RESEARCH ARTICLE
Multiple linear regression approach to deduce Internet addiction impact on the psychosocial wellness of young medical students

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ABSTRACT
Background: The Internet is an inevitable part of life especially in the education sector, but at the same time irrational use of the Internet causes behavioral disorders. A high number of personality disorders such as impulsive behavior, depression, anxiety, and stress were also observed among medical students. Aim and Objectives: Hence, the present study hypothesized to find out the association of depression, anxiety, and stress with Internet addiction (IA) among young medical students.
Materials and Methods: A cross-sectional survey was conducted among 250 1st-year medical students after taking ethics approval and written informed consent. Personal information and socio-demographic profile of participants were obtained. Young IA Test and Depression Anxiety Stress Scale (DASS-21) survey questionnaire was self-administered by participants. To identify the risk and protective factors for IA with DASS-21 stepwise multiple linear regression analyses were performed. Results: The prevalence of IA was 24.0% with mean scores (±Standard Deviation [SD]) of 39.01 (±16.99) among the medical students. Depression, anxiety, and stress mean scores (±SD) were 5.44 (±4.21), 4.94 (±3.84), 6.77 (±3.83), respectively. Students with IA had a statistically significant difference (P = 0.001) in all domains of DASS-21 over the non-internet addicted. A statistically significant positive relationship of IA with depression (coefficient of determination (R2), (R2 = 0.22)), anxiety (R2 = 0.26), and stress (R2 = 0.33) were observed. Conclusions: 1/4th of the medical students were internet-addicted and 3.0% having severe anxiety. 22.0% of depression, 26.0% of anxiety, and 33.0% of stress among young medical students are attributable to IA. The rational use of the internet should be learned for psychological health and well-being.
KEY WORDS: Anxiety; Depression Anxiety Stress Scale 21; Depression; Internet Addiction; Medical Students; Stress

INTRODUCTION
Digital technology has turn out to be an integral part of everyday life in today’s world, across rural and urban areas. There are lots of benefits of the Internet (faster communication, social networking, shopping, entertainment, and information). Internet as the technology, which has penetrated its availability and uses across all age groups, has become inevitable. In this era, young adults and teenagers greatly affected by digital technology. Teenagers and young adults have been called the Y generation, millennial or digital.[1] The recent trends indicate that Internet use rises tremendously, today there are 4.66 billion active Internet users worldwide, 92.6% (4.32 billion) of the total 59.5% of the global population access the Internet through mobile devices and the majority belongs to young students.[2,3] Internet addiction (IA) was first reported in the mid-1990s and the conceptual framework was first developed by Young.[4] Uncontrolled and excessive use of the Internet severely disrupts people’s lives leading to significant clinical distress.[5,6] IA is also defined by various terms such as pathological internet use, Internet dependence, and
problematic Internet use. Widyanto et al. defined IA as withdrawal, poor planning abilities, tolerance, preoccupation, impairment of control, and excessive online time. IA predominates more among young college students and also had a high rate of personality disorders. Mood disorders, poor sleep quality, low self-esteem, impulsivity, suicide, reduced levels of physical activity, and health problems (migraines, back pain, and obesity) were all linked to IA. All India Institute of Medical Sciences, Delhi started special behavioral psychiatric outpatient department for cyber addicts, increasing addicts among school and college students. Patients addicted to the Internet are more likely to suffer from depression, anxiety, and substance abuse.

Depression, anxiety, and stress have been seen in medical students, but it has not been measured and what are the reasons behind it yet need to be explored. Among medical students, IA may be a major concern. Whether the internet use helps to relax the students or its use cause depression, anxiety, and stress.

**Primary Objective**

The present study hypothesized to find out the association of IA with domains of depression, anxiety, and stress among young medical students.

Hence, appropriate steps could be done to address this problem at an early stage. Medical students are our future health care providers, and the repercussions of their addiction can obstruct their education, damage their long-term career goals, and have far-reaching and negative ramifications for society as a whole.

**MATERIALS AND METHODS**

The cross-sectional questionnaire-based survey was conducted among young medical students of the institute after taking ethics approval and written informed consent from the study participants. The medical students of phase-I those present on the day of data collection and willing to participate included for the study purpose. Students seriously ill or with no exposure to the internet or unwilling to participate were excluded from the study.

Personal information such as age, gender, family type, and socio-demographic profile of participants were recorded by pre-designed proforma. To assess the mental status of students, a self-administered standardized survey-questionnaire validated Young IA Test (IAT) and Depression Anxiety Stress Scale (DASS-21) was administrated.

**IAT**

It had a total of twenty questions, with the respondent being asked to answer each one on a five-point Likert scale (1 = rarely, 2 = occasionally, 3 = sometimes, 4 = often, and 5 = always). The following are the scoring ranges

**Mild (20–49 score)**

Complete control of Internet use (Normal) (Non-Problematic Internet Users).

**Moderate (50–79 score)**

Overuse with frequent problems and full impact on life (Mild IA) (Problematic Internet Users).

**Severe (80–100 score)**

IA with significant problems (Severe IA) (Problematic Internet Users).

**DASS-21**

It consists of 21 questions that had three subscales, namely depression, anxiety, and stress, with the following possibilities based on the Likert scale: 0 = not at all, 1 = slightly, 2 = moderately, and 3 = very. The severity levels are described based on the population full range of scores. The cut-off scores have been developed for defining mild, moderate, severe, and extremely severe score for the DASS-21 scale. For each subscale following cut-off scores were used:

**Depression**

Normal 0–9, Mild 10–13, Moderate 14–20, Severe 21–27, and Extremely severe 28+.

**Anxiety**

Normal 0–7, Mild 8–9, Moderate 10–14, Severe 15–19, and Extremely severe 20+.

**Stress**

Normal 0–14, Mild 15–18, Moderate 19–25, Severe 26–33, and Extremely severe 34+.

**Statistical Analysis**

The statistical analysis was performed using Statistical Package for the Social Sciences software (version IBM 20). The qualitative data was expressed in the form of percentages and proportions, and quantitative data were expressed in the form of mean ± Standard Deviation (SD). A significant difference in proportions was inferred by the Chi-square test and the significance of the difference in means ± SD by unpaired student’s “t” test. Levene’s Test for equality of variance was applied for the independent “t” test. The significance value >0.05 in stress and depression, so equal variance is assumed. Correlation between two unpaired variables was expressed in terms of Pearson’s correlation.
coefficient. To identify the risk and protective factors for IA with DASS-21 stepwise multiple linear regression analyses were performed. The $P < 0.05$ considered as statistically significant.

**RESULTS**

A total of 215 students participated in the present study with an 86.0% response rate. The prevalence of IA was 24.0%, out of which only one female student was severely addicted (0.5%), whereas 76.0% of students were not addicted and had complete control over internet use. The mean score (±SD) of IA was 39.01 (±16.99) among the medical students. Depression, anxiety, and stress mean scores were 5.44 (±4.21), 4.94 (±3.84), 6.77 (±3.83), respectively.

The IA of medical students was not influenced by sociodemographic profile as all variables were statistically non-significant, so they are compatible for study purpose [Table 1].

The prevalence of depression, anxiety, and stress were less among young medical students, as most of the students belong to the normal category of the DASS-21 scale. The distribution pattern showed that the prevalence of anxiety was more among students, followed by depression [Figure 1].

Table 2 shows that the medical students with problematic internet scores (IAS ≥50) had a statistically significant difference ($P = 0.001$) in all domains of DASS-21 (depression, anxiety, stress) over the non-problematic internet users.

Table 3 shows a statistically significant positive relationship of IA with depression (correlation coefficient (r), $r$ [213] = 0.47, $P = 0.001$), anxiety, ($r$ [213] = 0.50, $P = 0.001$) and stress ($r$ [213] = 0.57, $P = 0.001$). Likewise, depression also correlated with anxiety ($r$ [213] = 0.62, $P = 0.001$) and stress ($r$ [213] = 0.67, $P = 0.001$). There was also positive relationship between anxiety and stress ($r$ [213] = .66, $P = .001$).

Figure 2 depicts Pearson correlation coefficient of determination ($R^2$), the amount of variance in the dependent variable-depression that accounted for or explained by the independent variable, IA. $R^2$ is 0.224, in percentage 22.0%, which means IA scores explain 22.0% of the variance in depression among medical students. It can be predicted that 1/4th cause of depression by IA, 3/4th cause of depression by other variables. Similarly, the $R^2$ for anxiety is 0.26, which explains 26.0% of the variance in anxiety among medical students. $R^2$ for stress explains 33.0% of the variance of IA in medical students.

To identify the risk and protective factors for IA with DASS-21 stepwise multiple linear regression analyses were performed. In the case of the independent risk factors, IA was higher for depression, anxiety, and stress. IA was a significant predictor of depression ($\beta$ = standardized regression coefficient, $t = t$-test) ($\beta$ = 0.47, $t$ (213) = 7.9, $P = 0.001$, $R^2 = 0.22$), anxiety ($\beta$ = 0.51, $t$ (213) = 8.63, $P = 0.001$, $R^2 = 0.26$) and stress ($\beta$ = 0.57, $t$ (213) = 10.20, $P = 0.001$, $R^2 = 0.33$) among medical students [Table 4].

**DISCUSSION**

The present study found that the medical students with problematic Internet use had a statistically significant difference in all domains of DASS-21 (depression, anxiety, and stress) over non-problematic Internet users, and a positive relationship between IA and DASS-21 was observed.
Regression analysis results also suggested that 22.0% of depression, 26.0% of anxiety, and 33.0% of stress among young medical students was due to IA.

In the present study, IA prevalence was 24.0% and the mean score (±SD) was 39.01 (±16.99), no case of severe depression and stress, and only 3.0% were having severe anxiety among medical students. While the medical students of Azad Kashmir were more addicted to the Internet (52.0%), and severe depression, anxiety, and stress were observed among 40 (19.0%), 97 (46.2%), and 5 (2.4%) medical students, respectively. They found a mild positive correlation between IA with depression ($P < 0.001$) and stress ($P = 0.003$), but no significant correlation was found between IA and anxiety.\cite{22} While the present study found a significant positive correlation between IA and all DASS-21 Domains.

The incidence of IA was 80.7 percent among students in Assam’s Kamrup district’s higher secondary schools and colleges. They discovered a link between IA and stress (odds ratio = 12), depression (odds ratio = 14), and anxiety (odds ratio = 3.3) in their study.\cite{23} In Bengaluru city, IA prevalence was 67.0% among undergraduate students of medical and engineering college and the prevalence of depression, anxiety, and stress was 49.5%, 52.5%, and 67.5%, respectively. A statistically significant association ($P = 0.0002$) was found between IA and depression levels; depression and anxiety levels ($P = 0.00001$); depression and stress levels ($P = 0.0002$). In contrast to the above results, in the present study, only 3.0% of cases of severe anxiety were reported among medical students, but the DASS-21 and IA have a statistically significant positive association.

Chinese children and adolescents aged 6–18 years old in a survey self-reported 2.68% of addictive Internet use (IAT $\geq 70$) and 33.37% of problematic Internet use ($69 \geq$ IAT $\geq 40$). Linear regression analysis showed IAT total scores ($R^2 = 0.291$, $P < 0.001$) were significantly correlated with depression ($\beta = 0.257$, $P < 0.001$) and stress ($\beta = 0.323$, $P < 0.001$).\cite{25}

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Table 3: Pearson correlation for IA (n=215)

<table>
<thead>
<tr>
<th>Variables</th>
<th>IA</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>1</td>
<td>0.47**</td>
<td>0.50**</td>
<td>0.57**</td>
</tr>
<tr>
<td>Depression</td>
<td>1</td>
<td>0.62**</td>
<td>0.66**</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>1</td>
<td>0.66**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** Correlation was statistically significant at the 0.01 level (2-tailed),
n: Number of subjects, IA: Internet Addiction
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![Figure 1: Distribution of depression, anxiety, and stress among young medical students](image1)

![Figure 2: Simple Linear regression between Independent Variable (IA) and Dependent Variables (Depression, Anxiety, and Stress)](image2)
Table 4: Regression analysis summary for IA predicting DASS-21

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent variable</th>
<th>B</th>
<th>95% CI</th>
<th>B</th>
<th>R²</th>
<th>t</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>(Constant)</td>
<td>0.86</td>
<td>–0.39, 2.11</td>
<td>0.47</td>
<td>0.22</td>
<td>1.4</td>
<td>0.178</td>
</tr>
<tr>
<td></td>
<td>IA</td>
<td>0.12</td>
<td>0.09, 0.15</td>
<td>0.47</td>
<td>0.22</td>
<td>7.9</td>
<td>0.001*</td>
</tr>
<tr>
<td>Anxiety</td>
<td>(Constant)</td>
<td>0.44</td>
<td>–0.68, 1.56</td>
<td>0.51</td>
<td>0.26</td>
<td>0.78</td>
<td>0.438</td>
</tr>
<tr>
<td></td>
<td>IA</td>
<td>0.12</td>
<td>0.09, 0.14</td>
<td>0.51</td>
<td>0.26</td>
<td>8.63</td>
<td>0.001*</td>
</tr>
<tr>
<td>Stress</td>
<td>(Constant)</td>
<td>1.72</td>
<td>0.67, 2.79</td>
<td>0.57</td>
<td>0.33</td>
<td>3.20</td>
<td>0.002*</td>
</tr>
<tr>
<td></td>
<td>IA</td>
<td>0.13</td>
<td>0.10, 0.15</td>
<td>0.57</td>
<td>0.33</td>
<td>10.20</td>
<td>0.001*</td>
</tr>
</tbody>
</table>

B: Unstandardized regression coefficient, CI: Confidence Interval for B, β: Standardized regression coefficient, R²: coefficient of determination, t: t-test, *P < 0.05 as Significant

Similarly, present study reported 24% (IAT ≥50) prevalence of IA and a significant linear regression among IA and depression (β = 0.47, P < 0.001), stress (β = 0.51, P < 0.001) and anxiety (β = 0.57, P < 0.001).

Early exposure to technology, as well as its excessive use, has been linked to behavioral problems in children and young adolescents, according to Kuss and Griffith.[26] Excessive internet use alters brain structure that might impairs the executive skills such as planning and thinking, raising the likelihood of impulsivity and addiction. Few studies reported disturbance in the prefrontal cortex responsible for cognitive function, motivation, and impulse control. When the youths were presented an image about their IA, hyperactivity was identified in the prefrontal dorsolateral cortex and amygdala on functional magnetic resonance imaging BOLD examination.[27] The prefrontal cortex associated with the obsession of IA. The parahippocampal, cingulate gyrus, precuneus, and amygdala show greater activation with IA. These brain areas are linked to the emotional desire process (fear, sadness, and anxiety).[28,29] As a result, Internet addicts are more likely to suffer from depression, anxiety, and stress, and the current study also validates and shows a positive correlation of IA with depression, anxiety, and stress in young medical students.

Strength and Limitations, Future Recommendation

A high response rate of 86.0% is the strength of the present study while at the same times all years of medical students were not involved in the study and not compared the IA with non-technical branch students is the limitation of the present study. IA should be compared with the educational level of students to observe whether addiction is due to academic or non-academic (entertainment) reasons.

CONCLUSIONS

The prevalence of IA depicted was 24.0% and only 3.0% cases of severe anxiety observed among young medical students. A positive relationship of IA with depression, anxiety, and stress was observed. Regression analysis results also suggested that 22.0% of depression, 26.0% of anxiety, and 33.0% of stress among young medical students was due to IA. There are lots of benefits of the internet, but the unwise use of the Internet negatively affects individual life. We need to learn self-control for judicial use of technology or handle it smartly to save our time and psychological health.

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