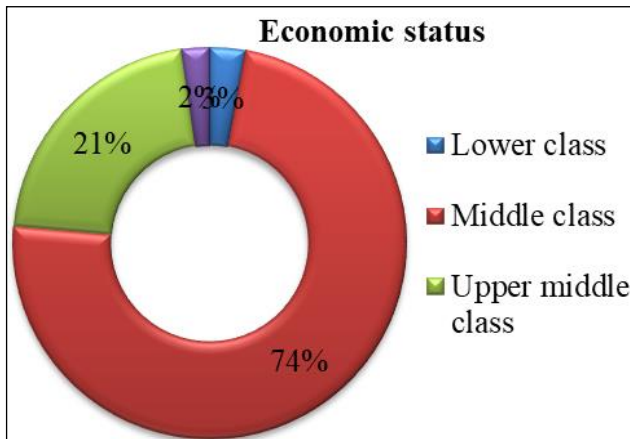| Sl. No.	Economic status	No's	Percentage
1.	Lower class	9	2.91%
2.	Middle class	227	73.46%
3.	Upper middle class	66	21.35%
4.	High class	7	2.26%
	Total	309	

Fig 3: Smart phone usage in various economic statuses

Table 4: Smart phone usage in different occupations

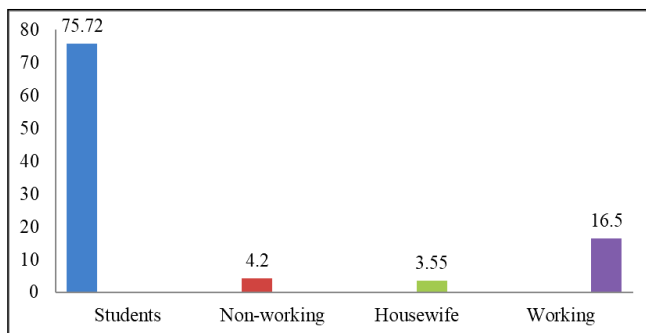| Sl. No.	Occupation	No's	Percentage
1.	Students	234	75.72%
2.	Non-working	13	4.20%
3.	House wife	11	3.55%
4.	Working	51	16.50%
	Total	309	

Fig 4: Smart phone usage in different occupations

Surprisingly the percentage of smart phone usage was high among females [63.4%] than males [36.60%] and the usage among middle class [73.50%] was higher than upper middle class [21.40%]. During the pandemic it was the student community whose smartphone usage was more [75.70%] than working population [16.50%].

The respondents were asked about the time spent on usage of smartphone and the purpose of usage along with the discomforts and ailments experienced [physical & psychological] from the use of smartphone; measures taken by them to reduce the usage of smartphone.

The No. of hours spent more than 5 hours on smart phone among high-risk group was 45.6% compared to 19.2% among normal usage group. [Table 5]

During lockdown, the participants used their smart phone for communication like phone calls/messaging 81.5% among high risk and 72% among normal usage followed by the usage of social media was 76.6% among high risk, 64.8% in normal usage. Majority of the participants gave positive response [79%] to effect of lockdown on smart phone usage.

Table 5: Level of usage

No. of hours spent	High risk group n= 184	Percentage High risk	Normal usage group n = 125	Percentage Normal usage
Less than or equal to 2hrs	20	10.9%	25	20%
2-5hrs	80	43.5%	76	60.8%
More than 5hrs	84	45.6%	24	19.2%

No of hours spent on online classes		Percentage High risk		Percentage Normal usage
2-3 hrs	62	33.72%	44	35.2%
4-5 hrs	51	27.7%	26	20.8%
6-7 hrs	21	11.41%	07	5.6%
No online classes	50	27.17%	48	38.4%

Table 6: Purpose of usage

Purpose	High risk group n= 184	Percentage	Normal usage group n = 125	Percentage
Phone calls/Messaging	150	81.5%	90	72%
Learning and browsing	137	74.4%	96	76.8%
Gaming and entertainment	119	64.6%	71	56.8%
Shopping and banking	84	45.6%	51	40.8%
Social media	140	76.08%	81	64.8%

Table 7: Impact on activities of daily living

Impact	High risk group n= 185	Percentage	Normal usage group n = 124	Percentage
Decreased productivity	143	77.29%	43	34.6%
Change in sleep pattern	103	55.67%	21	16.9%
Urge to check the message	139	75.1%	35	28.2%

Regarding the impact on daily living, the high-risk group complained of decreased productivity, change in sleep pattern, urge to check the message more [77.9%, 55.67%, 75.1%] compared to normal usage group [34.6%, 16.9%, 28.2% respectively].

Table 8: Impact of Smart phone usage on Physical and Psychological Health

Impact	High risk group n= 185	Males	Female	Normal usage group n = 124	Male	Female	Total n =309 (High risk+ normal)
Physical							
Eyestrain	108	35	73	52	16	36	160
No discomforts	41	27	14	53	18	35	94

Headache	80	20	60	24	05	19	104
Neck pain	64	23	41	20	03	17	84
Visual disturbance	35	09	26	11	03	08	46

Psychological	High risk	Males	Females	Normal	Male	Female	Total (High risk +normal)
Anger and irritable	51	16	35	13	6	7	64
Tense and anxious	66	24	42	19	11	8	85
Restlessness	46	16	30	12	05	7	58
Sad, feels like crying	30	10	20	12	04	9	42
None and others	75	28	47	66	23	43	141
Lack of concentration	70	26	44	14	06	08	84

Impact of smartphone usage on physical health

■ Eyestrain ■ No discomforts ■ Headache ■ Neck pain ■ Visual disturbance

	High risk group	Males	Female	Normal usage group	Male	Female	Total
Visual disturbance	35	9	26	11	3	8	46
Neck pain	64	23	41	20	3	17	84
Headache	80	20	60	24	5	19	104
No discomforts	41	27	14	53	18	35	94
Eyestrain	108	35	73	52	16	36	160

n= 185 (High risk group)   n = 124 (Normal usage group)   n =309 (High risk+ normal) Total

Impact of smartphone usage on psychological health

■ Anger and irritable ■ Tense and anxious ■ Restlessness ■ Sad, feels like crying ■ None and others ■ Lack of concentration

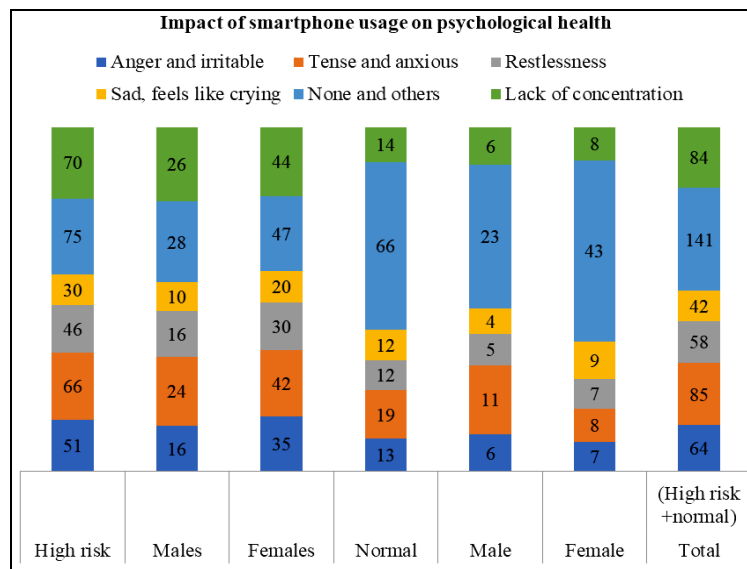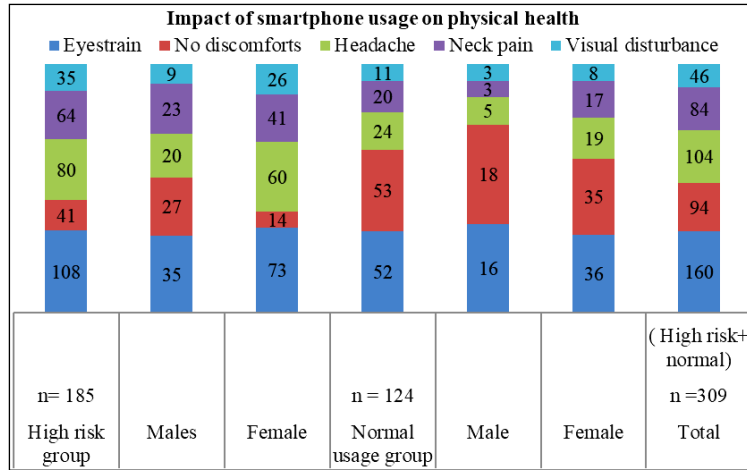|	High risk	Males	Females	Normal	Male	Female	Total (High risk +normal)
Lack of concentration	70	26	44	14	6	8	84
None and others	75	28	47	66	23	43	141
Sad, feels like crying	30	10	20	12	4	9	42
Restlessness	46	16	30	12	5	7	58
Tense and anxious	66	24	42	19	11	8	85
Anger and irritable	51	16	35	13	6	7	64

Table 9: Chi-square analysis for physical strain and sex of high-risk group

Physical	High Risk		Total	Chi-Square Value	P-Value
	Male	Female			
Eye Strain	35	73	108		
Discomforts	27	14	41		
Headache	20	60	80	22.41	< 0.0001
Neck Pain	23	41	64		
Visual Disturbance	9	26	35		
Total	114	214	328		

H0: There is no association between physical strain and sex among smart phone users belonging to high-risk category.
H1: There is an association between physical strain and sex among smart phone users belonging to high-risk category.

Conclusion: Since Chi-Square calculated is 22.41 which is much greater than tabled value of Chi-Square (i.e., 13.27) at one percent level of significance for 4 degrees of freedom, hence H0 is rejected. Indicating that there is an association between the types of physical strain and the sex. i.e., vulnerable group seems to be women (65%). Concluding that women are more probable to be effected physically than men when used smart phones during Covid Pandemic.

Table 10: Chi-Square Analysis for Physical Strain and Sex of Normal Usage Group

Physical	Normal usage Group		Total	Chi-Square Value	P-Value
	Male	Female			
Eye Strain	16	36	52		
Discomforts	18	35	53		
Headache	5	19	24	3.41	< 0.10
Neck Pain	3	17	20		
Visual Disturbance	3	8	11		
Total	45	115	160		

H0: There is no association between physical strain and sex among smart phone users belonging normal usage category during Covid Pandemic.
H1: There is an association between physical strain and sex among smart phone users belonging to normal usage category.

Conclusion: Since Chi-Square calculated is 3.41 which is smaller than tabled value of Chi-Square (i.e., 9.488) at five per cent level of significance for 4 degrees of freedom, hence H0 is accepted. Indicating that there is no association between the types of physical strain and the sex.

Table 11: Chi-Square Analysis for Physical Strain and Different Risk Categories

Physical	Risk Categories		Total	Chi-Square Value	P-Value
	High	Normal			
Eye Strain	108	52	160		
Discomforts	41	53	94		
Headache	80	24	104	32.92	< 0.001
Neck Pain	64	20	84		
Visual Disturbance	35	11	46		
Total	328	160	488		

H0: There is no association between physical strain and sex among smart phone users belonging normal usage category during Covid Pandemic.
H1: There is an association between physical strain and sex among smart phone users belonging to normal usage category.

Conclusion: Since Chi-Square calculated is 32.92 which is much higher than tabled value of Chi-Square (i.e., 13.277) at one per cent level of significance for 4 degrees of freedom, hence H0 is rejected. Indicating that there is an association between the types of physical strain and risk categories i.e., vulnerable group seems to be of high-risk category representing 67%. Concluding that mobile users are more probable to be effected physically with high risk compared to normal usage group.

Table 12: Chi-Square Analysis for Psychological Factors and Sex among High-Risk Group of Smart Phone Users

Psychological	High Risk		Total	Chi-Square Value	P-Value
	Male	Female			
Anger & Irritation	16	35	51		
Tense and Anxiety	24	42	66		
Restlessness	16	30	46		
Sad, Feels like Crying	10	20	30	0.67	< 0.95
None & Others	28	47	75		
Lack of Concentration	26	44	70		
Total	120	218	338		

H0: There is no association between psychological factors and sex among high-risk group of smart phone users.
H1: There is an association between psychological factors and sex among high-risk group of smart phone users.

Conclusion: Since Chi-Square calculated is 0.67 which is much less than tabled value of Chi-Square (i.e., 0.831) at ninety-seven per cent level of significance for 5 degrees of freedom, hence H0 is accepted. Indicating that there is no association between the types of psychological factors and sex among high-risk group.

Table 13: Chi-Square Analysis for Psychological Factors and Sex among Normal Risk Group of Smart Phone Users

Psychological	Normal Risk		Total	Chi-Square Value	P-Value
	Male	Female			
Anger & Irritation	6	7	13		
Tense and Anxiety	11	8	19		
Restlessness	5	7	12		
Sad, Feels like Crying	4	9	13	3.99	< 0.05
None & Others	23	43	66		
Lack of Concentration	6	8	14		
Total	55	82	137		

H0: There is no association between psychological factors and sex among normal risk group of smart phone users.
H1: There is an association between psychological factors and sex among normal risk group of smart phone users.

Conclusion: Since Chi-Square calculated is 3.99 which is much lesser than tabled value of Chi-Square (i.e., 11.07) at five per cent level of significance for 5 degrees of freedom, hence H0 is accepted, indicating that there is no association between the types of psychological factors and sex among normal risk group.

Table 14: Chi-Square Analysis for Psychological Factors and Different Risk Categories

Psychological	Risk Categories		Total	Chi-Square Value	P-Value
	High	Normal			
Anger & Irritation	51	13	64		
Tense and Anxiety	66	19	85		
Restlessness	46	12	58		
Sad, Feels like Crying	30	13	43	34.18	<0.001
None & Others	75	66	141		
Lack of Concentration	70	14	84		
Total	338	137	475		

H0: There is no association between psychological factors and risk levels smart phone users during Covid Pandemic.
H1: There is an association between psychological factors and risk levels smart phone users during Covid Pandemic.

Conclusion: Since Chi-Square calculated is 34.18 which are much higher than tabled value of Chi-Square (i.e., 15.08) at one per cent level of significance for 5 degrees of freedom, hence H0 is rejected. Indicating that there is an association between the psychological factors types and risk categories i.e., vulnerable group seems to be of high risk category representing 71%. Concluding that mobile users are more probable to be effected psychologically with high risk compared to normal usage group.

5. Discussion
Excessive smartphone usage is a common problem among adults worldwide. And the usage has increased during COVID Pandemic. However, many people fail to realize that they have addiction to smartphone and it is a serious issue that can have a negative effect on the person's physical and psychological health.

Addiction is a disorder with severe effects on physical and psychological health. Behaviour may have a similar presentation as addiction in terms of excessive use, impulse control problems, and negative consequences, but that does not mean that it should be considered an addiction [4]. When studying technological behaviours using other terms such as "problematic use" or excessive use are more appropriate. So here the term excessive usage has been used.

This study aimed at finding the prevalence of smartphone usage among males and females, studying the demographic characteristics, level of usage, purpose of usage, impact of lockdown on smartphone use and the impact on physical and psychological health. The smartphone has become an essential part of daily life and the attachment to smartphone was assessed by questioning about the urge to check the phone, sleeping with phone under the pillow and loosing track of time while using the same with positive responses.

Contrary to our expectation, 84% of the participants responded positively for spending quality time with family and that is the measure they are taking to reduce smartphone usage.

Statistical analysis showed the positive association between high-risk group and Physical and psychological impact, women being more vulnerable for physical strain.

5.1 Limitations
Some variables were measured subjectively, using simple questions without using standardized scales.

Self-reported data and actual smartphone use data could provide a comprehensive explanation about smartphone usage patterns.

A survey during the non-covid period would have given a better comparison of data and increase in smartphone usage during lockdown in true sense.

6. Conclusion
This study showed that the prevalence of smart phone usage was high among females [63.4%] than males [36.60%].

The causes of over use of smart phone are fairly general and vary from person to person. The impacts are also person dependent. The study identified that 59.5% of users are at a high risk, and 40.4% % are normal usage group. This percentage vary largely based on the region of study and age group and time of study. On analysing the duration and event of usage of mobile phones, it was found that the phone was maximum used for social networking, phone calls/messaging, online classes.

Chi-square analysis for physical strain and sex of high-risk group indicated that there is an association between the types of physical strain and the sex. i.e., vulnerable group seems to be women (65%). Chi-square analysis for physical strain and different risk categories indicated that the mobile users are more probable to be effected physically with high risk [67%] compared to normal usage group.

Chi-square analysis for psychological factors and sex among high-risk group of smart phone users indicated that there is no association between the types of psychological factors and sex among high-risk group. Chi-square analysis for psychological factors and different risk categories indicated that mobile users are more probable to be effected psychologically with high risk [71%] compared to normal usage group.

Conflict of interest: The authors declare no conflict of interest.

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Annexure

Table 1: Frequently used apps

Frequently used apps in smart phone			
Sl. No.	Apps	No's	Percentage
1.	WhatsApp	132	42.71%
2.	YouTube	52	17%
3.	Amazon	4	1.29%
4.	Facebook	12	4%
5.	Instagram	77	25%
6.	Goggle	27	9%
7.	Zoom	36	12%
8.	Pubg	8	2.58%
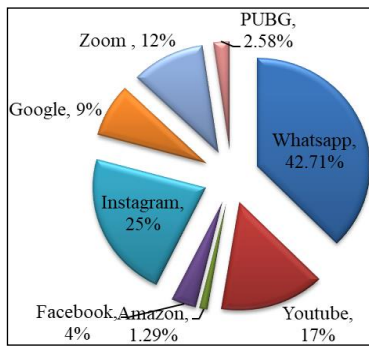
Table 2: Usage of smartphones for online classes

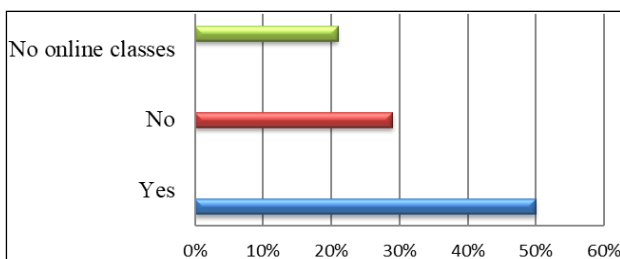| Using smart phone for online classes, a burden			
Sl. No	A Burden	No's	Percentage
1	Yes	154	50%
2	No	90	29%
3	No online classes	65	21%
	Total	309	

Fig 2: Using smartphones for online classes, a burden

Table 3: No of hours spent on online classes

Sl. No.	Time Spent	No's	Percentage
1.	2-3 hrs	106	34%
2.	4-5 hrs	76	25%
3.	6-7 hrs	28	9%
4.	No online classes	99	32%
	Total	309	
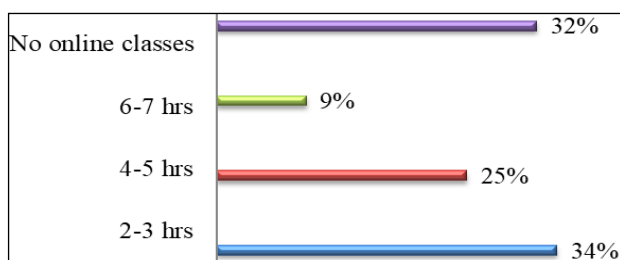
Fig 3: No of hours spent on online classes

Table 4: Sleeping with smartphone under the pillow

Sleeping with smart phone under pillow			
Sl. No.	Sleep with phone	No's	Percentage
1.	Yes	157	51%
2.	No	152	49%
	Total	309	
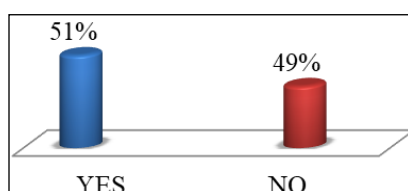
Fig 4: Sleeping with smartphone under the pillow

Table 5: Hours of sleep

Sl. No.	Hours of sleep	No's	Percentage
1.	8-9 hrs	143	46.27%
2.	5-7 hrs	149	48%
3.	3-5 hrs	16	5.17%
4.	<3 hrs	1	0.32%
	Total	309	
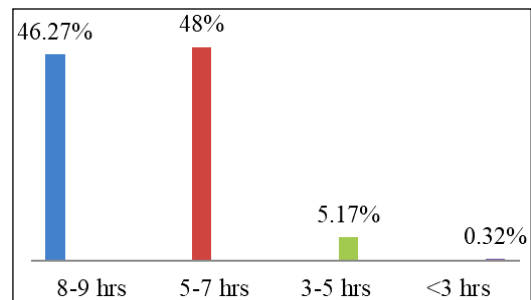
Fig 5: Hours of sleep

Table 6: Change in sleep pattern

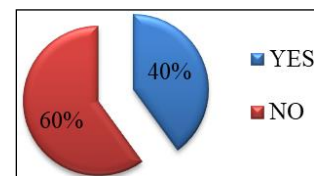| Change in sleep pattern			
Sl. No.	Any changes	No's	Percentage
1.	Yes	124	40%
2.	No	185	60%
	Total	309	

Fig 6: Change in sleep patterns

Table 7: Usage of phone to view calls/messages always

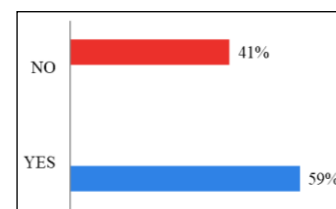| Usage of phone to view, calls/message always			
Sl. No	Used to view	No's	Percentage
1.	Yes	182	59%
2.	No	127	41%
	Total	309	

Fig 7: Usage of phone to view calls/messages always

Table 8: Feeling of decreased productivity

Feeling of decreased productivity			
Sl. No.	Reduced productivity	No's	Percentage
1.	Yes	245	79%
2.	No	64	21%
	Total	309	
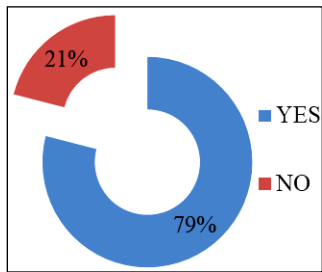
Fig 8: Decreased productivity

Table 9: Usage of smartphone while eating

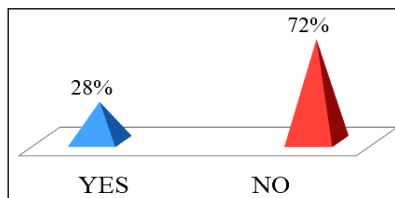| Watching smartphone while eating			
Sl. No.	While eating	No's	Percentage
1	Yes	88	28%
2	NO	221	72%
	Total	309	

Fig 9: Usage of smartphone while eating

Table 10: Spending quality time with family and friends

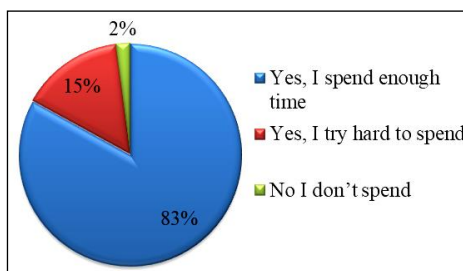| Spending quality time with family and friends			
Sl. No.	Spending quality time	No's	Percentage
1	Yes, I spend enough time	258	83%
2	Yes, I try hard to spend	46	15%
3	No, I don't spend	5	2%
	Total	309	

Fig 10: Spending quality time with family and friends

Table 11: Able to concentrate on work and stay active after smartphone usage

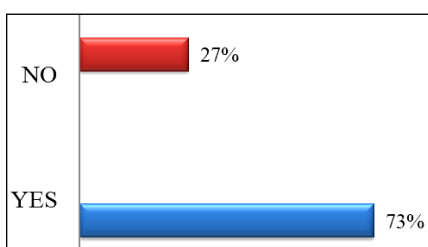| Able to concentrate and stay active after smartphone usage			
Sl. No.	Able to be active	No's	Percentage
1.	Yes	225	73%
2.	No	84	27%
	Total	309	

Fig 11: Able to concentrate on work and stay active after smartphone usage

Table 12: Loosing track of time while using a smartphone

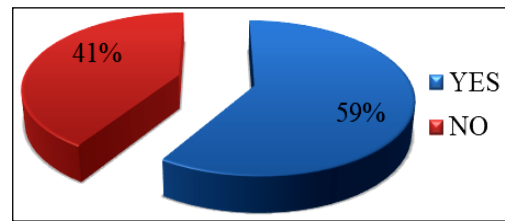| Loosing track of time while using a smartphone			
Sl. No.	Loosing time	No's	Percentage
1.	Yes	182	59%
2.	No	127	41%
	Total	309	

Fig 12: Loosing track of time while using a smartphone

Table 13: Effect of lockdown due to pandemic on smartphone usage

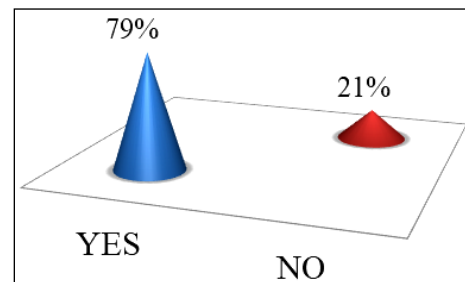| Effect of lockdown on smartphone usage			
Sl. No.	Lockdown effect	No's	Percentage
1	Yes	245	79%
2	No	64	21%
	Total	309	

Fig 13: Has lockdown due to pandemic affected the usage of smartphone?

Table 14: Measures taken to reduce the usage of smartphone

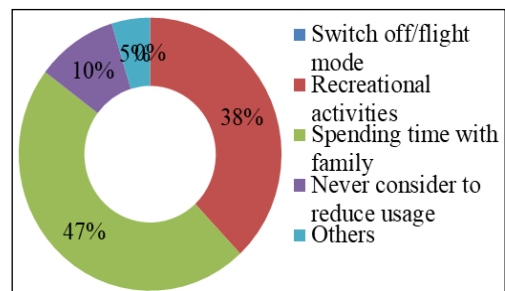| Measures taken to reduce smart phone usage			
Sl. No.	Measures taken	No's	Percentage
1	Switch off/flight mode	1	0%
2	Recreational activities	150	49%
3	Spending time with family	190	61%
4	Never consider to reduce usage	40	12.90%
5	Others	19	6.10%

Fig 14: Measures taken to reduce smartphone usage