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**Title:** Internet Addiction and Psychological Health in Adolescent Indian Medical Students- A Cross Sectional Study

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**Abstract:**

**Background:** With the inclusion of Internet in daily lifestyle, it has become crucial to explore its purpose, effects on mental health and to understand the implications. As adolescence is a vulnerable age group, this study has taken Indian medical students in late adolescence to understand how Internet impacts their lives.

**Objectives:** 1. To explore the severity of problematic Internet use 'PIU' in Indian medical students.

2. To assess its effects on psychological health and loneliness.

3. To correlate problematic Internet use with the purpose of use.

**Materials And Methods:** 185 first MBBS students of BMCRI (Mean age- 18.075 years) were administered 4 questionnaires- Young's Internet Addiction test, UCLA loneliness questionnaire (Version 3), General Health Questionnaire (GHQ12) and a self administered questionnaire to assess purpose of Internet usage.

**Results:** Out of 185 students, 67 were average users who showed control over their use of Internet and 118 had PIU (113 with frequent, 5 with significant problems). Significant positive correlation was found between PIU and psychological morbidity ( $r=0.3442$ ,  $p<0.0001$ ) as well as loneliness ( $r=0.2045$ ,  $p=0.0051$ ). Daily average use of Internet was mostly for social media (51.2%) followed by academics (20%), others (20%) and gaming (8.2%). PIU was significantly positively correlated to social media usage ( $r=0.2666$ ,  $p=0.0002$ ) as well as negatively correlated to academics ( $r=-0.372$ ,  $p<0.0001$ ).

**Conclusion:** In our study, PIU was positively correlated to poor psychological health, loneliness and use for social media. It showed negative correlation with academics. This may suggest that PIU is linked to psychosocial implications. It may be worthwhile correlating purpose of use with severity of PIU. Social media seems to be of importance in India as opposed to China, where gaming is the major concern. As some activities could be more addictive than others leading to dysfunctional lifestyle, Internet use must be regulated and used judiciously.

**Keywords:** Problematic Internet Use, Internet Addiction, Social Media, Indian Medical Students, Adolescence

## INTRODUCTION

Internet has become an indispensable necessity of modern times offering multiple benefits such as information, recreation and communication. However, excessive usage of Internet has been found to be associated with a host of problems in some individuals affecting their personal, professional and social lives. This “loss of control” or “inability to regulate Internet use” has been termed as “Internet addiction” at its extreme, and has been compared to a phenomenon akin to substance abuse leading to an inquiry into its mechanism, whether its disadvantages outweigh its advantages and if it can be regulated or minimized by intervention. [1]

The use of Internet and its after-effects vary significantly in different cultures and populations. Thus, not many scientists agree with this term and the field is still under extensive research worldwide. Till date “Internet addiction” is not considered a clinical entity however recently, in 2013, Internet gaming disorder (IGD) was listed in DSM5 as a “condition for further study” [2].

Interestingly, the term “Internet addiction” was suggested as a satirical hoax in 1995 by a psychiatrist Dr. Ivan Goldberg based in New York. Later, Dr. Young observed severe psychosocial problems in a young man who used Internet excessively. She found it similar to pathological gambling- an impulse control disorder listed in DSM IV. [3] She gave its first scientific description in 1996 and later, developed an Internet Addiction Test. [1] She also suggested that there could be various types and purpose of Internet addiction such as sexual, relationship and information based [4]. Many other single and multiple-case studies were done later. Griffith (2000) considered internet addiction a part of behavior addiction, having six “core components” of addiction, i.e., mood modification, withdrawal, tolerance, conflict, salience and relapse [5]. Davis (2001) however, preferred using the term “pathological internet use” (PIU), reserving usage of the word “addiction” for psychoactive substance dependency. [6] Caplan (2002) suggested replacing the term “pathological” with “problematic” for Internet use after testing Davis’ theory. He argued that as social isolation was a major contributing factor, it should not be considered psychopathology. [7]

The terminology is still under debate as to whether it is a relatively less severe maladaptive coping mechanism akin to obsessive-compulsive disorder or impulse control disorder rather than addiction per se [8]. Addicts generally use Internet excessively ranging anywhere between forty to eighty hours per week with up to twenty hour long sessions, however, timing is not considered a hallmark of Internet addiction [4]. Rather, the loss of control is more crucial in assessing this disorder, as seen in various questionnaires. Presently, this phenomenon is being studied globally and assessment tools as well as cut-off scores are yet to be standardized [1].

There has been a lot of speculation to assess if the “addiction” is real- the most important criterion to ascertain “addiction” being “inability to control the behavior” or “loss of control” [1]. It has been found recently by imaging techniques that prolonged Internet use may result in grey matter atrophy causing decrease in concentration, memory and executive ability. [1] This phenomenon is very similar to other substance abuse and involves dopaminergic system [9,10] and sympathetic nervous system [11]. Increased sympathetic activity is linked to rise in adrenaline and cortisol levels, which decreases immune function especially in stressful individuals [12,13] and people with psychological morbidity [1]. Performance at school and work [14] and interpersonal relationships [15] are affected. Neurological impairments [10,16] as well as sleep issues [17] like insomnia, poor sleep duration, latency and quality have also been documented [18]. Lack of physical activity may cause obesity in people using Internet excessively. [17]

The objectives were to explore the severity of problematic Internet use in Indian medical students in their adolescence, to assess its relationship with psychological health/loneliness and to correlate problematic Internet use with the purpose of use.

Although Internet abuse is a burning issue globally, very few studies have explored the situation in India. Adolescence is a particularly vulnerable group owing to higher experimental and risk taking behavior [19] along with lesser cognitive maturity [20] and limited ability of critical thinking [21]. In this phase, adolescents struggle with issues of self-identity and social adjustment. This study has been done on an academic group of Indian Medical students in their late adolescence to assess how purpose of use impacts their psychosocial health.

## **MATERIALS AND METHODS:**

### **SUBJECTS:**

185 (105 Males, 80 females) healthy first MBBS students of BMCRI of age group 17-19 years were included in the study (Mean age-18.075 years). The exclusion criteria consisted of any previous history of anxiety/depression/ psychiatric problems, drug history of antidepressants/ tranquilizers, etc., thyroid disorders or history of substance abuse.

### **METHODOLOGY:**

Informed consent was given by all the participants. The study design was cross sectional and descriptive. Ethical clearance was obtained from Institutional Ethical Committee.

### **INSTRUMENTS:**

#### **Young's Internet Addiction test (YIAT20)**

Severity of problematic Internet use was assessed by the Internet Addiction Test (IAT) developed by Young. The test contains 20 self-reported items using Likert scale in which scores of 1 and 5 are defined as "rarely" and "always" respectively. It includes questions on how Internet behavior affects an individual's lives on a day to day basis including social interactions, feelings and sleeping patterns.<sup>[22]</sup> High scores indicated higher severity or problems with internet use. As per a recent meta-analysis<sup>[23]</sup>, the scoring was done as follows: **20-39**- Average users with complete control, **40-69**- Internet usage with frequent problems/ "Possible addicts" and **70-100** - Internet usage with significant problems/ "Addicts". Since the cut-off scores for addiction have not been clearly established, we have considered scores  $\geq 40$  as "Problematic Internet Use"(it being a more acceptable term in the scientific community.)

### **UCLA loneliness questionnaire (version 3)**

The revised UCLA Loneliness Scale (Version 3) consists of 20 items to assess the degree of loneliness. It's a 4-point scale ("never" to "often") and each statement is scored from 1 to 4. A higher score indicates increased severity of loneliness. The measure has high internal consistency (coefficient alpha = 0.89-0.94) and a test-retest correlation of 0.73 [24].

### **General Health Questionnaire (GHQ12)**

The General Health Questionnaire-12 (GHQ-12) is an instrument used in detecting psychological distress with high sensitivity and specificity. Developed in the 70s, it detects non-psychotic psychiatric problems such as depression, anxiety and related psychiatric morbidity. Studies of GHQ-12 have yielded high validity coefficients when administered in several languages and has been used in countries including India. It consists of 12 questions in a Likert scale with best to worst scores (0-3) [25,26].

### **Self-administered questionnaire**

It was used to assess duration and purpose of use in terms of " % of average time spent using Internet daily" in four categories - social media, gaming, academics and others (e.g.- hobbies, movies, recreation). For e.g.- out of 100% of time spent using Internet in a day, what is the rough proportion of time (in %) he/she uses for social media, academics, others or gaming. The exact duration in hours could not be assessed accurately as the participants were unable to quantify the time spent using Internet.

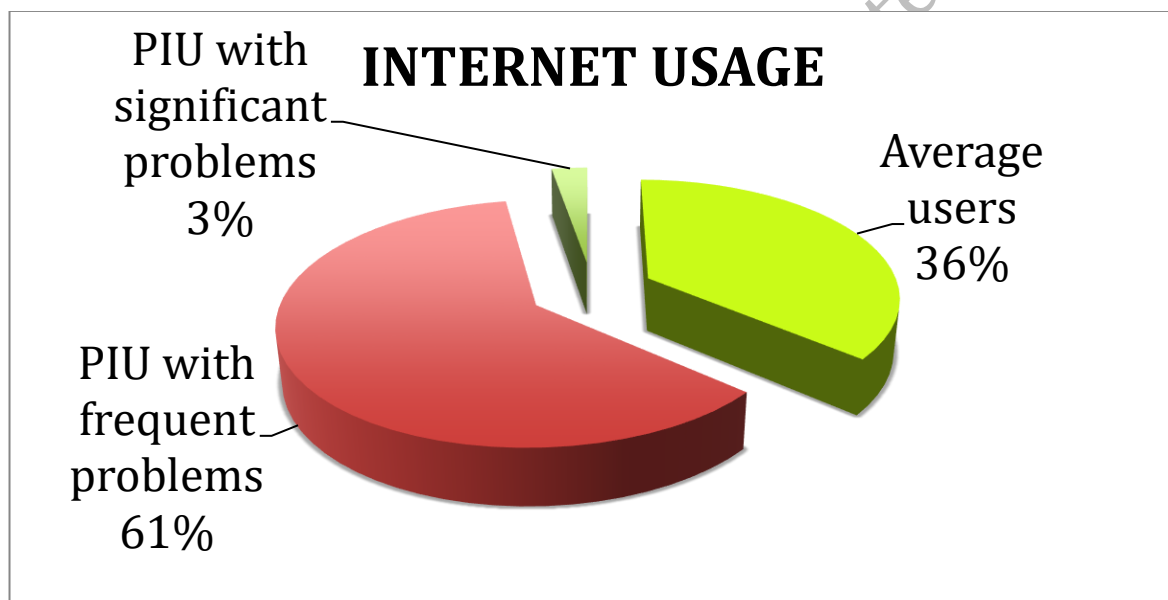
### **STATISTICAL ANALYSIS**

Data has been represented as Mean  $\pm$  SD. The sample size was calculated based on a recent study on Indian medical students that found Internet addiction to be 58.87% [27]. The formula used was  $n = Z^2 p^*(1-p) / E^2$ . Z for  $\alpha=0.5$  is 1.96. Unpaired "t" test and ANOVA were used for intergroup comparison. Pearson's Correlation was used to find the strength of association.  $p < 0.05$  (two tailed) was considered significant. This cross-sectional study was done as per STROBE guidelines.

## RESULTS:

### *Prevalence of PIU in the study population*

The YIAT was divided into 3 categories: average users (20-39), frequent problems/ possible addicts (40-69) and significant problems/ addicts (70-100). Scores above 40 were considered as problematic Internet usage (PIU). Out of 185 first year students, 36% were average users with complete control over Internet use and 64% of medical students showed problematic Internet use (61% were possible addicts with frequent problems, 3% were addicts with significant problems) [Fig 1].

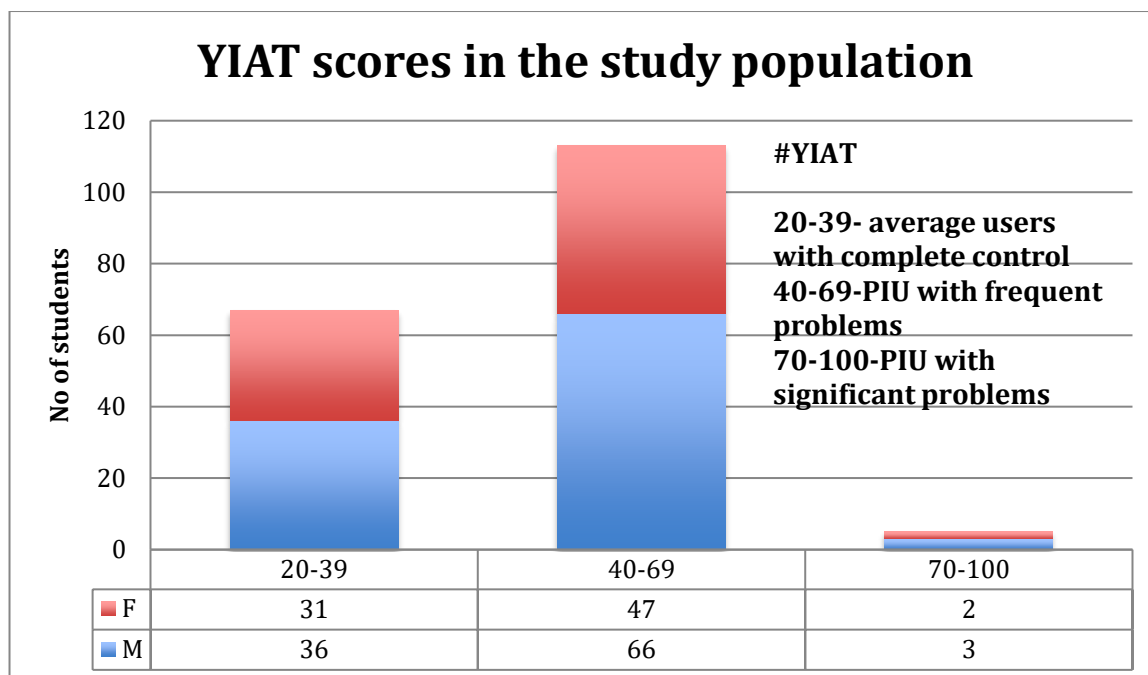


**Fig 1: INTERNET USAGE (YIAT)**

### *PIU and gender differences*

There was slight preponderance of PIU in males (65.7%) as compared to females (61.25%)[Fig 2] but it was not statistically significant ( $p>0.05$ ) [Fig 2, Table 1].





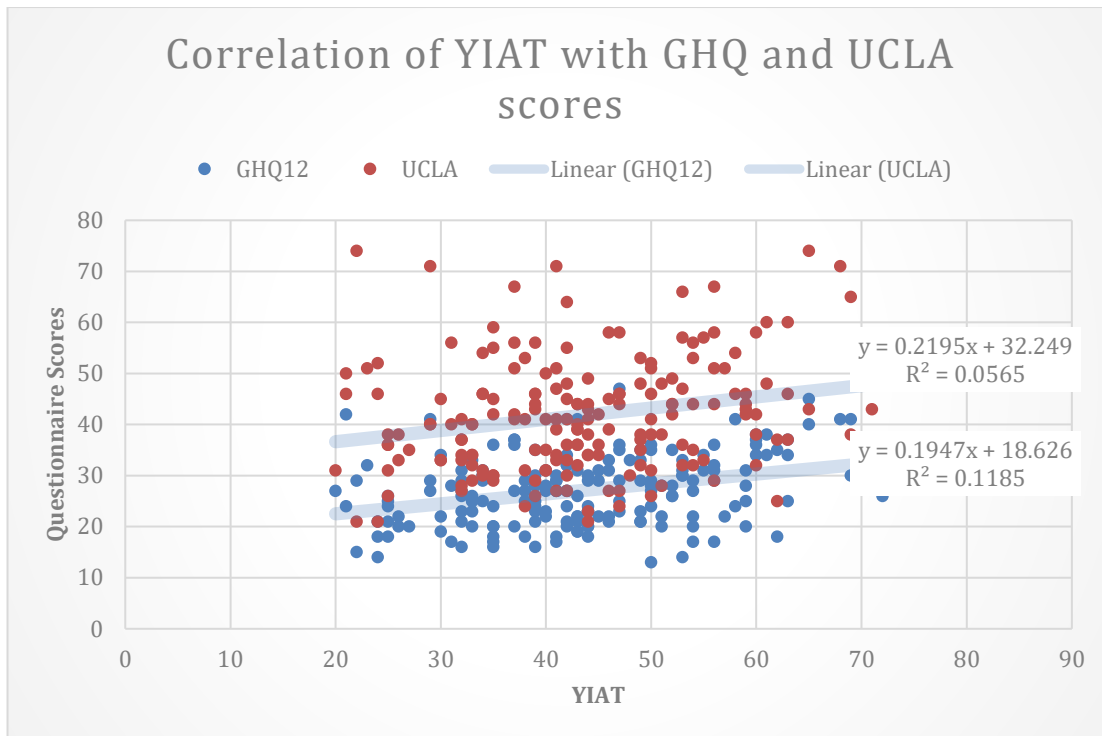
**Fig 2: GENDER DIFFERENCES IN PIU IN THE STUDY POPULATION**

YIAT scores	Males (n)	Females (n)	T	P
20-39	32.86±4.88 (36)	30.55±5.96 (31)	1.75	0.08
40-69	49.94±7.78 (66)	49.98±7.4 (47)	-0.03	0.97
70-100	74±4.36 (3)	73.5±3.53 (2)	0.13	0.90
Total score	44.77±11.70 (105)	43.04±12.60 (80)	0.97	0.33

**TABLE 1. COMPARISON OF PIU SCORES BETWEEN THE TWO GENDERS.**

*GHQ and UCLA scores in the study population*

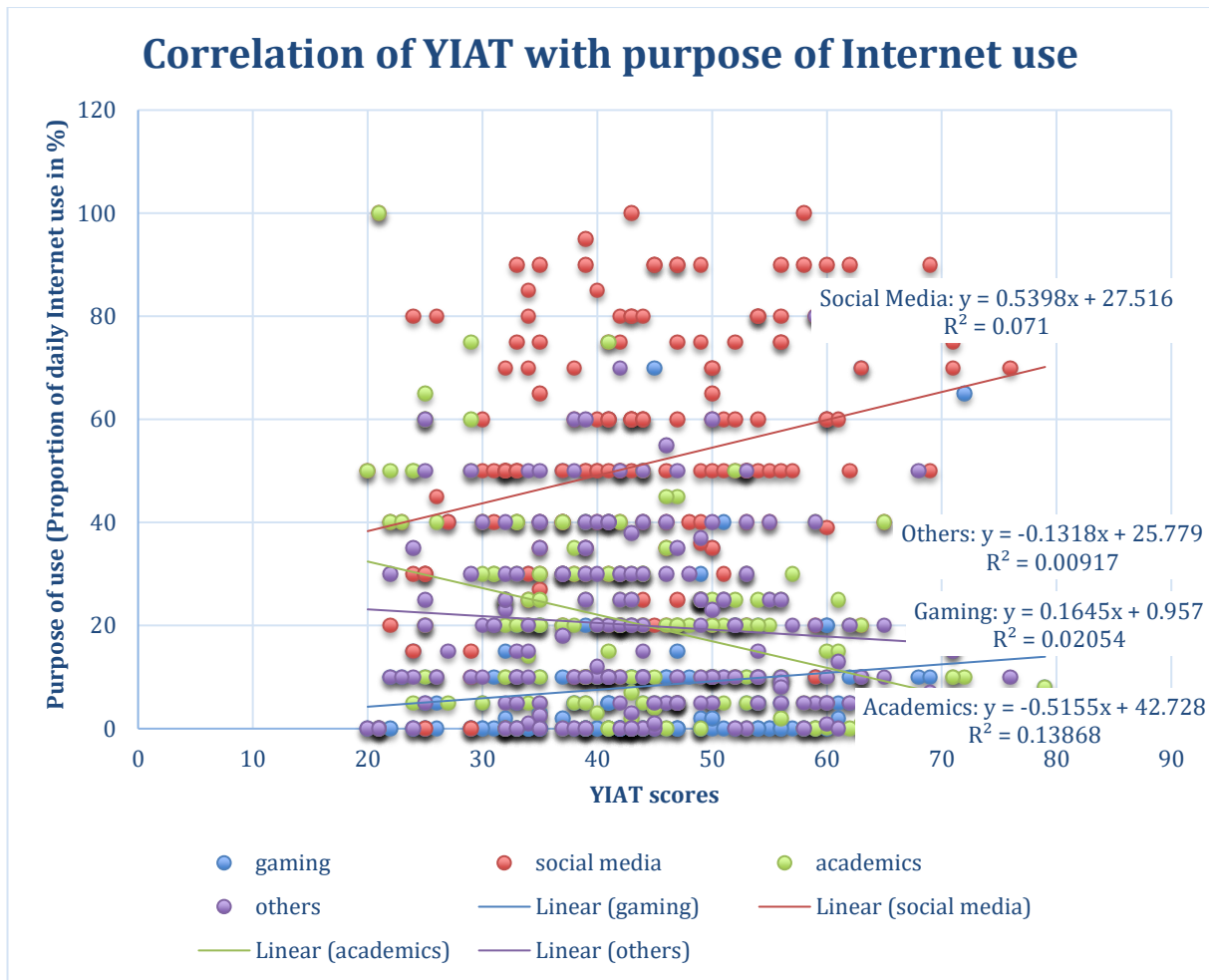
Significant positive correlation was found between DOCS scores and GHQ ( $r=0.3442$ ,  $p<0.0001$ ) as well as loneliness ( $r=0.2045$ ,  $p= 0.0051$ ) [Fig 3].



**Fig 3: Correlation of YIAT scores with GHQ and UCLA loneliness scores**

*PIU and Purpose of Use*

In our population, the maximum average % of total daily time spent using Internet was on social media (51.2%) followed by academics (20%), others (20%) and gaming (8.2%). PIU correlated positively with social media ( $r=0.2666$ ,  $p= 0.000246$ ) and gaming ( $r=0.1433$ ,  $p=0.051$ ); negatively with academics ( $r=-0.372$ ,  $p<0.0001$ ) and other purposes ( $r= -0.958$ ,  $p=0.195$ ) with significant values for social media and academics [Figure 4].



**Fig 4: Correlation of YIAT scores with purpose of Internet use**

## DISCUSSION

The term “addiction” is debatable but can be characterized by loss of control, repeated engagement to achieve appetitive effects, feeling of temporary satiation, preoccupation and negative consequences. [28] Though different kinds of addictions may be linked to different neurotransmitters that may affect different receptors, most addictions lead to long lasting neuroplastic changes. [29] The common pathway is the reward pathway which involves prefrontal cortex/hippocampus in pre-occupation/ anticipation, dorsal striatum/ventral tegmental area/cerebellum for bingeing/intoxication and basolateral amygdala/central amygdala in withdrawal/negative effect. [30]

Executive dysfunction is a common phenomenon seen in addicted individuals affecting primarily three core areas: working memory, cognitive flexibility and inhibitory control. [31,32]. However, in this study we have focused more on psychosocial health that is linked to Internet addiction and correlated it with the purpose of use.

**i) *Background characteristics and extent of use***

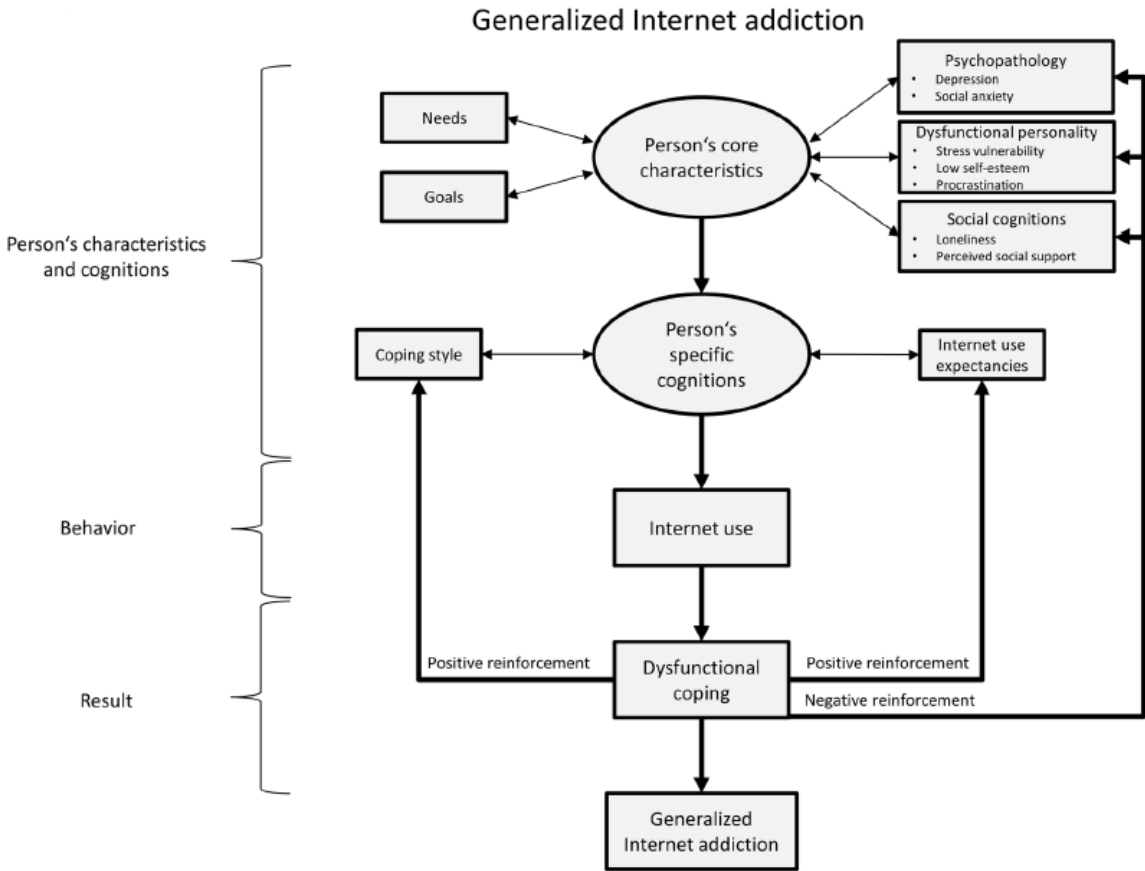
Among 185 Medical students, we found that 64% students had Problematic Internet Use (61% with frequent problems and 3% with significant problems). This finding is in accordance to previous studies. In a study done by Chaudhari et al in 2015, 58.87% of the Indian medical students were affected, with mild and moderate addiction in 51.42% and 7.45% students respectively<sup>[27]</sup>. However, due to heterogenous study samples and multiple diagnostic tools used, there is a marked variation in prevalence of PIU globally. <sup>[1]</sup>

Slight preponderance was found in males (65.7%) as compared to females (61.25%) however, no significant difference was found between the two genders. Other study suggests girls are more judicious in using information and knowledge provided by Internet in comparison to boys of same age, who take Internet as one of the necessities of life. In terms of disposition, boys are more likely to indulge in risk taking, thrilling and adventurous activities. Some studies have shown that boys prioritize on-line games whereas girls are addicted to on-line relations. <sup>[33]</sup>

***Association with psychological morbidity***

We also found significant correlation of PIU with GHQ scores suggestive of psychological morbidity such as anxiety/depression ( $r=0.3442$ ,  $p<0.0001$ ) and UCLA loneliness scores ( $r=0.2045$ ,  $p=0.0051$ ). Though it is a cross sectional study and the causal association cannot be determined, there are some theories to explain the association of psychosocial factors and PIU. Lack of social support, social isolation or loneliness can be considered catalysts for Internet Addiction <sup>[34]</sup>. Certain psychopathological factors such as depression and social anxiety <sup>[35]</sup> as well as

dysfunctional personality facets e.g. shyness, low self-efficacy, vulnerability due to stress and tendency to procrastinate [35, 36, 7, 37, 38, 1] have been proposed to cause ‘Generalized Internet Addiction.’ In addition, ‘Specific Internet Addiction’ may also be found in individuals with specific predispositions for certain applications [1]. This may then intensify the overuse of the Internet as a (dysfunctional) coping strategy to fulfill expectancies from the Internet- help distract from problems, escape from reality (positive reinforcement) or to reduce negative emotions (negative reinforcement). [1] [Figure 5]



**FIGURE 5: THE PROPOSED MODEL ON THE DEVELOPMENT AND MAINTENANCE OF GENERALIZED INTERNET ADDICTION. [1]**

Though Internet may be an effective coping strategy, unfortunately prolonged usage may also perpetuate negative psychological states in the long-term. [18] Eventually, the cognitive control of an individual becomes more effortful due to strong

reinforcing character of certain Internet applications causing reduction in prefrontal control leading to decreased grey matter, executive and decision making ability. [1,39] The most consistent findings from the Imaging studies available so far are atrophy in the prefrontal cortex (PFC) [i.e., orbitofrontal cortex (OFC), dorsolateral prefrontal cortex (dlPFC) and anterior cingulate cortex (ACC)], striatum and insula [40]. Diffusion tensor imaging (DTI) abnormalities also revealed decreased connectivity in an area involved in inhibitory control: the striatum and the inferior frontal gyrus (IFG), [41,42]. This might eventually lead to impulsivity (lack of response inhibition) or an inability of the prefrontal cortex to regulate the limbic system and may contribute to persistence of online activity despite maladaptive behavior [43,44]. IAD individuals can relapse when presented with Internet related cues because of poor response inhibition. Therefore, poor inhibitory control [45] and the involvement of 'reward pathways' could explain why it is effortful for some individuals to regulate their Internet use and why they experience "craving" for Internet akin to substance abuse.

[1]

### ***iii) Correlation with purpose of use***

In our study population, we found out that the average proportion of daily use of Internet was maximum for social media (51.2%) followed by academics (20%), other purposes (20%) and gaming (8.2%). There was a significant positive correlation of PIU with social media, as well as a negative correlation with academics. This could suggest that certain applications could have a relatively higher addictive potential as compared to others.

Social media seems to be a priority for our study population. Research suggests that some adolescents might prefer sharing information on a Social Network Site (SNS) than in person [46]. While unhealthy online interactions are possible for some [47], SNS may provide needed platform for many vulnerable youngsters [48] with potential mental health benefits including sense of belongingness, socialization and supportive relationships. They may also help build self-esteem, identity formation, communication and learning. [42] Cyberbullying, sexting, harassment and privacy concerns may be some of the potential risks involved. [47, 49] Declines in depression have been documented by longitudinal research [50] by re-establishing friendships

following social withdrawal <sup>[51]</sup> however, SNS-induced depression has also been reported. <sup>[52,53]</sup> This bidirectional effect of SNS on depression may happen depending on content, type of interaction and discretion of user. For example, positive online interactions may lead to better mental health and social support whereas negative online interactions with a focus on negative emotions/content may lead to poor psychological health and morbidity <sup>[33]</sup>. Qualitative differences among young people may also play a role for example, hopelessness may be linked to engagement in blogging sites eg, Online Support Groups (OSGs) versus briefer posts/content, which may in turn help alleviate depression. <sup>[54,55]</sup>

In a study on female College students, it has been observed that cell phone use or social networking diminish concentration and distract from academics. There might be personality differences <sup>[56]</sup> or prioritization of social interaction over academics <sup>[34]</sup>. Young adults use Internet for “releasing” rather than information seeking. <sup>[21]</sup> This may explain why there was a significant decrease in use of Internet for academic purposes while a positive correlation with social media in our study.

Other uses of Internet may include online shopping, watching movies, videos, pursuing hobbies, newsreading and pornography. Social interactions like using e-mail and chat room/instant messaging (IM) have been found to be associated with decreased depressive symptoms, while activities such as online shopping, gaming or research are linked with increased depressive symptoms <sup>[57]</sup>. Literature suggests an overlap between various addictions is quite common <sup>[58]</sup> and addictive behaviors co-occur. Problematic computer (game) use could coexist with pornography <sup>[59]</sup>, substance use <sup>[60]</sup> or gambling <sup>[61,62]</sup>. History of pornographic use from individuals is difficult to procure, as it is a personal and sensitive subject.

In our study population, gaming was the least important preoccupation where Internet was considered. This is in contrast to China where gaming is a major subtype of IA <sup>[18]</sup>. Appendix of Diagnostic and Statistical Manual of Mental Disorders (5th Ed., DSM-5) also includes internet gaming disorder as a “condition for further study.”<sup>[2]</sup> There is evidence that computer game practice improves visual attention skills, spatial performance and iconic (image representation)<sup>[63]</sup> and may be associated with improved self-esteem. <sup>[62]</sup> However, when indulged in excessively,

gaming may lead to decreased psychosocial functioning and lower grades [62]. It is proposed that increased virtual immersion, pleasure, excitement, thrill, social interactivity and competitive rivalry associated with gaming causes neuropsychological stimulation [64] of the hypothalamus-pituitary-adrenal (HPA) axis as well as endogenous dopaminergic reward pathways. Sympathetic system may get activated increasing heart rate, blood pressure and sympathetic vasomotor tone [65] as seen by fMRI scans [66,67]. Built-in music also contributes to the immersive environment of the video game and influences affect, stimulating the release of cortisol via stress response [68]. Playing the game competitively with peers releases testosterone in men [69,70] and increases food intake, regardless of appetite sensations [65]. It is a kind of operant conditioning where the individual feels rewarded and is more likely to engage in that behavior again causing a pattern similar to substance abuse. [1] Moreover, it provides an escape from rigid parenting and gives a sense of accomplishment and satisfaction.

### ***Limitations and future directions***

From our study, it is interesting to note that though gaming is the commonest subtype of IA in China [18], social media addiction seems to be more prevalent in our Indian study population. Therefore, Internet usage may have cultural differences and may reflect the needs, preferences and priorities of a society. Also, certain applications of Internet like social media interaction and gaming could be more addictive than others, thus highlighting the importance of self-regulation.

Technology is a double-edged sword. It is how we use it that makes all the difference. Neglect of restorative processes such as sleep, lack of physical exercise due to excessive time on Internet, diminished real life social interaction and symptoms of withdrawal are the reasons how Internet use affects mental health. [71,72] Internet use is not intrinsically harmful, but its effects depend on the usage by the individual. Negative consequences might overshadow the good effects of Internet when used excessively. Thus, interventions use could target these negative consequences and dysfunctional patterns. [73] It has been observed in certain substance addictions that longer duration of addictions can affect executive functions more, and prolonged abstinence might improve executive functions eventually. [74]



“Integrated Internet addiction prevention program” could help individuals self-regulate excessive Internet use [75]. Since Internet has become indispensable in everyday life, thus, in the future efforts must be made to develop robust protocols to integrate beneficial effects of Internet within a regulated framework<sup>[49]</sup>.

There are some limitations of this study. First, since it is a cross sectional study, the causal association could not be assessed. Second, accurate information about duration of usage could not be collected and correlated with severity and purpose of PIU.

## **CONCLUSION**

To conclude, in our study increasing severity of problematic Internet use had significant positive correlation with poorer psychological health and loneliness, use of Internet for social media while a decrease in use for academics. There could be cultural preferences in usage of Internet and certain applications may be more addictive than others. This may depend upon personality, needs and psychosocial factors. Thus, efforts must be made so that Internet use is regulated and used judiciously especially in adolescence.

**CONFLICTS OF INTEREST :** None

**SOURCE OF FUNDING:** None

## **AUTHOR CONTRIBUTIONS**

Author Dr. Megha Agrawal designed the study and wrote the paper. Author Dr. Sowmya Rajaram gave her critical feedback and helped in interpretation. Dr. Girija B reviewed the paper and gave necessary guidance wherever required.

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