Association between increased screen time, sedentary behavior, and insomnia among Indian adults: A cross-sectional nationwide online survey

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ABSTRACT

Context: During the "coronavirus disease 2019 (COVID-19)" pandemic, screen time saw a notable increase, ranging from 2.5 to 7.5 hours per day. Scientific evidence has demonstrated a strong correlation between heightened digital media usage and heightened levels of stress, anxiety, and depression. Research indicates that engaging in screen time for four hours or more daily can elevate the likelihood of experiencing symptoms of depression among children and adolescents by 46–80%. Despite this, there remains a paucity of medical evidence elucidating the intricate interplay between screen time, physical inactivity, and insomnia in adults. **Aim:** The aim of the study was to estimate the prevalence of increased screen time, insomnia, and physical inactivity among adults and their association during the COVID-19 pandemic. **Settings and Design:** A cross-sectional study through an online Google Form questionnaire was conducted among the Indian population. **Methods and Materials:** The study was conducted between June and August 2020 and comprised 658 participants aged 18 and above. Participants were recruited using a chain sampling procedure, with the majority being female, accounting for 54% (355 individuals). **Statistical Analysis:** The mean and standard deviation were calculated for numerical variables, while percentages and proportions were determined for categorical variables. The Chi-square test was employed to examine associations between variables. For assessing the predictors of screen time, a multivariate logistic regression analysis was conducted. **Results:** The majority of participants reported screen time exceeding 2 hours per day (85%), clinical insomnia symptoms (59%), moderate to high physical activity levels (92.8%), and low levels of sedentary behavior (60.5%). Variables such as gender, age, and screen time demonstrated significant associations with insomnia and physical activity. The odds ratio for insomnia in relation to screen time was 2.84 (95% confidence interval: 1.78–4.58) with a *P* value of 0.001. Multivariate logistic regression analysis indicated that increasing age was significantly associated with lower levels of screen time. **Conclusions:** Screen time showed a significant association with insomnia. Less screen time was reported with increased age.

Keywords: Insomnia, obesity, physical activity, screen time, sedentary behavior

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Introduction

On March 24, 2020, India underwent a nationwide lockdown, compelling all individuals to remain indoors.[1] With physical interactions severely restricted, digital media became the primary mode of communication during this period of home isolation, facilitating various online activities such as remote work, virtual

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classes for students at all educational levels, and more.[1] As the coronavirus disease 2019 (COVID-19) lockdown continued, the duration of screen time also witnessed a notable surge.[2] Studies indicate that screen time experienced a significant increase ranging from 2.5 to 7.5 hours per day amidst the pandemic.[3]

The heightened screen exposure during this period had a detrimental impact on mental health.[4] Numerous studies have demonstrated a strong correlation between increased digital media usage and elevated levels of stress, anxiety, and depression.[5] Furthermore, engaging in screen time exceeding four hours per day has been shown to increase the risk of developing symptoms of depression in children and adolescents by 46–80%.[6] In addition to its adverse effects on mental health, higher screen time has also been associated with disruptions to sleep patterns.[4,7]

Exposure to electromagnetic radiation emitted from screens has been linked to the suppression of melatonin production, disrupting the circadian rhythm, and consequently causing sleep disturbances.[8] A study revealed that watching television (TV) for 3–4 hours was associated with an increased risk of insomnia.[9] Beyond its psychological impact, insomnia is also linked to higher cardio-metabolic risks.[9]

A sedentary lifestyle is well-established to increase the risk of various non-communicable diseases, including cardiovascular diseases, obesity, diabetes, and hypertension. Engaging in at least 30 minutes of moderate to vigorous physical activity (PA) per day, or over 15 minutes of vigorous PA per day, has been reported to be protective against symptoms of depression and anxiety.[10] However, due to the lockdown, PA was limited to home settings, leading to prolonged sedentary behaviors such as TV viewing, prolonged sitting, and reading. This, in turn, contributed to social isolation, which is associated with increased social anxiety.[11]

Another observed negative impact of home quarantine was the adoption of unhealthy patterns of food consumption, compounded by sedentary lifestyles, which escalate the risk of obesity and type 2 diabetes mellitus.[12,13]

Concerns about the damaging effects of increased screen exposure have been expressed by both the media and the scientific community. Recognizing these concerns, the Government of India launched "PRAGYATA" guidelines for digital education. These guidelines recommend that states limit screen time for lectures to one session of 30 minutes for pre-primary students (0.5 hours), two sessions of up to 45 minutes each for students in 1st to 8th standard (1.5 hours), and four sessions of 30–45 minutes duration for students in 9th to 12th standard (three hours).[8,14]

Given the limited medical evidence to comprehend the intricate relationships between screen time, physical inactivity, and insomnia among adults, this nationwide study aimed to address several pivotal questions. These included determining the prevalence of increased screen time, insomnia, and physical inactivity among adults during the COVID-19 pandemic, as well as exploring potential associations between these factors.

Materials and Methods

Design and sample

A nationwide cross-sectional study was conducted to assess the patterns of screen time, sleep, and PA among the Indian population during the COVID-19 pandemic. The study employed a chain sampling procedure to recruit participants. Ten researchers, coordinated by two investigators, were deployed across different states of India to approach potential participants. Each researcher enlisted twenty individuals from their social networks, resulting in an initial sample of 240 participants referred to as "influencers." These influencers were then asked to distribute the survey link within their social networks to maximize participating.

Contributors were required to review the written consent and study objectives provided in a Google Sheet and provide online consent before completing the questionnaire. A total of 658 participants completed the questionnaire. Data collection took place from June to August 2020. The study methods and processes were meticulously reviewed and approved by the Institutional Ethics Committee (AIIMS/IEC/20/556) at the All India Institute of Medical Sciences, Rishikesh, Uttarakhand. All participants provided informed consent before participation.

The inclusion criteria were participants currently residing in India, aged between 18 and 69 years. No exclusion criteria were specified other than failure to fully complete the Google questionnaire.

Study tools

A web-based questionnaire was developed in both English and Hindi and administered using Google Forms. The questionnaire comprised two main sections.

The first section collected demographic information such as the participant's current state of residence, gender, age, educational status, occupational status, and living arrangements during the data collection period.

The second section assessed participants' screen time patterns, followed by questions regarding their sleep patterns and physical activities.

Measures
Screen time
Participants were asked about their screen time usage, inquiring, "How much time did you spend using TV-connected devices, laptops, computers, smartphones, tablets, or television, from when you wake up until you lie back down in bed at night?" Responses ranged from less than one hour to more than 10 hours. Screen time patterns were then categorized into two groups:

adequate screen time (less than or equal to two hours) and high screen time (more than two hours).[15]

Sleep pattern

The sleep pattern was assessed using the Insomnia Severity Index (ISI) questionnaire,[16] consisting of seven questions addressing domains such as difficulty in sleep onset, problems with sleep maintenance, dissatisfaction with sleep, impaired daytime functioning due to sleep, sleep problems noticeable by others, and distress caused by sleep difficulties. Participants were then categorized into one of four groups: no clinically significant insomnia, subthreshold insomnia, moderately severe clinical insomnia, or severe clinical insomnia.

Physical activity

The seven items of the short version of the International Physical Activity Questionnaire (IPAQ) were used to measure PA.[17] Participants were asked about their powerful "physical activities" in the last seven days like heavy weight lifting, digging, aerobic exercise, and bicycling. Powerful physical activities refer to "activities that take hard physical effort and make you breathe much harder than normal." They were also enquired about their moderate physical activities in the past seven days like carrying light loads, bicycling at a regular pace, or doubles tennis. Moderate physical activities refer to "activities that take moderate physical effort and make you breathe somewhat harder than normal." The last "item" from the short version of IPAQ was used to measure the sitting time (i.e., sedentary behavior). The participants were asked, "During the last 7 days, how many hours per day did you spend sitting?" The PA was categorized into three levels according to IPAQ-SF: 1) high level of PA, 2) moderate level of PA, and 3) low level of PA. Sitting time was categorized into four groups: 1) "<4 hrs per day," 2) "4 to <6 hrs," 3) "6 to <8 hrs," and 4) "≥8 hrs per day." The sedentary behavior was classified into higher category (≥8 h/day) and lower category (6 to <8 h/day).[18]

Data management and statistical analyses

Data from the completed questionnaires were directly imported into an Excel sheet and subsequently exported to IBM Statistical Package for Social Sciences (SPSS) Statistics software, version 26 (Chicago, USA), for cleaning, coding, and detecting missing values. Continuous variables were described using mean ± standard deviation, while categorical variables were summarized using frequencies or percentages. Inferential statistics were performed using the Chi-square test or Fisher's exact test for categorical variables, and independent t-tests or Mann-Whitney U tests were utilized where applicable.

A univariate binary logistic regression analysis was employed to gain initial insights into the association of each independent variable with the dependent variable, with statistical significance set at $P < 0.05$. Furthermore, to measure the overall effect of each independent variable on the dependent variable (screen time), a multivariate regression analysis was conducted.

Results

Sociodemographic characteristics

Out of the 300 study participants, 355 (54%) were female. The mean age of the participants was 28.67 ± 11.75 years. The majority of participants were residents of central India (66.0%), had an educational level of graduate and above (91%), and were unemployed (52%) [Table 1].

Risk variables

Demographic and other variables such as gender, age, and screen time demonstrated a statistically significant association with the outcome variables, namely screen time, insomnia, and PA, with *P* values less than 0.05. Conversely, variables including education status, occupation, current stay, and residency did

Table 1: Sociodemographic characteristics among study participants		
	Frequency	**Percentage**
Gender		
Male	303	46
Female	355	54
Age		
Mean±SD	28.67±11.75	
Educational status		
Secondary	2	0.3
Higher secondary	57	8.7
Graduate and above	599	91
Occupation		
Employed	280	42.4
Unemployed	365	52
Retired	13	5.6
Current stay		
Alone	40	6.1
With friends or colleagues	40	6.1
With family	578	87.8
Residence		
Northern	107	16.2
Central	434	66
Eastern	36	5.5
Western	43	6.5
Southern	38	5.8
Screen time		
≤2 h/day	95	14.4
>2 h/day	563	85.6
Insomnia		
Not clinically significant	265	41
Subthreshold	256	39
Clinically moderate	108	16
Clinically severe	29	4
Physical activity		
Low	47	7.1
Moderate	326	49.5
High	285	43.3
Sedentary behavior		
Low (<8 h/day)	398	60.5
High (≥8 h/day)	260	39.5

SD=Standard deviation

not exhibit any significant associations with the outcome variables [Table 2].

Among the participants, a prevalence of screen time exceeding two hours was reported in 85.6%, clinical insomnia in 59% [Figure 1], low PA in 7.1%, and low sedentary behavior in 60.5%. The odds ratio for insomn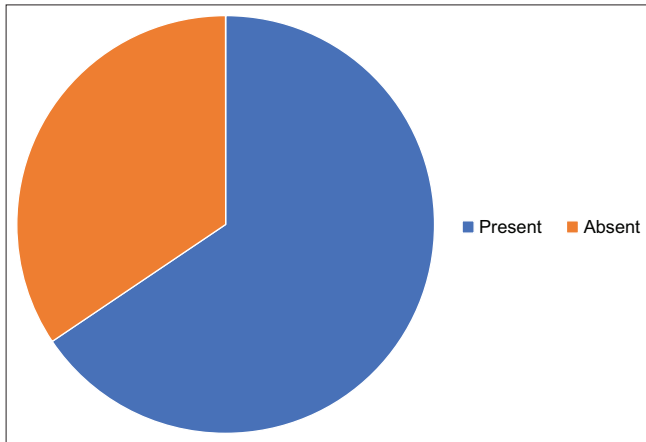ia in relation to screen time was 2.84 (95% confidence interval [CI]: 1.78–4.58) with a P value of 0.001. Insufficient PA in conjunction with screen time yielded an odds ratio of 0.86 (95% CI: 0.29–2.12), with a P value of 0.73 [Table 3].

Logistic regression

Selected risk factors that demonstrated a significant association with a P value less than 0.25 were included in the univariate binary logistic regression analysis. Following consideration of potential confounding effects, risk factors with a P value of 0.05 or below in the univariate logistic regression analysis were incorporated into a multivariate binary logistic regression model to identify risk factors independently predicting screen time [Table 4]. The analysis revealed that only increasing age was significantly associated with reduced screen time.

Discussion

During the COVID-19 pandemic in India, we conducted a study with 658 individuals to assess the prevalence of insomnia, PA, and their association with increased screen time. Age and gender were found to be associated with screen time, insomnia, and PA among various sociodemographic factors, while screen

Figure 1: Prevalence of clinical insomnia among study participants

Table 2: Association of sociodemographic characteristics and factors with screen time, insomnia, and physical activity										
Characteristic	Screen time		P	Insomnia		P	Physical activity			P
	≤2	>2		Clinical	Non-clinical		Low	Moderate	High	
Gender										
Male	49	254	0.242	252	52	0.03	25	132	146	0.017
Female	46	309		270	85		22	194	139	
Educational status										
Secondary	1	1	0.3	1	1	0.2	0	0	2	0.172
Higher secondary	7	50		42	15		4	22	31	
Graduate and above	87	599		478	121		43	304	252	
Occupation										
Unemployed	44	236	0.6	231	49	0.07	21	147	112	0.14
Employed	50	315		278	87		24	176	165	
Retired	1	12		12	1		2	3	8	
Current stay										
Alone	3	37	0.2	29	11	0.4	0	27	13	0.07
With friends	3	37		30	10		2	23	15	
With family	69	489		462	116		45	276	257	
Residence										
Northern	13	93	0.3	84	22	0.8	4	55	47	0.1
Central	70	366		346	90		34	205	197	
Eastern	6	29		26	9		1	19	15	
Western	4	40		37	7		3	29	12	
Southern	2	35		28	9		5	18	14	

Table 3: Association of screen time with clinical insomnia and physical inactivity							
Screen time	Insomnia		P	Odds ratio	Physical activity		P Odds ratio
	Clinical	Non-clinical			Group 1	Group 2	
≤2	86	435	0.001	2.84*	6	89	0.09 0.86#
>2	9	128			41	532	

*Screen time was categorized into two groups: ≤2 h and >2 h. Insomnia: no clinically significant category was tested against other three groups of subthreshold, moderate, and severe. #Screen time was categorized into two groups: ≤2 h and >2 h. Physical inactivity (coded into two groups), low as group 1 and moderate/high as group 2

Table 4: Logistic regression with screen time			
Variable	Category	Unadjusted OR (95% CI, *P*)	Adjusted OR (95% CI, *P*)
Age		0.98 (0.96–0.99), 0.05	0.97 (0.95–0.99), 0.02
Gender	Male	1	1
	Female	1.3 (0.84–2.0), 0.24	1.13 (0.72–1.80), 0.57
Education	High school	1	1
	Higher secondary	7.14 (0.40–127.55), 0.18	6.72 (0.23–194.23), 0.26
	Graduate	6.28 (0.39–102.21), 0.19	6.14 (0.23–161.64), 0.27
	Post-graduate	5.43 (0.33–88.71), 0.23	5.90 (0.23–151.52), 0.28
Occupation	Students	1	1
	Self-employed	0.46 (0.24–0.90), 0.02	0.77 (0.36–1.70), 0.52
	Professionals	1.01 (0.62–1.67), 0.94	1.41 (0.77–2.60), 0.26
	Home-maker/unemployed/retired	0.9 (0.37–2.68), 0.99	2.40 (0.70–8.24), 0.16
Current stay	Alone	1	1
	Friends/colleagues	1 (0.19–5.28), 1.0	0.64 (0.10–4.12), 0.64
	Family	0.45 (0.13–1.48), 0.18	0.31 (0.07–1.33), 0.11

For multi-variate analysis, any group with *P*<0.25 was included. Only increasing age is found to be significantly associated with higher screen time. OR=Odds ratio

time showed associations with both insomnia and PA among the risk factors.

Most participants in our study were in their early 30s and reported a screen time exceeding 2 hours, compared to pre-pandemic years. With limited opportunities for outdoor activities, individuals may have had more leisure time, potentially leading to increased social media usage and binge-watching of TV shows, possibly exacerbated by feelings of loneliness. These findings are consistent with previous studies.[5] The resulting delays in bedtime due to altered habits may contribute to the observed link between insomnia and our study's findings, aligning with recent research.[19]

Furthermore, our study indicated a decrease in PA, likely due to restricted access to exercise facilities such as gyms. The lockdown may have presented challenges for individuals accustomed to walking, jogging, or participating in other forms of PA due to limited mobility. These results are congruent with findings from a Chinese online survey.[20]

In our survey, the percentage of women slightly exceeded that of men, and we found a correlation between female gender and insomnia. Potential explanations for this association include heightened concern for the health of family members, particularly children, increased feelings of loneliness during the lockdown due to heightened smartphone usage, and elevated anxiety regarding grocery maintenance amid restricted access to produce and grocery stores. While an online survey conducted in China yielded inconsistent results, with lower PA significant in both sexes,[21] a Spanish study[22] reported findings similar to ours.

Regarding our identified risk factor, screen time exceeding two hours was linked to insomnia. Factors such as heightened future uncertainty, decreased exposure to sunlight, increased social media usage—particularly before bedtime—and a lack of meaningful daily activities leading to dissatisfaction could contribute to this phenomenon. These alterations may disrupt the sleep-wake cycle, increasing the risk of insomnia. Comparable results were reported in other studies.[1,5]

Through univariate logistic regression analysis, we found that only an increase in age was significantly associated with watching less than or equal to two hours of TV daily. This finding could be attributed to participants' reduced exposure to social media at a younger age, evolving perspectives on leisure activities as they mature, and an increased appreciation for quality family time as they age.

Strengths

Given the growing concern surrounding screen time and its impact on public health, several studies have explored the relationship between adult screen time, PA, and sleep patterns. Therefore, our nationwide study of the adult Indian population contributes to our understanding of how the COVID-19 pandemic may influence rest and PA. In our study, participant gender and unemployment distributions were similar, indicating the generalizability of our findings. Furthermore, we utilized an objective and repeatable assessment method to measure screen time, PA, and sleeplessness.

Limitations

Compared to their counterparts, there was a notably higher representation of graduates, individuals from central India, and those living with family in our study. A more balanced and representative involvement across these categories would have further strengthened the study's findings.

Conclusion

Increasing age emerged as the sole consistent predictor of reduced screen time, while a strong association between screen time and insomnia was observed. Consequently, to safeguard the physical and mental well-being of the economically productive segment of our population, it is imperative to educate and

empower young adults, as well as children and adolescents, with healthy coping mechanisms to combat loneliness, such as engaging in regular physical exercise.

Conflicts of interest

There are no conflicts of interest.

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