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A Cross-Sectional Study on the Effect of Smartphone Use on Sleep Quality and Mental Health Among MBBS Students of Medical College, Kolkata

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ABSTRACT

Smart phone addiction (SMA) is recognized as a health risk and is often linked with sleep disruption and psychological distress. This study assessed the prevalence and inter-relationships of SMA, sleep quality and mental health parameters-including self-belief, self-esteem, hopelessness and emotional stability-among MBBS students. A cross-sectional study was conducted among 380 MBBS students chosen randomly at Medical College, Kolkata. Data were collected using a structured, pre-tested questionnaire incorporating the Depression Anxiety Stress Scale and a modified SMA Scale. Statistical tests included chi-square tests, t-tests, correlation and regression, with significance set at $p = 0.05$. Prevalence of depression, anxiety and stress were 64.7%, 64.7% and 49.5%, respectively; 53.2% had SMA and 55% reported poor sleep. More than half of the participants reported low self-belief (50.5%), low self-esteem (55.8%), hopelessness (55.8%) or emotional stability (54.5%). SMA correlated positively with depression, anxiety, stress and sleep disturbance and negatively with self-belief and self-esteem ($p < 0.01$). Significant risk factors included living away from one's parents, reserved category status, allergies and gastrointestinal upset. Physical activity was protective, inversely related to SMA, sleep disturbance and psychological morbidity. Novel associations emerged between SMA and hopelessness, alongside evidence of bidirectional pathways linking poor sleep with distress. SMA, poor sleep and psychological morbidity are highly prevalent among medical students. By incorporating self-belief and hopelessness as new dimensions, this study highlights the need for holistic interventions that combine digital hygiene, resilience training and physical activity.

INTRODUCTION

Smart Phone addiction (SMA) has become a global concern, which may hamper mental health, causing sleep disturbances, depression, lower self belief, anxiety, stress and neuroticism[1,2]. The prevalence of smartphone use is higher among the youth[3]. It interferes with student's academic performances and personality traits, impacting extraversion, conscience, emotional state and social behaviour[4,5]. This is the time period for developing personality and social interaction skills. During this time, seeking social validation, peer acceptanceand a sense of belonging are popular behavior pattern during adolescence. Smart phones fulfill these needs by providing constant connectivity through social media and online communities. The desire of staying connected and "fear of missing out" (FoMO) can drive impulsive smart phone overuse as they tend to maintain social relationships and seek approval from their peers[2,6]. Higher prevalence is noticed amongst medical students, particularly the male candidates[7]. Medical students have reported to have higher levels of stress, anxiety and depression and sleep deficit. They are often sleep deprived and burdened with curricular demands, can experience severe psychological problems due to excessive smartphone usage. This might deteriorate their potential and work efficiency as budding doctors[8].

Sleep restructures new memory representations and helps in extraction of explicit knowledge, in addition to improving the retaining capacity of brain[9,10]. Besides poor sleep quality, SMA and stress can increase mental morbidity, manifesting as hopelessness, abnormal social interactions, frequent emotional turbulence, along with classical finding of anxiety, depression and stress[11]. A statistically significant relationship exists between poor sleep quality and SMA[12]. Habitual behaviours including depressive disorders and interpersonal sensitivity are usually affected by smart phone overuse. Several studies have also focused on association of insomnia with mental health[13]. The exposure to electromagnetic frequency (EMF) at night modulates the rhythm of melatonin and pineal gland activity, which may affect the cerebral blood flow and electrical activity of the brain and there by impairs sleep quality. In particular, bedtime cell phone usage in adolescents can interrupt sleep and lead to stress, depression and anxiety. Moreover, the late night smart phone users are significantly associated with delayed sleep latency, insufficient sleep duration, increased awakenings at night, inadequate sleep and excessive daytime sleepiness and tiredness[14-16]. Hence, social media usage is also adversely associated with sleep quality[17]. Excessive usage of smartphone can impede physical activities, leading to sedentary lifestyle and obesity[18-20]. There has been significant impact of exercise on quality of life and SMA[21].

Although there have been several studies on the association smartphone use and mental health parameters, there is rarely any study that focuses on the causal relationships among sleep quality, SMA and associated psychological factors[22,23].

As such, against this backdrop, the objectives of present study were framed viz., to access the pattern of smartphone use amongst them, to evaluate sleep pattern among them, to determine the mental status of the students including several parameters such as depression, anxiety, stress, hopelessness, self doubt, social functioning, relationship maintenance and emotional stability, to establish the association of SMA with sleep deficit.

MATERIALS AND METHODS

This descriptive, observational and institute based cross-sectional study was conducted between September and December, 2024 among undergraduate students in Phases 1, 2, 3 and 4 at Medical College, Kolkata. The primary objective of the study was to determine the effects of smartphone use on sleep quality and mental health among MBBS students at Medical College, Kolkata. Sample size was calculated using Cochran's formula with prevalence of SMA as 52% among undergraduate medical students according to study of Dhamija S *et al*. considering 5% absolute error[15]. Students from each phase were selected by simple random sampling. Data collection was performed through a predesigned and pretested structured Questionnaire, which had several domains-exercise profile, sleep disturbance, self-esteem, self-belief, hopelessness, emotional stability and social behaviour. The domains were identified through few focus group discussions among students of all professional years and distributions of those suspected factors were searched among the students. Depression, anxiety and stress were evaluated according to Depression, Anxiety and Stress Scale -21 scale[24]. For assessment of smartphone usage, Smart phone Addiction Scale – Short Version (SAS-SV) was used[25]. The Questionnaire was validated using Crohnback's alpha (0.93). The study tool was face validated and content validated by the subject experts from Department of Community Medicine and Department of Psychiatry of Medical College, Kolkata. Data collection form was completed by the students who were present on the day of data collection. Students diagnosed with psychological disorder before joining MBBS were excluded from the study. Information form and Consent form to participate in a research study (English/ Bengali/ Hindi) was used to obtain consent

from the study participants. Anonymity of the participants was ensured. The study commenced after obtaining permission from the Scientific Advisory Committee and Institutional Ethics Committee following standard ethical guidelines. All data presented as a comparison between stressed and non stressed population, including their association with socio-demographic details. Comparisons were performed by Chi-square test for quantitative data. The data was compiled on SPSS Software version 23. Results were presented using charts, graphs, tables, diagrams, etc. For all the statistical tests level of significance was set at p=0.05.

RESULTS AND DISCUSSIONS

The study population comprised 380 undergraduate medical students from all phases of MBBS. The mean age of the participants was 20.66±1.43 years ranging from 18 to 30 years. Male students were 252 (66.3%); 336 (88.4%) study participants belong to urban origin. 214 (56.3%) of them stayed with family. At least one of their parents were doctor for 44(11.6%) of the participants. 238(62.6%) participants reported that they live alone for maximum hours. Among the study population, 7.4% were underweight, 21.1% were overweight and 3.7% were obese. Using the study tool adopted and modified from DASS-42, 64.74%, 64.74% and 49.47% of the undergraduate medical students were found to be depressed, anxious and stressed respectively. 53.16% had smartphone addiction; 55.00% had sleep disturbance; 50.52% had lower self belief; 55.79% had lower self-esteem; 55.79% suffered from hopelessness; 54.47% had emotional disturbance and 65.26% had good social behavior.

Stress was significantly higher in females. Self belief and emotional stability in males; self esteem in rural population; sleep disturbance, stress and SMA in students who are staying without their parents; hopelessness in the study population whose parents were doctor; sleep disturbance in those who stay alone at residence were significantly higher. Depression, anxiety, stress were significantly lower in rural population; self esteem in students having doctor parents; self esteem and emotional stability in those who stay alone were significantly lower (Table 1A and 1B).

Significant association was found between sex with self belief, emotion and stress; residence with self esteem, depression, anxiety, stress and social behavior; living without parents with sleep disturbance, depression, stress and SMA; doctor-parent/s with self esteem and hopelessness; caste with self belief, self esteem and SMA and staying alone at residence with sleep disturbance, self esteem and emotional. (Table 2A and Table 2B).

Significant positive correlation was found between self belief with self esteem and emotional stability; self esteem with emotional stability; Hopelessness with depression, anxiety and sleep disturbance; depression with anxiety, stress, SMA and sleep disturbance; anxiety with stress and SMA; stress with SMA and sleep disturbance; SMA with social behavior and sleep disturbance. Significant negative correlation was found between self belief, self esteem and emotional stability with hopelessness, depression, anxiety, stress, SMA and sleep disturbance (Table 3).

Significant association was found between BMI with sleep disturbance; type of exercise and self esteem, hopelessness and social behavior and the frequency of exercise and self belief, hopelessness, emotional stability, depression, anxiety, stress, social behavior, SMA and Sleep disturbance (Table 4).

Excessive use of social media, instant messaging and communication in place of face-to-face interactions leads to social isolation as was evident during COVID 19 pandemic related lockdown period, which indirectly causes stress, anxietyand depression[5,11,12]. The study found higher prevalence of depression (64.74%), anxiety (64.74%), stress (49.47%) and SMA(53.16%) among study population as compared to existing literature[1,3,5,7,8,11-13, 19,22]. This might be explained by the differences in scales and the socio demographic variables of the population under other studies.

Present study found that self-belief, emotional stability and stress were significantly higher among females, similar to the findings of Malek Mohammadi N et al[22]. We found that depression, anxiety, stress and social behavior were significantly lower in the rural population consistent with findings of Kharb et al[26]. Grover et al. indicated that living away from home was associated with higher levels of stress and anxiety among medical students, which supports our findings[27]. Students with one parent as a doctor had significantly lower self esteem and higher hopelessness, maybe because of huge academic expectations from them.

Present study essentially reflected that stronger self-belief acts as a protective factor against depression, hopelessness, anxiety, SMA and poor sleep quality. Self-esteem was found to be lower among students with SMA, consistent with findings of Dhamija S et al.[12] which might be due to internet and smart phone usage providing alternate way for individuals who are less confident and shy[28]. Hopelessness was positively correlated with depression, anxietyand sleep disturbance in our study.

Emotional stability was inversely related with SMA, sleep disturbances, depression and anxiety. This aligns with the inverse relationship between positive emotional well-being and mental distress, consistent with the associations found in references linking SMA

Table 1A: Distribution of the study population based on demographic and social variables with mean score (and SD) obtained in study variable (n=380)

Socio-demographic variables:-	Sleep disturbance score		Self belief score		Self esteem score		Hopelessness score		Emotional stability score	
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Sex										
M										
F	15.27	3.03	24.65	4.89	20.26	5.14	19.42	5.35	18.70	4.62
	15.38	3.32	23.48	5.62	19.50	6.22	18.73	5.82	16.45	4.85
Address										
Urban										
Rural	15.18	2.95	24.16	5.04	19.66	5.36	19.22	5.37	17.88	4.87
	16.27	4.21	25.05	6.04	22.64	6.17	19.00	6.58	18.46	4.42
Living Accommodation										
With parents										
Without parents	14.95	2.94	24.50	4.88	20.00	5.21	18.97	5.90	18.26	5.12
	15.76	3.31	23.95	5.51	20.01	5.94	19.48	4.98	17.54	4.38
Any one of the parent is doctor										
Yes										
No	14.55	2.67	23.36	4.39	18.18	5.66	21.50	3.96	17.35	4.12
	15.40	3.18	24.38	5.26	20.24	5.48	18.89	5.62	18.02	4.90
Staying alone at residence										
Yes										
No										
	16.54	3.79	16.54	3.79	18.78	6.18	20.18	6.08	16.64	4.17
	14.92	2.79	14.92	2.79	20.39	5.27	18.89	5.30	18.35	4.94

Table 1B: Distribution of the study population based on demographic and social variables with mean score (and SD) obtained in study variables (n=380)

Socio-demographic variables	Depression score		Anxiety score		Stress score		Social behaviour score		SMA score	
	MEAN	S.D.	MEAN	S,D,	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
Sex										
M										
F	13.79	10.31	11.96	9.82	15.22	9.82	16.16	3.43	30.02	10.75
	16.12	12.06	13.84	9.57	18.43	10.42	15.78	3.49	31.01	13.71
Address										
Urban										
Rural	15.09	10.85	12.98	9.95	16.85	10.10	16.18	3.43	30.71	11.94
	10.63	11.18	9.63	7.68	12.09	9.40	14.90	3.40	27.73	10.65
Living Accommodation										
With parents										
Without parents	13.47	10.58	11.77	9.82	15.36	10.21	16.15	3.57	28.9	11.50
	16.00	11.33	13.66	9.61	17.51	9.92	15.88	3.28	32.13	12.03
Any one of the parent is doctor										
Yes										
No	16.00	10.47	13.36	11.58	17.09	9.46	15.50	2.61	28.82	10.17
	14.39	11.03	12.50	9.52	16.20	10.22	16.10	3.54	30.56	12.02
Staying alone at residence										
Yes										
No	16.26	11.28	12.93	8.97	17.37	9.92	16.42	3.88	32.38	12.23
	14.05	10.83	12.49	10.01	15.97	10.18	15.92	3.30	29.74	11.64

Table 2A: Distribution of study population according to association of demographic variables with study variables (n=380)

	Sleep disturbance score		Self belief score		Self esteem score		Hopelessness score		Emotional Score	
	t	Sig(2 tailed)	t	Sig(2 tailed)	t	Sig(2 tailed)	t	Sig(2 tailed)	t	Sig(2 tailed)
Sex	-0.34	0.73	2.08	0.03	1.27	0.2	1.12	0.2	4.34	0.00
Address	-2.19	0.2	-0.93	0.35	-3.05	0.00	0.21	0.83	-0.8	0.42
Living accommodation	-2.47	0.01	1	0.31	-0.02	0.98	-0.89	0.37	1.47	0.14
Any of the parent is doctor	-1.96	0.5	-1.4	0.16	-2.28	0.02	3.88	0.00	-0.97	0.33
Staying alone at residence	4.4	0.00	-1.81	0.07	-2.42	0.01	1.8	0.07	-3.24	0.00

Table 2B: Distribution of study population according to association of demographic variables with study variables (n=380)

	Depression score		Anxiety score		Stress score		Social behaviour score		Smartphone addiction score	
	t	Sig(2 tailed)	t	Sig(2 tailed)	t	Sig(2 tailed)	t	Sig(2 tailed)	t	Sig(2 tailed)
Sex	-1.96	0.05	-1.78	0.07	-2.89	0.00	1.02	0.31	-7.66	0.44
Address	2.49	0.01	2.15	0.03	3.13	0.00	2.33	0.02	1.72	0.09
Living without parents	-2.21	0.02	-1.87	0.06	-2.07	0.04	0.8	0.43	-2.57	0.01
Any of the parent is doctor	0.95	0.34	0.55	0.58	0.58	0.56	-1.38	0.17	-1.05	0.2
Staying alone at residence	1.64	0.1	0.39	0.69	1.16	0.24	1.21	0.23	1.8	0.07

to negative mental health outcomes[2-4,7,8,12]. Social engagement was inversely correlated with SMA, depression, anxiety. Individuals with SMA usually neglect real world and social interactions, resulting in frustrated public relations and reduced social support[26].

Our study found that positive correlation existed among depression, anxiety, stress, SMA and sleep disturbance. Existing literature stated positive correlation of SMA with psychological distress, including anxiety and stress[4,7]. A study by Buysse DJ *et al*. highlighted the co morbidity of insomnia and depression[13]. A systematic review by Elhai *et al*.

demonstrated a vicious connection between excessive smart phone use with depression, anxiety and stress[29]. This is consistent with literature which correlated SMA to anxiety, depression and stress[2,4,7,11,12,22,23]. Higher age, female gender, stress and SMA were predictors of anxiety levels in MBBS students[11]. Any addiction is influenced by self-control. Increase in stress results in a reduced self-control ability which further increases the chances of SMA. Medical students are prone to stress which lowers self-control, contributing to their chances of SMA[30]. Fear of missing out may lead to frequent use of smart phone contributing to

Table 3: Distribution of the study population according to correlation between study variables (n=380)

		self esteem score	hopelessness score	emotional score	depression score	anxiety score	stress score	Smart phone addiction score	social behavior score	Sleep disturbance score
self belief score	Pearson Correlation	.729**	-.329**	.439**	-.465**	-.266**	-.401**	-.118*	-.090	-.191**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.021	.078	.000
self esteem score	Pearson Correlation		-.418**	.479**	-.519**	-.218**	-.432**	-.199**	-.014	-.222**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.784	.000
hopelessness score	Pearson Correlation			-.072	.292**	.092	.262**	.014	.033	.229**
	Sig. (2-tailed)			.161	.000	.074	.000	.782	.523	.000
emotional score	Pearson Correlation				-.342**	-.213**	-.430**	-.255**	.071	-.246**
	Sig. (2-tailed)				.000	.000	.000	.000	.166	.000
depression score	Pearson Correlation					.727**	.859**	.317**	-.036	.188**
	Sig. (2-tailed)					.000	.000	.000	.485	.000
anxiety score	Pearson Correlation						.750**	.266**	-.041	.088
	Sig. (2-tailed)						.000	.000	.429	.087
stress score	Pearson Correlation							.394**	-.065	.187**
	Sig. (2-tailed)							.000	.203	.000
Smartphone addiction score	Pearson Correlation								-.149**	.237**
	Sig. (2-tailed)								.004	.000
Social behavior score	Pearson Correlation									-.010
	Sig. (2-tailed)									.852

Table 4: Distribution of study population according to physical and social characteristics and the study variables (n=380)

	BMI		Type of exercise		Frequency of exercise	
	F	Sig.	F	Sig.	F	Sig.
self belief score	.533	.660	2.577	.054	3.278	.021
self esteem score	1.367	.252	3.490	.016	2.421	.066
hopelessness score	.555	.645	2.864	.037	3.647	.013
emotional score	.505	.679	.618	.604	5.113	.002
depression score	.649	.584	1.555	.200	4.522	.004
anxiety score	.234	.872	2.404	.067	4.286	.005
stress score	.259	.855	1.314	.270	2.992	.031
social behaviour score	.148	.931	4.559	.004	3.806	.010
Smartphone addiction score	.155	.926	1.209	.306	3.381	.018
Sleep disturbance score	3.103	.027	2.229	.084	2.844	.038

depression and anxiety[31]. SMA may result in reduction of social physical interaction leading to higher levels of loneliness, anxiety and depression[4,7,26].

Present study revealed that SMA was not associated with any gender which was contrary to the literature where male gender is found to be significantly associated with SMA1 Studies suggest SMA impacted sleep and staying alone might influence usage patterns[12,14,15]. We found that SMA has significant positive correlation with social behaviour and sleep disturbance corroborating with the vast literature support[2,3,8,12,14-17].

Data on sleep behavior included time of going to bed and rising, sleep latency, screen time before going to bed etc. Sleep disturbance was found higher in females, those who stay alone at residence, smart phone addicts, depressed and anxious study participants. SMA is usually found to be associated with poor sleep quality, including delayed bed times and reduced sleep duration as screen usage replaces sleep schedule and impacts circadian rhythm[2,8,12,32]. The literature suggests poor sleep increases hopelessness and anxiety which leads to higher nocturnal usage of smart phones leading further to mental illness[33,34].

Present study found a significant association between BMI and sleep disturbance. A systematic review by Xu et al found a significant association between short sleep duration and increased risk of obesity in adolescents[35]. Physical Activity has negative relation with SMA and sleep disturbance. Smartphone usage usually involves sedentary behavior contributing to higher body mass index[19,36]. Lin et al observed that nocturnal exercise reduced bed time phone usage, addiction and anxiety though does not relate with the type of exercise[21]. Existing literature shows that higher physical activity increased self-control and reduced SMA[18,37]. A meta-analysis by Liu H et al found that physical activity was significantly associated with higher self-esteem in adolescents[38]. Schuch et al demonstrated that exercise significantly reduced symptoms of depression and anxiety[39]. Hence, regular physical exercise acts as a protective factor against SMA and its associated ill effects.

CONCLUSION

The present cross-sectional study among MBBS students revealed significant associations of SMA with poor sleep quality, elevated anxiety, depression, stress, hopelessness, reduced self-esteem, diminished self-belief, emotional stability and impaired social behavior. This study reinforces established links between SMA and poor sleep and mental health in medical students, while expanding scholarly understanding by integrating dimensions of self-belief and hopelessness. The findings support bidirectional pathways and gender-sensitive effects.

Recommendations: Periodic monitoring of mental health status of Undergraduate medical students and early psycho-social intervention are possible amicable solutions to the existing problem. Institutional counseling should encourage participation of the students and offer cognitive behavioral therapy if needed. Institutions must promote responsible usage of smart phone through awareness campaigns, posters and focus group discussions and encourage physical activity through sports. Modification of course curriculum with inclusion of coping mechanism and peer support may be encouraged at the University level.

Statements and Declarations: Ethical Consideration: The research protocol was issued for ethical review and approval to Scientific Advisory Committee and Ethics Committee for Human Research of Medical College & Hospital, Kolkata on July 20, 2024. (MC/KOL/ECNON-SPON/2527/06/2024).

Consent to Participate: Informed Consent was obtained from all the study participants. The Informed Consent form of the participants is attached with the supplementation.

Consent for Publication: Not applicable

Declaration of Conflicting Interest: No conflict of interest exists among the authors with respect to the research, authorship, and/or publication of this article.

Data Availability Statement: The datasheet is attached as supplementation.

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