

## **Did COVID-19 trigger a Digital Epidemic? An exploratory study in adolescents**

### **ABSTRACT**

**Background:** This study aims to investigate the usage pattern of gadgets during the COVID-19 pandemic and its potential long-term consequences.

**Material & methods:** Observational cross-sectional study. This design is helpful for public health planning, monitoring, and evaluation of demographically diverse populations of varied age groups, socioeconomic status, religion, etc. The research gathered information on participants' demographic characteristics, gadget usage patterns, and reasons behind the increased reliance on gadgets. Additionally, questions were asked to gain deeper insights into participants' subjective experiences and perceptions regarding gadget usage during the pandemic. Multi-stage random sampling was done. One thousand one hundred fifty-five students were recruited from diverse geographic locations and demographic backgrounds. The study instrument used was a pretested, validated questionnaire. Field investigators collected the data after taking informed consent from participants. Data were compiled and analysed using SPSS 23.

**Results:** A substantial increase in gadget usage during the COVID-19 pandemic was found in this study. Participants reported heightened dependency on gadgets for remote learning, virtual social interactions, recreation or seeking information, etc. Factors such as social isolation, restrictions on physical activities, and the need for constant connectivity contributed to the surge in gadget usage. However, excessive screen time and digital fatigue were noted as negative consequences of this increased reliance.

**Conclusions:** The study highlights the unprecedented rise in gadget usage during the COVID-19 pandemic and its multifaceted implications. While gadgets have played a crucial role in facilitating remote work and maintaining social connections, excessive reliance on **them challenges** to individuals' well-being. It is crucial to develop strategies to address the potential negative consequences, such as promoting digital well-being and finding a balance between virtual **and** offline activities. Further research is warranted to examine the long-term effects of increased gadget usage on mental health, social interactions, and overall quality of life.

**Keywords:** COVID, **adolescents**, gadgets, digital-epidemic, screen-time.

## **INTRODUCTION**

COVID-19 wreaked havoc on countries worldwide, forcing many nations to implement containment measures, including lockdowns (mass quarantines), curfews, and other similar restrictions (such as stay-at-home orders or shelter-in-place orders) to combat the spread.

At the beginning of April 2020, around 3.9 billion people were under lockdown across the planet<sup>1</sup>. This led to unprecedented circumstances in almost all areas of life, the long-lasting consequences still present themselves. Though COVID-19 does not affect children severely at a clinical level, their lives were not spared from this pandemic's disruption<sup>2,3</sup>. To maintain social distancing, schools/ playgrounds were closed and children were confined to their homes for extended periods. This extended captivity has been a cause of concern for doctors, psychologists, and educationists<sup>4,5</sup>.

The schools adjusted to these unprecedented circumstances by switching to virtual platforms for learning. Digital technology posed a boon during this crisis as a platform for education and recreation. Although the main motive was to continue education and social communication between the children, the move paved the way for an inadvertent increase in screen time. This led to increased psych-social problems, socioemotional lag, and low self-esteem in children who spent more time watching TV or surfing the internet<sup>6-9</sup>. Teenagers now have access to entertainment 24/7 and to adulterated media content, causing digital dependency.

Also, the gadgets were the only option for maintaining contact with friends and family due to limitations on in-person meetings and activities. The need for recreation and social interaction thus became another factor contributing to the rise in gadget use.

This became more problematic for a generation already obsessed with spending time in front of a screen, browsing social media or playing video games even before the pandemic had hit<sup>10</sup>. Excessive Internet/gaming/mobile addiction, a worrying trend even in pre-COVID days, had reached new heights during the pandemic.

The pandemic facilitated increased gadget use, leading to circadian rhythm abnormalities. The closure of schools removed the requirement to get up early in the morning for children. A new routine became a hit for children of being on gadgets late at night, having trouble sleeping(sleep latency), and sleeping late till the day. This slowly mushroomed the problem of decreased sleep quality among children. Other that aggravating the sleep problem were the dread of contracting COVID-19 and emotional concerns.<sup>11</sup>

The study of increased gadget use during COVID-19 lockdowns is vital for numerous reasons. It reveals significant impacts on mental health, education, and physical well-being due to prolonged screen time. Understanding the digital divide, shifts in workplace productivity, cybersecurity risks, and social implications informs policy and interventions. Moreover, it offers insights into economic changes and underscores technology's transformative role during the pandemic, guiding adaptation to digital-age challenges post-COVID-19. This research is unique due to its global scope, rapid tech adoption, interdisciplinary approach, and longitudinal focus. It uncovers diverse consequences, from mental health to digital inequality, highlighting pandemic-driven opportunities and challenges in an increasingly digital world. Considering the above information, this study was conceptualized to assess the impact of the COVID lockdown on adolescents' increased gadget use and screen time.



## **MATERIALS & METHODS**

**Study Population:** School-going adolescents, 14-19 years

**Study Design:** Observational design-based Cross-sectional study

**Study Duration-:** 3 months (Oct 2021-Mar 2022)

**Study units/ participants:** Students of age, 14-19 years

**Sampling:** Multi-stage random sampling

**Study Procedure:** First, the list of all government/government-recognized private schools was obtained from the office of DEO( District Education officer). The students from class 8<sup>th</sup>, 9<sup>th</sup> and 11<sup>th</sup> class were included in the study. Out of the total, 5 Govt. schools. From each school, on average, 231 students were selected. Hence in total, approximately 1155 students were covered.

A team comprising research assistants and trained field investigators visited the schools after getting permission from the respective principals of schools.

Information was then collected on pre-designed forms. Class teachers were involved in the program as coordinators.

**Study Instrument:** A pre-designed pretested questionnaire was developed. The study instrument encompassed various variables under different domains.

1. Socio-demographic and socio-economic profile (age, gender, the profession of parents, education of parents, work setting, housing, income, etc.)
2. Education details of adolescents ( Class, school, mode of online classes, personal gadgets, etc.).

3. Gadget and screen time details( Gadgets so used, timing of gadget usage, social media timing, video games timing etc.)
4. Sleep pattern changes( hours of sleep, the timing of waking and sleeping, any problems with sleep, etc.)

The tool was prepared in English, Hindi, and the local language. The questionnaire was pilot tested on around 50 respondents to determine its comprehensibility, validity, and estimated completion time. Appropriate changes were made to upgrade its reliability. The data was collected from various schools after seeking permission from principals. Our trained research staff took adequate help from teachers to have quality data. The adolescents were explained clearly the purpose and objectives of the study. Their doubts were clarified by the research workers and assistants in the local vernacular language, too.

#### **Statistical analysis:**

The collected data was cleaned by removing all duplications and analyzed. It was entered into the computer in Excel spreadsheets. Statistical analysis was performed by using a statistical package for social sciences, SPSS version 20. Descriptive statistics were performed on the whole sample. Numerical and categorical variables were summarized as mean and total numbers (percentages) and proportions.

## **RESULTS:**

Our study showed that the maximum number of students were from Class 9<sup>th</sup> (46.9%, n=542) followed by 11<sup>th</sup> (27.1%, n=313) and Class 8<sup>th</sup> (26%, n=300)

This table depicts that most adolescents were **in the** age group 11-14 years (70.5%) followed by 14-16 years (29.4%). Males (58.9%) outnumbered females (41.1%). Maximum adolescents belonged to the Hindu religion (82.4%). The students staying in the nuclear family were more **than those** in the joint family. Fathers (87%) were educated more as compared to mothers (73%). (Table 1)

Maximum students were using phones (92.4%) followed by laptops (3.7%). The average screen time was 1-3 **hours (63.6%)**, followed by 3-5 (22.5%) hours. The preference for offline classes was more as compared to online classes. Internet connectivity was the major **problem faced** by adolescents while attending online **classes**, followed by gadget availability. **Surprisingly, more than 10% indulged in other activities like being on other gadgets while attending online classes.**

Table 3 shows that in COVID-19 1/3<sup>rd</sup> of adolescents were doing self-study, which were more in comparison to pre-COVID times. Around 40 % were **indulged** in 1-2 hours of self-study **during** COVID times. The time spent on screen increased from 1 hour to more than 2-3 hours in **COVID**. It was a big **transition observed in COVID** owing to the lockdown. The adolescents were now more time in front of the screen. The **percentage doubled in adolescents** from pre COVID times (10.4%) to COVID times (25.1%). The majority (40.9%) of adolescents **spent** 1-2 hours on assignments on screen.

**Our research found that** around 10% of adolescents were using reading glasses. Of these, around 1/3<sup>rd</sup> started using in COVID times. And of those who were using

reading glasses, in 5% the number increased in lockdown due to excessive screen time.

Table 4 shows the sleeping **patterns** of adolescents before, during, and after COVID. Adolescents started sleeping for more hours in COVID times. The percentage of them sleeping for 7-9 hours was (40%) and those sleeping for 9-10 hours were 24.9%.

The transition of delay in wake-up time was observed in COVID times. **A higher** percentage of adolescents started getting up **late compared** to pre-COVID time. The delay pattern in going to bed was also seen. It was found that more percent of adolescents started going to sleep late though a maximum of 23.5% were sleeping at 10-11 am **unlike** pre-COVID time where **most slept** at 9-10 pm.

Another interesting finding was that most of them were finding it difficult to sleep early **after bed**. 23.9% reported that it took them too long to **rest** after going to bed and 20.7% felt a little more effort to sleep than in pre-COVID time. An increase of around 10% was found in the usage of gadgets before sleep in adolescents.

Table 5 shows various reasons for a change in sleeping **patterns since COVID-19**. The most common (28.2%), was that there was no stress of getting up early in the morning **to go** school, hence they indulged in late-night activities. Others **spent more time** on gadgets (23.1%) and more on social media(23.4%). It was also affected by less (16.2%) time given to physical activities due to the closure of schools, playgrounds, and other facilities.

## **DISCUSSION**

The present research aimed to assess the impact of the COVID-19 lockdown on varied domains of life among the young population of adolescents. The effort **was to develop** profiles and analyze patterns of gadget use and its health impacts during the COVID - 19 crisis.

The exponential rise in the usage of gadgets was evident in our study. **Similar** results were found in a study done by Rashid et al<sup>12</sup> in Bangladesh that showed participants reportedly used gadgets significantly more ( $P < .05$ ) in 2020 as compared to 2019. The concordant results were also seen in a **study by** Nadeem et al who demonstrated that increased frequent interaction of kids and teenagers with their electronic gadgets during COVID-19 had severe and distressing effects on them.<sup>13</sup>

The most common **gadget used** was mobile smartphones (92.4%), **as** per our study. It may be because mobile phones can be connected to cellular networks easily, enabling users to be connected to the web most of the time, being pocket friendly, **and** easy to carry, and in our study **most** families were of low socio-economic status. Similar results were found in a study done by Rashid<sup>12</sup> , that showed 62.4% of adolescents using mobile phones for classes.

The average screen time in our study majority (63.6%) was 1-3 hours. Another interesting finding was that an increased percentage of adolescents indulged in gadgets for about 3-5 hours(22.5%) and a few also till 10 hours. In India Bahkir et al<sup>14</sup> conducted a social media survey of 407 young adults (average age 27.4 years) and discovered that during the lockdown, exorbitant media exposure caused an unabated increase in screen time, **hiking** it to an average of  $4.8 \pm 2.8$  hours per day,

totalling to  $8.65 \pm 3.74$  hours. Similar results were evident in a study done by Anitha<sup>15</sup> and Nagata JM.<sup>16</sup>

The Blue light hypothesis"-states that the short wavelength light emitted by digital media suppresses melatonin production by the brain causing media-induced sleep displacement and media-induced sleep time-shifting.<sup>17</sup> Our study also revealed sleep behavior changes in school-going adolescents. The number of hours of sleep increased, wake up time and time taken to sleep got delayed, compared to pre COVID era. Similar findings were seen in the study by Lim et al<sup>18,19</sup>, who found a significant change in sleep duration during lockdown when schools were closed and learning shifted to home. This constituted a serious health risk because insufficient, inconsistent sleep was linked to non-communicable disorders such as systolic hypertension.<sup>20</sup> Additionally, Guo et al. found this was linked to worse memory and behavioral issues.<sup>21</sup> Other Detrimental effects of disturbed sleep were nightmares in students (16.9%). This finding was reiterated by Bhat et al, in pharmacy students in Karnatka<sup>22</sup> and Kennedy et al.<sup>23</sup>

**Conclusions:** The study highlights the unprecedented rise in gadget usage during the COVID-19 pandemic and its multifaceted implications. While gadgets have played a crucial role in facilitating remote work and maintaining social connections, excessive reliance on them challenges to individuals' well-being. It is crucial to develop strategies to address the potential negative consequences, such as promoting digital well-being and finding a balance between virtual and offline activities. Further research is warranted to examine the long-term effects of increased gadget usage on mental health, social interactions, and overall quality of life.

**Consent:** Informed consent was taken from the participants. The complete privacy and confidentiality of participants were assured. All data was used for research purposes. It was encrypted and stored electronically in a secure location, with a password-protected file by the principal investigator.

**Acknowledgment:** Nil

**Conflict of Interest – Nil**

**Word count** (excluding Abstract, Tables, References): 1890

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**TABLES:**

Table 1. Showing the socio-demographic profile Of Adolescents

Variable	Frequency(n)	Percent (%)
Age (in years)		
11 to 14	814	70.5
14 to 16	340	29.4
17to19	1	0.1
Sex		
1. Male	680	58.9
2.Female	475	41.1
Religion		
1. Hindu	952	82.4
2. Muslim	88	7.6
3. Christian	15	1.3
4. Sikh	99	8.6
5. Other	1	0.1
Type of family		
1. Joint	300	25.9
2. Nuclear	823	71.3
3. Three Generation	31	2.68
4. Other	1	0.086
Total Family Income		
1.<10,000	585	50.6
2.>20,000-40,000	424	36.7

3.>40,000-60,000	68	5.9
4.>60,000	78	6.8
Education of Mother		
1. Illiterate	318	27.5
2. Primary /middle	428	37.1
3. Secondary	259	22.4
4. Graduation	97	8.4
5. Post-Graduation	53	4.6
Education of Father		
1. Illiterate	157	13.6
2. Primary /middle	464	40.2
3. Secondary	356	30.8
4. Graduation	123	10.6
5. Post-graduation	55	4.8

Table 2. Showing gadget usage in adolescents

Variable	Frequency (n)	Percent (%)
Proportion of gadgets used		
1.Phone	1067	92.4
2.Tablets	31	2.7
3.Laptop	42	3.6
4.Desktop	9	0.8
5.Smart TV	6	0.5
Total	1155	100

Average screen time for online classes		
1. 1-3 hours	735	63.6
2. 3-5 hours	260	22.5
3. 5-7 hours	95	8.2
4. 7-10 hours	44	3.8
5.10+hours	21	1.8
Total	1155	100
Students' likeness/preference online classes over offline classes		
1. very likely	209	18.1
2. Likely	212	18.4
3. Same	262	22.7
4. Unlikely	295	25.5
5. Very unlikely	177	15.3
Total	1155	100
Reading of newspaper at home among adolescents		
1. Daily	409	35.4
2. At sometimes	553	47.9
3. Never	193	16.7
Total	1155	100
Difficulties faced during online classes		
1. Internet issue	537	46.5
2. Gadget availability	372	32.2
3. Electricity issue	107	9.3
4. Other (problem)	88	7.6

5. No Problem	51	4.4
Total	1155	100
Play on some other gadget during online classes		
1. Always	169	14.6
2. Sometimes	408	35.3
3. Never	578	50

Table 3. Showing the distribution of time (academic & entertaining) during gadgets usage by adolescents

	Before COVID		During COVID		After COVID	
Variable	Freq	Variable	Freq	Variable	Freq	Variable
Time for self-study						
1) <1 hour	264	22.9	351	30.4	230	19.9
2) 1-2 hours	411	35.6	426	36.9	365	31.6
3) 2-3 hours	337	29.2	212	18.4	319	27.6
4) >4 hours	143	12.4	166	14.4	241	20.9
Total	1155	100.0	1155	100.0	1155	100.0
Total time spent on screen (including gaming, YouTube, etc.)						
1) <1hour	474	41.0	271	23.5	473	41.0
2) 1-	347	30.0	315	27.3	360	31.2

2hours						
3)2-3 hours	214	18.5	279	24.2	131	11.3
4)>4hours	120	10.4	290	25.1	191	16.5
Total	1155	100.0	1155	100.0	1155	100.0

Table 4. Showing change in sleeping pattern among adolescents

	Before COVID		During COVID		After COVID	
Variable	Freq	Variable	Freq	Variable	Freq	Variable
Total sleeping hours						
< 7 hours	525	45.4	405	35.1	554	47.9
7-9hours	539	46.7	462	40.0	523	45.3
> 9 hours	91	7.9	288	24.9	78	6.8
Total	1155	100.0	1155	100.0	1155	100.0
Wake up time						
up to 8 am	966	83.7	620	53.7	938	81.2
8-10am	134	11.6	359	31.1	153	13.2
After 10am	55	4.8	176	15.2	64	5.6
Total	1155	100.0	1155	100	1155	100.0
Use of gadgets before sleep						
More	504	43.6	578	50.4	478	41.4
Less	409	35.4	388	33.6	471	40.8
No	242	21.0	189	16.4	206	17.8

Total	1155	100.0	1155	100.0	1155	100.0
Sleeping with parents/siblings						
More	586	50.7	585	50.7	535	46.3
Less	351	40.4	348	30.1	417	36.1
No	218	18.9	222	19.2	203	17.6
Total	1155	100.0	1155	100.0	1155	100.0
Nightmares						
More	461	39.9	436	37.7	390	33.8
Less	342	29.6	370	32.0	414	35.8
No	352	30.5	329	28.5	351	30.4
Total	1155	100.0	1155	100.0	1155	100.0
Sleepwalking						
More	158	13.7	143	12.4	120	10.4
Less	235	20.3	264	22.8	275	23.8
No	762	66.0	748	64.8	760	65.8
Total	1155	100.0	1155	100.0	1155	100.0
Use of a doll or a stuffed animal while sleeping?						
More	173	14.9	187	16.2	177	15.3
Less	191	15.5	186	16.1	191	16.5
No	791	68.5	782	67.7	787	68.1
Total	1155	100.0	1155	100.0	1155	100.0

Table 5. Showing reason for a change in sleeping pattern since COVID

Variable	Frequency(n)	Percent (%)
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More time on social media	270	23.4
More time playing mobile/computer games	267	23.1
Less physical activities		
No need to wake up early in the morning	187	16.2
Other	326	28.2
Total	105	9.1