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Comparative study to evaluate the effect of smart phone addiction on various components of mental health among high school students of Surat city

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Abstract
Background: Mobile phones are an important part of high school student's life. Addiction to smartphone usage is a common worldwide problem among students, which might negatively affect their mental wellbeing. The aim of this research was to examine the effect of mobile phone use on mental health of high school students by measuring the levels of depression, anxiety, fear of missing out, isolation and sleep quality among higher secondary students of various schools of Surat city.

Methods: A cross-sectional study was conducted on a total of 250 numbers of higher secondary students (Grade 10-12) aged between 14-16 years. All the subjects were asked to complete a self-reported Smartphone Addiction Scale-short version (SAS-sv) for measuring smart phone addiction. Subjects were assigned to 2 groups based on their scores on the Smartphone Addiction Scale Short Version for Adolescents (SAS-SV): addicted group (score > 32, n = 155) and non-addicted group (score ≤ to 32, n = 95). Secondary outcome measures were Revised Children's Anxiety and Depression Scale (RCADS) for anxiety and depression, FOMO scale for fear of missing out, PROMIS sleep disturbance short form for sleep disturbances. 6 items from the Children's Behavior Checklist (CBCL) was used to measure social isolation.

Results: Statistical analysis indicates that 62% of students were addicted to smart phone. Anxiety, depression, fear of missing out, isolation and sleep disturbance had positive significant correlation with smart phone addiction ($p<0.05$). Anxiety and depression (p = 0.000) were highly correlated with smart phone addiction followed by Sleep disturbance (0.002), isolation (p = 0.029) and fear of missing out (p = 0.049). The results revealed there were high chances of anxiety and stress for cell phone addicts.

Conclusions: The results indicated that the intensity and modality of mobile phone use could be a factor that can influence causal pathways leading to mental health problems in the high school student population of Surat. The positive correlation between smartphone addiction and various components of mental health is alarming.

Keywords: Smart phone addiction, students, sleep quality, depression, anxiety, fear of missing out, isolation

Introduction
Mobile phone use has become a necessity, due to wide – spread availability [1]. Addiction to smartphone usage is a common problem among adults worldwide which is manifested as an excessive usage of phones, while engaged in other activities such as studying, driving, and social gatherings and even sleeping [2]. Young people watch videos, express themselves, communicate with friends, and search for information using smartphones, while older people use their smartphone for having video calls with their children living far away and for playing games. However, many people don't realize that addiction to smartphone is a serious issue leading to a negative effect on the person's thoughts, behavior, tendencies, feelings, and sense of well-being [3]. In particular, it can be a risk factor for depression, loneliness, anxiety and sleep disturbances [4]. Recent researches have shown that the use of mobile phone is associated with headaches, neurodegenerative dystonia, irritability, sleep disorders, fatigue, and dizziness [5-9]. so, smart phone has overall negative impact in mental health, physical health and social well-being of an individual.

Even though there are numerous evidences which shows positive/useful examples of mobile phone use (mostly smart phones) in medicine, education, and other fields [10-14], most smartphone users show high degree of Internet use and there may exist further association

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with addiction and behavioral changes [15].

Considering the age group, according to a study by Sandor *et al.,* (2019) [49] preschool children and young adults are at highest risk for smartphone-related addictive behaviour. Even though there are no discrete diagnostic criteria for smartphone addiction, the definition of addiction in general has been expanded to include areas of behavioral addiction (i.e., gambling, internet gaming) [16]. This type of addiction is more common in adults which lead to negative effects, as adolescence is a sensitive period characterized by the occurrence of many changes physiologically, psychologically and socially [17, 18]. Addiction manifests itself in various forms such as preoccupation, tolerance, lack of control, withdrawal, mood modification, conflict, lies, excessive use and loss of interest [19]. Smartphone addiction has been found to be correlated with various physical and psychological issues, as indicated in a number of studies that tested this relationship among various age groups. Most common issues which are proven include stress, anxiety, depression, attention deficit, insomnia or other sleep quality related issues and effect on academic performance.

"Depression" derives from the word "depressus" in Latin, means pressing down, suffering, exhausted, woeful, sorrowful, discouraged, and deaden [20]. Depression is one of the most common mental disorders in young people and causing severe disruptions in psychosocial and academic functioning [21]. Many studies have revealed positive correlation between smartphone addiction and depression; however, all these studies were conducted in specific populations [22, 23, 24]. The positive correlation between smartphone addiction and depression is alarming. Reasonable usage of smart phones is advised, especially among adolescents and adults as they have higher risk of depression [25] so in this study we are going to focus over effect of smart phone addiction in adolescents as they are more prone to get smartphone addiction.

Origin of the word "anxiety" is "anxietas" in Greek, meaning "worry, fear, and curiosity". In other words, anxiety is a mood, experienced in the face of danger resulting externally [20]. According to Aydemir *et al.,* [26] anxiety is a reaction that is unconscious and unknown by person and that occurs against internal threats. Various epidemiological studies have revealed that its prevalence in adolescent psychiatry is the highest. [27] Many researches proved correlation between "depression and anxiety". According to classical theory, anxiety and depression do not differ from each other and may exist together [28]. So in this study effect of smart phone addiction on depression and anxiety are studied together.

Diagnosis of "insomnia" is based on the patient's subjective perception of unsatisfactory sleep quantity and/or quality. Ever since, for the diagnosis of insomnia impaired sleep quality is given equal importance as that of reduced sleep quantity and the patient's subjective assessment is not discarded [34]. It is reported that mobile phone use in bed at night negatively impacts sleep outcome, [35-37] this may be due to exposure to bright light from electronic devices, disturbing the circadian rhythms and then sleep quality [37-40]. FOMO aka (Fear of Missing Out) is a real thing now. The popularity of social media and sharing everything has led to this new sensation where everyone feel the pressure to attend every event and share every experience. Isolation is the important component related to FOMO, excessive technology use can lead to feelings of isolation or the eventual isolation of a person due to so much time spent with technology as opposed to making real connections with human friends. In this study we are going to focus over the overall effect of mobile phone addiction with disturbances in sleep pattern rather than use of mobile phone only while sleeping.

Nowadays, adolescents are likely to use mobile phones for more hours per day, which can lead to different psychological and physiological problems. Even though use of mobile phone has been proven positive in many areas like medicine, e learning, social media marketing, entertainment etc. but when it the use of mobile phone becomes addictive it leads to negative effect on different components of health. So this study has been conducted to find out the effect of mobile phone addiction on various components of mental health such as anxiety, depression, isolation, fear of missing out and insomnia in high school students.

Methodology
- **Study design:** A Cross sectional study
- **Study population:** 15 to 17 years old higher secondary students of various schools of Surat city
- **Sample size:** 250
- **Sampling Technique:** Convenient Sampling
- **Inclusion criteria:**
  1. Students who agreed to participate in study.
  2. Minimum use of mobile phone >1 hour / day.
  3. Those who use smart phone with active internet connection.
- **Exclusion criteria**
  1. Incomplete response on following scales:
     a. SAS - sv
     b. RCADS
     c. FOMO
     d. PROMIS sleep disturbance short form
     e. 6 items from CBCL
  2. Who didn't give their informed consent
  3. Known case of other psychological disorders
- **Outcome measures**
  1. RCADS [41, 42]: For Anxiety and depression
  2. Smart phone addiction scale - Short version [SAS - sv] [43]: For smart phone addiction
  3. FOMOs [50]: For fear of missing out
  4. PROMIS sleep disturbance short form [51]: For Sleep quality
  5. CBCL (6 items related to isolation and loneliness) [52]: For social isolation

- **Procedure for data collection**
  250 higher students (122 males and 128 Females) whose age ranged from 15 to 17 years participated in the study. Participation in the study was voluntary and informed consent was taken prior to participation. They were selected by convenient sampling. All the subjects were explained about this study and about the questionnaires that were to be filled prior to the participation. 250 subjects were divided -into two groups based on the scores on SAS-sv. Addicted group (Group A) SAS-sv score>32 (n = 155) and non-addicted group (Group B) SAS-sv score≤32 (n = 95). After group allocation other three questionnaires i. e. RCADS, FOMOs, PROMIS sleep disturbance short form were handed out amongst the students and CBCL (6 items

related to isolation and loneliness) scale was sent to their parents and collected after being filled.

Data analysis and results
Data analysis was done using SPSS 26 and frequency distribution. Unpaired t test was used for between group comparisons. P value <0.05 was considered as statistical significant.

There was no statistical significant difference between demographic characteristics (Table 1).

Table 1: Demographic details

	Group A	Group B	P value
Mean age	15	15	>0.05
Gender male	67	40	>0.05
Gender female	88	55	>0.05

Table 2 shows the mean and standard deviation of all the dependent and independent variables along with the result of unpaired t test, which showed there was a significant difference found among two groups in the scores of RCADS, FOMO, PROMIS Sleep disturbance short form and CBCL (p Value = 0.05)

Table 2: Comparison between independent and dependent variables

	Group A	Group B	P Value
SAS-sv	43.69 (±5.5)	23.58 (±5.2)	0.000
RCADS	51.80 (±1.2)	51.2 (±1.0)	0.000
FOMO	20.82 (±1.1)	20.2 (±3.7)	0.049
PROMIS	21.74 (±1.8)	21.07 (±1.3)	0.002
CBCL	5.67 (±2.0)	5.18 (±1.0)	0.029

Discussion
The purpose of this study was to compare the effect of smartphone addiction on various component of mental health such as anxiety, depression, fear of missing out, isolation and sleep disturbance. With the growing popularity of smartphone technology among children, it is important to understand predictive factors of depression, anxiety, fear of missing out, isolation and quality of sleep to prevent negative outcomes [44].

Smart phone use has dramatically increased in today's world. Since electromagnetic waves are used for data transmission by cell phones, some concerns have been raised about their negative impacts on public health. The effect of cell phone use on anxiety, depression, stress and sleep quality is among these concerns, which can be evaluated by laboratory methods, epidemiological surveys, and standard questionnaires [45].

In this study, by using five standard questionnaires (SAS-sv, RCADS, FOMO<, PROMIS sleep scale, CBCL form), severity of various components of mental health were assessed and the relationship between smart phone overuse and anxiety, depression, sleep quality, feeling of isolation and fear of missing out was analysed among higher secondary students. According to some previous studies, increased incidence of insomnia is attributed to increased emotional reactivity. In previous studies, SMS users were more likely to be neurotic, depressed, or anxious, indicating the possibility of disturbance in sleep quality [45] The present study showed that excessively long hours of mobile phone use were associated with insomnia, particularly in students using mobile phones for 5 h or more per day compared with those using mobile phones for less than 1 h per day. To our knowledge, there are only two studies examining the association between sleep disturbances and hours of mobile phone use. Among adolescents in Hong Kong, long hours of mobile phone use were correlated with short sleep duration, poor sleep quality, and excessive daytime sleepiness [46].

In our study the RCADS scale revealed that all the subjects were having low severity of depression and anxiety. But between group comparisons showed a significant difference between both the groups with the p value of 0.000 (<0.05) and mean value of 51.8 in group A and 51.1 in group B. However, interestingly, long hours of mobile phone use for SMS or online chat was related to depression, particularly in students who spent 120 min or more on SMS and online chat, while hours spent using a mobile phone for internet searching, playing games or viewing videos was not associated with depression.

This study showed that long hours of mobile phone use were a risk factor for sleep disturbances and insomnia. Significant difference was found between group A and B (p = 0.002). However while considering overall sleep disturbances, It was medium (mean 21.74. In group A and 21.07 In Group B) according to PROMIS scale. It is also suggested that overuse of 5 h and more a day could be a marker of a higher risk of insomnia. An association between smart phone addiction and altered lifestyle habits was found, with higher tendency among smart phone addicts to skip meals, to eat unhealthy diets, to gain weight, and to experience sleep disorders compared to less addicted smartphone users. These can be accounted as predisposing factors to Depression [47].

Regarding the Fear of Missing Out, we observed that the degree of FoMO among students is greater in smart phone addicted group (p value = 0.049). At the same time, the students with FoMO tend to connect more frequently to the mobile phone because they feel more fear of not being connected, and of missing out on the experiences that this medium offers them; thus, a vicious circle is generated from which it is not easy to escape [53]. As for the relationship between FoMO and the preference to communicate via mobile phone with friends or family, it was found that students with a higher degree of FoMO tend to communicate more with friends. This could be explained by the stage of the life cycle they are going through: in adolescence, connection with and recognition of peers is sought, it is a stage in which one feels the need to belong to the group and the desire to be socially connected [54]. FoMO can lead to an increase in the frequency of peer-to-peer communication, which can lead to more problematic use of the mobile phone.

With respect to isolation component, the result showed significant difference between both the groups with the p value of 0.029 (<0.05). Past research has linked extroversion and feeling of social isolation with behavioral addictions including Internet, mobile phones, and smartphones [55-57]. The SMS (e.g., Facebook, Twitter or Instagram) and online chat (e.g., Line, Skype, Kakao Talk) are popular online communication tools among adolescents. Some earlier studies have indicated that their use is associated with mental health problems. SMS and online chat enable one to communicate and interact with a large number of people. Hence, young users may spend more time on them. However, the overuse of SMS and online chat sometimes undermines well-being and life satisfaction, increases risk of

cyber bullying victimization, and can also relate to depression in adolescents [46]. Over usage of smartphones causes problems with attention and focusing, as these people are more likely to show more functional impairments that interfere with school, work and family life [47].

Gender differences were not observed in this study, whether in relation to addiction literature. It was reported that males tend to use the internet mainly for online gaming, while females tend to use the internet for sending messages, chatting and blogging. Different kinds of depression are risk factors for developing an anxiety disorder, and these can, in turn, cause or worsen sleep disorders. Similarly, stress can trigger depression, which can then be complicated by anxiety. Several animal and human basic research studies indicate the effects of using mobile phones on cognition and brain functions. Our and similar research confirm the findings on the manifestation level of those complex conditions. Even if the exact underlying mechanisms are not clear because the conditions modified by mobile phones per se still do not have a fully explained etiopathogenesis, the quantity of new evidence indicates that mobile phone usage is part of multiple underlying causal links to those described conditions [48].

Conclusion

The main purpose of this study was to find out relation between smart phone addiction and various components like anxiety, depression, isolation, fear of missing out and seep quality. There was highly significant positive correlation between smart phone addiction and RCADS (Anxiety and depression) as well as between smart phone addiction and Sleep disturbance. Apart from this, moderate correlation was found between smart phone uses and fear of missing out as well as between smart phone use and isolation. So, smart phone addiction should be prevented in adolescents to save them from getting behavioral problems such as loneliness, anxiety, depression, fear of missing out and sleep quality.

Limitation and future scope of the study

- **Limitation**: The study is limited to Surat City only. The study is limited to the high school children population. The study is limited to 250 subjects for questionnaire based variables.
- **Future scope of the study:** Future studies can be done using larger sample size and on different age group people. Physical variables can be with be compared with behavioural variables. Comparison of smart phone addiction between various age groups can be performed.
- **Recommendations:** Awareness should be created among the students about the mental health. The curriculum of the subject should include the merits and demerits of mobile phone usage, Students should be made to understand the significance of their mental health in the day-to-day life activities, and Schools should take necessary steps regarding the ban of mobile phones within the campus of school.

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