Smart phone use and sleep disturbances, depression and anxiety in adolescents

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Background: Keeping in mind about the rapid advancement and extensive use of mobile phones, and their immense effect on communication and interactions, it is important to study potential negative health effects of mobile phone exposure especially among adolescents. **Material & Methods:** A cross-sectional study was conducted to assess smartphone use and sleep disturbances, depression in adolescents among 469 adoloscents studying in Government Polythechnic college, Vizianagaram using a structured questionnaire containing details of demographics, educational status, purpose of using the smart phone etc, PSQI and DASS 21 for sleep quality, depression stress and anxiety. **Results:** The prevalence of smart phone addiction among participants was 29.63% (30.08% in males and 29.21% in females). Factors associated with smartphone addiction in male students were use of gaming apps and internet surfing. Significant factors for female students were use ofuse of social networking services and communication services (Calling and texting). Depression, anxiety and quality of sleep are significantly associated with smart phone addiction. **Conclusion:** Smartphone addiction was common among the polyechnic students investigated. This study identified associations between smartphone usage, psycho-behavioral factors, and smartphone addiction, and the associations differed between males and females. These results suggest the need for interventions to reduce smartphone addiction among degree students. The results of this study suggest that adolescents might benefit from education regarding sleep hygiene and the risks of electronic media use at night.

Keywords: Smartphone, Adolescent, Addiction, Depression, Anxiety

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Introduction

A smartphone is "a mobile phone that performs many of the functions of a computer, typically has internet access, and an operating system capable of running downloaded applications" [1]. Communication channels have been so phenomenally upgraded that communicating a person with thousands of miles apart is simply a game of seconds now using messenger, WhatsApp, voice call etc.

Young people expand their opportunities for making social relationships using Smartphone [2]. It has become one of the most important academic and recreational tools for adolescents and young adults [3]. With the greater availability of the Smartphone, excessive Smartphone use for adolescents and young adults can Indian Journal of Science and Technology, lead to many problems such as low academic achievement [4], interpersonaldistress [5] and mal-adjustment of school life [6], sleeping disturbance [7], depression [8], psychological distress [9] and Smart phone addiction [10].

Objectives

01. To study the extent of smartphone addiction among adolescent students.

02. To determine whether overuse of smartphone is associated with anxiety and depression in adolescent students.

03. To determine whether overuse of smartphone is associated with quality of sleep in adolescent students.

04. To give suitable recommendations based on the study

Methodology

Study design: Cross sectional Analytical study.

Study area: Maharajaha Ananda Gajapathi Raju Government Polytechnic College, Phool Baugh, Vizianagaram.

Sample size: Ananda Gajapathi Raju's government polytechnic college, Vizianagaram. By taking the prevalence of smartphone addiction as 17% from a previous study conducted by Severin haug, Raquel pazcastroet al. on Smartphone use and smartphone addiction among young people, the sample size is calculated as below.

A sample size of 469 students is calculated out of

Total 1141 students in the age group 16 to 19 years studying in various branches of Maharajah

Sample size was calculated by using the formula:

$N = Z_2 \, pq \, / \, l_2$

Where p = 0.17 (prevalence of smartphoneaddiction 17%)

Q = 1- p = 0.83

L = 20% of p = 0.034

If α = 0.05then $Z_{0.05}$ = 1.96

Therefore, Sample size =469

Study instrument: Structured questionnaire was administered.

Semistructured proforma: Semi structured proforma that contained details of demographics, educational status, purpose of using the smart phone, money spent per month, place of access, the time of day when accessed the most and the average duration of use per day. Data was collected from those using smart phone for at least last 3 months.

Smart phone addiction scale (SAS) Short version: Smartphone addiction was measured using the Smartphone Addiction Scale short version (SAS-SV). The SAS-SV is a validated scale that contains 10 items rated on a dimensional scale (1 "strongly disagree" to 6 "strongly agree") [11].

The total score ranges from 10 to 60, with the highest score representing the maximum presence of "smartphone addiction" in the past year. The original SAS-SV showed content and concurrent validity and internal consistency (Cronbach's alpha: 0.91). Smartphone addiction cut-off values of ≥ 31 and ≥ 33 for male and female participants, respectively, were applied as suggested by Kwon et al. [11].

Pittsburgh sleep quality index: Sleep quality was assessed using Pittsburgh Sleep Quality Index (PSQI) [12], which is a widely used 19-item self-report questionnaire that measures subjective sleep quality. The 19 items are grouped into scores with seven components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction.

The scores of these components are added to a global PSQI score with a range of 0 to 21, with

Higher scores indicating worse sleep quality. PSQI scores above 5 were taken as abnormal.

Depression anxiety stress score 21 [DASS 21]: 21 item self-report questionnaires designed to assess the severity of core symptoms of Depression, Anxiety and Stress. It can be administered by the respondents themselves or by another person.

It is crucial that each question is answered. It is rated on a four-point Likert scale, each item is scored from 0 to 3. The sum of the relevant 7 items multiplied by 2 for each scale constitutes the participants' scores for each of Depression, Anxiety and Stress [13].

Study Period: A period of 3 months (1st Julyto 30th September, 2018)

Inclusion criteria
01. Maharajah Ananda Gajapathi Raju Government Polytechnic College Students of both genders in the age group of 16 to 19 years.

02. Adolescent students with Smartphone usage of 90 minutes and more in a day.

Exclusion criteria
01. Adolescent students with Smartphone usage of less than 90 minutes and more in a day.

Data analysis: Data was collected by using questionnaire and interviews to evaluate the percentage of smartphone usage for various purposes among the respondents. Collected data was entered in MS Excel and analyzed using SPSS version 21. Results are shown in the form of percentages, tables and figures.

**Ethical clearance:** Ethical clearance was obtained from Institutional Ethical Committee, MIMS

Results

In the current study among the total of 469 polytechnic students it was observed that 48.18% of them were malesand the remaining 51.82% werefemales. The students were aged between 16–19 years with a mean age of17.72 ± 1.43 years.

Table-1: Age and Gender wise distribution.

Age	Male (%)	Female (%)	Total (%)
<17	98 (43.36)	107 (44.04)	205 (43.71)
>17	128 (56.64)	136 (55.96)	264 (56.29)
Total	226	243	469

From the above table it is clear that majority (56.29%) of the study subjects were in the age

Group of more than Seventeen years and the remaining 43.71% belong to equal to or less than 17.
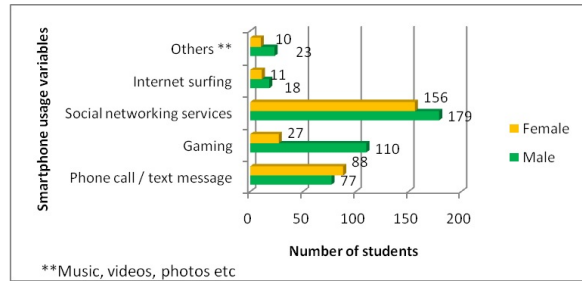
Fig-1 : Showing Smartphone usage among study subjects

Figure 1 show that usage social networking services was found to be higher i.e., 71.4% (79.2% males and 64.2% females) next to Phone call / texting (35.2%) and gaming (29.2%) and in these both male and female were found to be using smartphone for phone calling / texting in equal proportions but when it comes to gaming major proportion (48.6%) were males and only 11.2% of females.

Table-2: Smartphone addiction among polytechnic students.

Addiction	Male (%)	Female (%)	Total (%)
Present	68 (30.08)	71 (29.21)	139 (29.63)
Absent	158 (69.92)	172 (70.79)	330 (70.37)
Total	226	243	469

Chisquare value = 0.425, df = 1, p = 0.837

Smartphone addiction was found to be almost in similar proportions on comparison between male and female i.e., 30.08% of males have addiction towards smartphone and among females 29.21% have smartphone addiction.

Table-3: Showing distribution of Depression, anxiety and Sleep quality among the study subjects.

		Male (%) N = 226	Female (%) N = 243	Total (%) N = 469
Depression	Positive	73 (32.3)	55 (22.6)	128 (27.29)
	Negative	153 (67.7)	188 (77.4)	341 (72.71)
		**p value = 0.019		
Anxiety	Positive	29 (12.8)	17 (6.99)	46 (9.8)
	Negative	197 (87.2)	226 (93.01)	423 (90.2)
		**p value = 0.034		
Sleep Quality	Good	151 (66.8)	149 (61.3)	300 (63.9)
	Bad	75 (33.2)	94 (38.7)	169 (36.1)
		**p value = 0.215		

Table 3 presents that Depression and anxiety were significantly associatedin males on comparison with Females. Where as poor quality of sleep was predominant in females than in male students.

Table-4: Gender wise association of Depression, Anxiety and sleep quality with smart phone addiction.

Variables		Smartphone addiction							
		Male				Female			
		Positive	Negative	OR	P value	Positive	Negative	OR	P value
Depression	Present	30	43	2.86 (1.53-5.34)	<0.001	22	33	1.89 (1.01-3.55)	0.047
	Absent	28	115			49	139		
Anxiety	Present	15	14	2.83 (1.28-6.2)	0.009	10	7	3.86 (1.41-10.60)	0.008
	Absent	54	143			61	165		
Quality of sleep	Good	39	112	0.55 (0.30-0.99)	0.048	33	116	0.42 (0.24-0.74)	0.002
	Bad	29	46			38	56		

Table 4 represents the univariate analyses of potential factors (Depression, Anxiety and Sleep quality) related to smartphone addiction. Poor sleep quality, depression, and anxiety were significantly associated with smartphone addiction in both males and females.

Discussion

In the present study done on polytechnic students of Government polytechnic college students, majority (51.82%) were females and the remaining were male students. Similar setup was found in the study done by Baifen Chen et al[29] where 51.7% of the study participants were females.

The prevalence of smartphone addiction among the study subjects in the current study was found to be 29.63%, measured with the help SAS, which was higher than that in previous studies on college students using the same instrumentin Korea [14,15] and they found that proportion of students who are at risk of having smartphone addiction ranged from 21% to 27%. The prevalence of smartphone addiction in a sample of 293 undergraduate students from a university of J city, Korea was 14.7% [16]. Research was carried out on smartphone addiction and its effect on various activities on undergraduate students, done with different scales in a study conducted in China showed that the prevalence of smartphone associated problems in undergraduates was 21.3% [17].

A prevalence of 16.9% among 1519 participants was reported by a set of researchers from Switzerland [18]. Another study reported a much higher prevalence of 33.3% prevalence level among

Adolescentsin a college at Ajmer, Rajasthan [19], while a 27.2% prevalence has been linked to high-risk smartphone users among university students in Riyadh [20]. These discrepancies could be due to the different instruments and classification methods used at the time of data collection, and also differences among the participants and geographical setup in the different studies. Yet, the high prevalence rate identified in the current study is an indication of possible public health concern posed by smartphone over use among the adolescent students studied. The results of this study on prevalence of smartphone addiction showed no significant gender differences, where smartphone addiction was 30.08% in males and 29.21% in females with a probability value > 0.05. Similar results as of current study were reported in some previous research [16,21].

Nevertheless, some studies have reported that female participants have a higher prevalence of smartphone addiction than males [14,15]. A study conducted in Turkey on Medical studentsby Kadir reported that the mean SAS score of female students was significantly higher than that of male students [22]. Similarly, higher prevalence of 19.4% was observed in females and is only 14.1% in males[18]. The use ofsmartphones differed between the two gendersas male students were more likely to play games, watch videos, and listen to music, whereas female students were more tending to use the mobile phone communication functions (calling and texting) and social networking services were observed in the current study. Cell phone (smartphone) is a source of social contact for females in which messaging and social networks play major role, while for males, a more branched

Out type of usage was observed, involving text messages, phone calling, and gaming applications [23].

A study carried out by Roberts et al. [24] on cell phone activities and addiction among male and female college students, reported that the most challenging applications are voice calls, text messages, and social networks in relation to smartphone overuse. This inconsistent prevalence of smartphone addiction in males and females needs further research. Some evidence was available stating that smartphone overuse was associated with various psychological and behavioral problems, such as depression, anxiety, and sleep disturbance. However, the impending etiology was unclear.A significantly higher proportion of high smartphone users had depression and anxiety than low smartphone users (p = 0.005). There was no direct effect of high smartphone use on sleep quality but high smartphone use and poor sleep quality were also related to depression[22]. It has been found that depressed individuals use their smartphones as a coping strategy to deal with their negative emotions [25]. Excessive smartphone use at night could keep one up late leading to sleep difficulties, thus influencing stress and depression [26]. Use of computers, cell-phones and televisions at higher doses was associated with delayed sleep/wake schedules and wake lag, potentially impairing health and educational outcomes [27]. The relationship between excessive use of mobile phone use and lifestyle, social support, insomnia, and depression was found to have significant association [28].

The findings of the present study are consistent with some and contrary with other previous studies with respect to the over-use of smartphones and its relationship to depression, anxiety, and poor sleep quality. In the present study, some smartphone applications and psycho-behavioral factors were associated with smartphone addiction. Playing smartphone games was a predictor of smartphone addiction for males, whereas use of multimedia and social networking applications were predictors for females. Although the gender difference may only reflect preferences for smartphone apps, the findings indicate the need for gender-targeted prevention and intervention strategies to reduce smartphone addiction.

Regarding psycho-behavioral factors, depression, poor sleep quality and anxiety were significantly associated with smartphone addiction in both males and females, it is probable that depression was

More prevalent in male students than female students in the present study. Psychosocial factors such asgender differences in stress coping, gender-specific expectations that males should have a good economical settlement may be the reasons behind male preponderance towards depression.

Conclusion

- Wide spread smartphone addiction among polytechnic college students, which suggests that smartphone addiction would become a public health issue.

- Playing games on smartphones predicted addiction for male students, whereas uses of multimedia and social networking applications were predictors for females.

- Smartphone addiction may result in psychological and behavioral problems, such as depression, anxiety, and poor sleep quality, and females who scored at the addiction level were more likely to be depressed than males.

- Considering the gender differences in smartphone addiction targeted prevention and intervention strategies based on a multicomponent strategy to reduce these behavioral problems are recommended.

- Few healthcare providers, however, have received in-depth training in sleepand may not inquire about sleep as a contributor to largerhealth issues in their patients.

- Smart phones undoubtedly enhance connectivity and information for students. However, it is vital to curtail its usage to reduce depression anxiety and stress in order to improve the mental health status of students.

- Considering the gender differences in smartphone addiction highlighted by the present study, targeted prevention and intervention strategies based on a multi-component strategy to reduce this behavioral problem are recommended.

Limitations

01. A sample of 469 cannot be generalized to whole of adolescent's population.

02. The data was cross-sectional, which limits the ability to draw underlying inferences, particularly those concerning direction of association between smartphone addiction and risk factors of psychological behavior.

03. The participants were all polytechinic college students; this may limit the generalization of the present results to other at-risk groups.

04. Functional impairments such as blurred vision and pain in the wrists or necks of participants were not investigated here.

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