

# Internet Addiction and Its Relationship with Depression and Academic Performance: A Cross-Sectional Study at a Medical School in Pakistan

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## Abstract

**Background:** Excessive Internet use may induce depression, influence relationships, and decrease academic performance. There is scarce information about Internet addiction in Pakistan. This study aimed to determine prevalence of Internet addiction and its relationship with depression and academic performance. **Methods:** A study based on a self-administered survey was carried out at a medical school in Peshawar, Pakistan. Participants were medical students (MBBS) and a non-randomized convenience sampling technique was utilized for data collection. We collected demographic information, last professional exam score, Internet addiction, and depression scores using the Young's Internet Addiction Test (YIAT) and the Beck's Depression Inventory (BDI), respectively. The analysis included binomial 95% confidence intervals (95% CI) estimations and linear and logistic regressions to assess variables relations. **Results:** We analyzed responses from 231 participants (380 students approached and 250 responded: response rate=65.79%, 19 excluded), 64.07% were male and the age average was 21±2 years. Profound and slight addiction to the Internet was found in 9.09% (95%CI=5.71-13.56) and 41.99% (95%CI=35.55-48.64) of students, respectively. Frequency of depression (mild-severe) was 59.74% (95%CI=53.11-66.12). Levels of Internet addiction and depression were found associated after adjusting by sex and age ( $\beta=0.27$ ,  $R^2=0.03$ ,  $p\text{-value}=0.009$ ). Internet addiction (OR=0.54, 95%CI=0.2-1.49,  $p\text{-value}=0.23$ ) and depression (OR=0.62, 95%CI=0.36-1.09,  $p\text{-value}=0.10$ ) were not significantly associated with low grades after adjusting by sex and age. **Conclusion:** More than half of the students are having excessive Internet usage which could result in despondency and academic performance deterioration. Internet addiction should be considered an emerging challenge and appropriate mitigation measures should be taken opportunistically.

**Key Words:** Internet addiction disorder; Depression; Academic Performance; Medical Schools; Public health (Source: MeSH-NLM).

## Introduction

Internet Addiction is described as unnecessary or inadequately controlled distractions, desires or practices regarding excessive Internet utilization and web access that lead to devitalizing or stressful behaviour.<sup>1</sup> The condition has attracted increasing attention in the popular media and among researchers. The problem is arising as a result of increased access to personal computers and Internet services.<sup>2</sup>

The problem of Internet dependence prevails around the world, but mostly in nations where Internet access and innovation are easily accessible.<sup>3</sup> Onset is reported to occur usually in the second and third decade of life.<sup>4</sup> Internet Addiction Disorder disturbs and affects the daily life of individuals by causing neurological problems, psychosomatic perturbation, and difficulty in social interactions.<sup>5</sup> Studies carried out in European and American regions have shown inclined pervasiveness rates especially among youngsters aged 18 to 25 years.<sup>6</sup> The possibility that risky use of Internet-based gadgets meets criteria for dependence, and hence ought to be included in the Diagnostic and Statistical Manual of Mental Disorders (DSM), was first proposed in 1996.<sup>7</sup> In 2013, Internet addiction was integrated in the latest version of DSM-5 under the name of Internet gaming disorder by the American Psychiatric Association.<sup>8</sup> After integration of Internet addiction in DSM-5, many researchers came forward and progress was made to understand and address this issue and currently, it is widely known as Internet Addiction Disorder.<sup>3,9</sup>

In this manner an assortment of frequently used criteria have been proposed and contemplated, some of which have been recognized and practiced. However, observational studies gave a conflicting set of criteria to characterize Internet Addiction Disorder.<sup>10</sup> Presently, many reliable and diagnostic tools are available for evaluation of Internet Addiction Disorder including Young's Internet Addiction Test,<sup>11</sup> the Problematic Internet Use Questionnaire<sup>12</sup> and the Compulsive Internet Use Scale.<sup>3</sup> There are various models available for the improvement and upkeep of Internet Addiction Disorder, for example; cognitive-behavioral model of problematic Internet use,<sup>4</sup> the Anonymity, Convenience, Escape (ACE) model,<sup>13</sup> Triple-A engine,<sup>14</sup> and a far-reaching model of the advancement and support of Internet fixation by Winkler and Dörsing.<sup>15</sup>

There is emerging proof that genetics may play an important role in addictive behaviour. The hereditary hypothesis states that individuals suffering from Internet Addiction Disorder do not have sufficient number of dopamine receptors or they have a deficiency of neurotransmitters, besides experiencing issues in distinctive degrees of joy in activities that many other people would find rewarding.<sup>16</sup>

Various studies have revealed that excessive Internet use is associated with mood disturbance and unhappiness.<sup>5,9</sup> In addition, it has been described that youths' dependence on the Internet has brought about many negative outcomes including academic disillusionment, poor

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family connections, weakened social life, and emotional and mental issues.<sup>17</sup> There is a comparative occurrence of depression among people dependent on the Internet and of Internet addiction among depressed patients. According to the American Psychiatric Association; depression is a common and serious medical illness that negatively affects how an individual feels, thinks and acts.<sup>18</sup> Depression may present as profound distress or sadness, sleep deprivation, loss of hunger, agitated state of mind, fractiousness, and destructive inclinations. Besides these, characteristics such as low self-esteem, a dread of dismissal and need for affirmation, can be observed in depressed individuals.<sup>19</sup> It is also suggested that depression may lead to excessive utilization of the Internet, and the interesting and appealing elements of the websites may induce Internet addiction.<sup>20</sup>

World Development Indicator shows that almost half of the world's population have Internet access and majority of the users are college and university students.<sup>21</sup> It has been indicated that university students are more prone to the pathological use of the Internet.<sup>22</sup> A meta-analysis has indicated that the frequency of Internet addiction among medical students is approximately five times higher than the general population which depicts that medical students fall under the high-risk category.<sup>23</sup> Researchers have suggested that modern gadgets, unstructured timetable, availability of online learning material, and less parental control can contribute towards a higher predominance of Internet addiction and its negative outcomes among medical students.<sup>6</sup> Estimating the prevalence of Internet addiction and depression among medical students can be valuable, and their relationship can give new evidence in this domain. Comorbid Internet-based life dependence and depression is a significant clinical challenge as the consequences of both conditions are worsened by the other.<sup>12</sup> Minimal studies are conducted in Pakistan regarding Internet addiction and its association with depression. Therefore, the current study is aimed to determine the Internet addiction prevalence among undergraduate students of a medical college and its relationship with depression and academic performance.

## Methods

### Study Design and Setting

This is a cross-sectional study based on a self-administered questionnaire using a convenience sampling strategy. It was conducted at Northwest School of Medicine, Peshawar, Pakistan. This School of Medicine is a private medical institution situated in the provincial Capital, Peshawar and affiliated with the largest medical university (Khyber Medical University) of the province Khyber-Pakhtunkhwa. Students belonging from different cultures and ethnicities pursue their medical education in this institute. This medical school was established in 2016 and offers a five-year Bachelor of medicine and Bachelor of surgery (MBBS) degree program. Currently, four academic years are operational (one through four). The data for the study was collected during the first week of February 2019. The Independent Ethics committee of Northwest General Hospital granted ethical approval for the study (Ref No: NwGH/EC/24).

### Study Size

Openepi® software was used for sample size calculation, considering the entire population of college as 400, the calculated sample size with a confidence level of 95% and an error of 5% was 197.

### Participants

Data was collected from the students of all years in the medical school. All participants were the students of MBBS. The participation of the students in the study was voluntary and non-randomized convenience sampling technique was utilized for data collection. Trained research assistants approached the students of each class at the end of a long class format (LCF) lecture and requested all present students to participate in the study. Students were encouraged to participate in the study by explaining the purpose and need of conducting this study. During filling of questionnaires, investigators were present besides the

participants and helped them if they faced any equivocalness or needed any help; however, to overcome information bias, students were not permitted to discuss the questionnaire during the whole process. The academic score reported by the students was also verified by the students' affairs office. Only those students that signed the consent form and were willing to participate in the study were included in the study. Students aged less than 18 years or suffering from any acute or chronic mood disorder were not allowed to participate in the study. Exclusion criteria included questionnaires with incomplete or incoherent information, and on this basis, 19 forms were excluded. Data was collected in the 1st quarter of the academic year when students are not under stress and fear of final examinations, or other rigorous academic activities - so that the results could be fair and conclusive.

### Variables

Data was collected through self-administered questionnaires comprising of 4 sections. The first section consisted of an informed consent form developed by World Health Organization Research Ethical Review Committee.<sup>24</sup> The next section was for demographics while the third and fourth sections comprised of Young's Internet Addiction Test (YIAT)<sup>11</sup> and Beck's Depression Inventory (BDI)<sup>25</sup>, both are internationally recognized and have proven reliable. The YIAT is a 20-item questionnaire with 6 options on each question ranging from 0 to 5. The minimum conceivable score is 0, and the maximum is 100. According to developers' guidelines, individuals who acquire a score between 20-49 points are considered as normal users who have control over the Internet. Individuals who score in between 50-79 are experiencing slight Internet dependence while those who scored in the range 80-100 reflect severe Internet dependency.<sup>11</sup> For depression, BDI is the most widely accepted tool and it comprises of 21 items. Each question has options to be selected, and each option has a score ranging from 0 to 3. The lowest score is 0 while the highest score is 63. Based on the score obtained, there are six categories set by developers of the scale. A score of 1-10 is considered normal, 11-16 mild mood disturbance, 17-20 borderline clinical depression, 21-30 moderate depression, 31-40 severe depression, and over 40 is considered as extreme depression.<sup>25</sup> In the questionnaire, students were also asked to report their scores of the most recent professional examination in percentages. This annual professional examination practiced at the Northwest School of Medicine collects only scores of the final examination, and these are counted for promotion and earning a degree. So, the scores of professional examinations portray the academic performance of a student. However, for first-year medical students, the aggregate of Medical College Admission Test and Higher Secondary School final results were reported. Afterwards, the academic scores were categorized as low grades (those who scored less or equal than 75%) and high grades (those who scored more than 75%) to understand the association of academics with Internet addiction and depression.

### Quantitative Variables and Statistical Analysis

The analysis was run using a 95% confidence interval and p-value set at 0.05 using Statistical Package for Social Science (SPSS) Version 16.0 IBM INC. Chicago, USA and Stata16 (StataCorp, TX). Categorical variables were described using frequencies and percentages while continuous variables were described using central tendency and dispersion measurements. Bivariate analysis included the use of Chi-squared test and the Pearson correlation test, for categorical variables. For continuous variables, t-test was used. To identify the relation and effect of covariables on Internet addiction scores we used simple and multivariate linear regressions.

Internet addiction was further categorized in two sections as highly internet dependent students (who scored 80-100 on YIAT) and non-internet dependent students (who scored 20-79). Depression was also categorized into two groups; non-depressed individuals (who scored 1-16 on BDI) and depressed individuals (who scored 17-63). Using simple logistic regression, we estimated the odds ratio (OR) and confidence

intervals to assess the association of the study variables with depression. Furthermore, we assessed the association of the study variables with medical students' latest final examination result scores. We firstly assessed the variables with simple logistic regressions and added them into a multivariate logistic model to identify the adjusted effect of the variables on grades.

## Results

### Socio-Demographic Characteristics

Out of 380 students invited to participate in the survey, 250 students filled the survey for a response rate of 65.79%. We excluded 19 (7.6%) surveys and our final population for analysis was 231 (92.4%) participants. Our study population comprised of 148 (64.07%) male and 83 (35.93%) female students. Participants' distribution according to academic year was 23.38% (54), 25.54% (59), 26.41% (61), and 24.67% (57) for first, second, third, and fourth year, respectively. The age of respondents ranged from 18 to 29 with a mean of  $21 \pm 2$  years. Female students were younger than male students ( $20.07 \pm 1.89$  vs.  $21.74 \pm 1.51$ ,  $p$ -value=0.003). The academic scores ranged between 47% to 90% with a mean of  $73.31 \pm 7.27\%$  with no significant sex differences ( $p$ -value=0.97).

### Frequency of Internet Addiction

The mean Internet addiction score using YIAT was found to be  $50.52 \pm 18.80$  (range 1-97). Our results show that 4.76% ( $n=11$ , 95%CI=2.40-8.36) of students spend less time on the Internet than normal users, 44.16% ( $n=102$ , 95%CI=37.64-50.82) were average Internet users, and 41.99% ( $n=97$ , 95%CI=35.55-48.64) were experiencing occasional or frequent problems because of the Internet (slight Internet addiction), whereas 9.09% ( $n=21$ , 95%CI=5.72-13.56) of students were categorized as severe Internet dependents. There was a statistically significant difference when comparing sex by level of Internet addiction; 45.95% of male students report a slight addiction compared to 34.94% of female students ( $p$ -value>0.05). High Internet addiction was found in 11.49% of male students and 4.82% in female students ( $p$ -value=0.043). The mean YIAT score in males was  $53.41 \pm 18.26$ , while in females it was  $45.37 \pm 18.74$  ( $p$ -value=0.002).

### Frequency of Depression

The mean Beck's-Depression-Inventory score was  $20.09 \pm 12.1$  and ranged between 0-55. According to Beck's Depression Inventory categorization, 27.71% ( $n=64$ , 95%CI=22.04-33.96) of students fell in the normal category, 16.88% ( $n=39$ , 95%CI=12.29-22.35) were suffering from mild mood disturbance, 7.79% ( $n=18$ , 95%CI=4.68-12.04) were found to be at borderline clinical depression, 23.81% ( $n=55$ , 95%CI=18.47-29.84) were suffering from moderate depression, 19.05% ( $n=44$ , 95%CI=14.19-24.71) fell in the category of severe depression, while 4.76% ( $n=11$ , 95%CI=2.4-8.36) of the students were identified as extremely depressed. There was no statistical difference when comparing sex and the categories of depression ( $p$ -value=0.06). The mean depression score was  $20.19 \pm 12.92$  in males and  $19.92 \pm 10.53$  in female respondents ( $p$ -value=0.87).

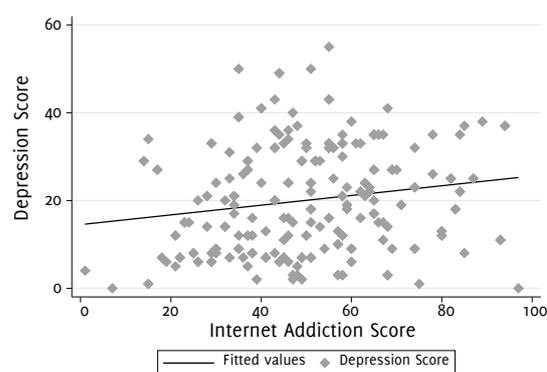
### Relationship Between Internet Addiction and Depression

Correlation between Internet addiction and depression was 0.164 (Pearson Correlation R) with a  $p$ -value 0.01. The simple linear regression model described that for each increase in the Internet addiction scorer there was an increase in the depression score ( $\beta=0.27$ ,  $p$ -value=0.009,  $R^2=0.03$ , Figure 1). Adjusting the model by age and sex, it was found that being male increased the Internet addiction levels ( $\beta=7.43$ ,  $p$ -value=0.004) and did not change the net effect of depression over the addition ( $\beta=0.25$ ,  $p$ -value=0.01) but the relation of this characteristics explained only 7.6% of the variability in Internet addiction. Finally, the odds ratio (OR) of depression among those addicted to the Internet was 1.34 (95%CI=0.53-3.37,  $p$ -value=0.53), indicating an association with depression; however, the confidence interval crossed the null value and further adjustment was not appropriate given the sample size.

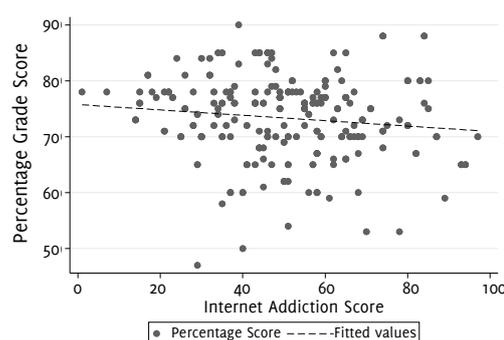
**Table 1.** Distribution of Internet Addiction and Depression Categories with Academic Performance ( $n = 231$ ).

Characteristic	Students who scored $\leq 75\%$	Students who scored $> 75\%$	Total	p-value
Internet Addiction				0.026*
Less Internet users	2 (1.59%)	9 (8.57%)	11 (4.76%)	
Normal Internet users	51 (40.48%)	51 (47.6%)	102 (44.16%)	
Slight Internet Addiction	60 (47.62%)	37 (35.24%)	97(41.99%)	
High Internet Addiction	13 (10.32)	8 (7.62%)	21 (9.09%)	
Depression Categories				0.125*
Within normal limits	32 (25.40%)	32 (30.48%)	64 (27.71%)	
Mild mood disturbance	17 (13.49%)	22 (20.95%)	39 (16.88%)	
Borderline Clinical depression	7 (5.56%)	11 (10.48%)	18 (7.79%)	
Moderate depression	33 (26.19%)	22 (20.95%)	55 (23.81%)	
Severe depression	29 (23.02%)	15 (14.29%)	44 (19.05%)	
Extreme depression	8 (6.35%)	3 (2.86%)	11 (4.76%)	

**Figure 1.** Scatter plot and linear relation of Depression and Internet addiction scores.



**Figure 2.** Scatter plot of the Internet addiction and Percentage of academic scores.



**Table 2.** Associated factors with low academic performance (low grades).

Characteristic	aOR	95%CI	P-value	aOR	95%CI	P-value
Internet addiction	0.71	0.28-1.80	0.479	0.54	0.19-1.48	0.234
Depression	0.60	0.35-1.01	0.0577	0.62	0.35-1.09	0.100
Sex	0.90	0.52-1.55	0.726	1.39	0.76-2.57	0.281
Age	0.62	0.50-0.75	<0.0001	0.59	0.48-0.73	<0.0001

### Association of Academics with Internet Addiction and Depression

There was an inversely proportional relation between academic performance and Internet addiction, where each increase in the YIAT's score decreased the percentage academic score ( $\beta = -0.32$ ,  $p$ -value=0.06,  $R^2=0.015$ ; **Figure 2**); however, it was not significant. Number of students who obtained a grade less than or equal to 75% were 54.55% while students who scored above 75% were 45.45%. **Table 1** shows the relationship between grades, Internet addiction ( $p$ -value=0.026) and depression ( $p$ -value=0.12). In the multivariate logistic regression analysis adjusted by sex and age (**Table 2**), it was found that Internet addiction (OR=0.54, 95%CI=0.2-1.49,  $p$ -value=0.23) and depression (OR=0.62, 95%CI=0.36-1.09,  $p$ -value=0.10) were associated with a score equal or below 75%; however, these findings were not statistically significant (Pseudo  $R^2=0.10$ ).

### Discussion

The global accessibility of better Internet service and availability of modern gadgets has raised the problem of Internet addiction. As Internet dependence is widely perceived as a mental health issue that might affect the lives of youngsters, it is important to watch out for its dominance and to initiate preventive and mitigation measures to keep control on this silent public health problem.<sup>26</sup> Few investigations are directed on the pervasiveness of Internet addiction in the subcontinent region which compelled us to establish the frequency of Internet addiction among students of a Medical school in Pakistan.

Various global investigations have shown that youngsters aged between 18 to 25 years have the highest chance of developing Internet dependence. Across the globe, the prevalence rates reported for Internet addiction vary widely (between 0.3% and 38%).<sup>27</sup> Systematic reviews in the United States and Europe have shown predominance rates fluctuating somewhere in between 1% and 8%.<sup>5</sup> Our study has demonstrated that Internet addiction among medical students was 9.09% (95%CI=5.71-13.56) while a local study has demonstrated that Internet addiction was found in 7.9% of medical students.<sup>28</sup> Investigators from India also revealed that the frequency of Internet addiction was discovered to be 6% at a dental college.<sup>29</sup> A middle-eastern study conducted on undergraduate medical students of Qassim University depicted that frequency of Internet-addicted students in their study sample was 12.4%.<sup>30</sup> These findings show the trend of having a high frequency of Internet addiction among medical students than the global average in the general population. Results from current investigation demonstrate that mean score of Internet addiction scale was higher in males than in females ( $p$ -value=0.043). A study from China bolsters our evidence by reporting the same trend.<sup>31</sup> Various review articles and meta-analyses have also shown that male students are more prone to developing Internet addiction than the counterpart gender.<sup>28,32</sup> Overall, our outcomes have indicated that predominance of web fixation in our study sample is marginally higher than the worldwide average and other local studies.

Beck Depression Inventory was used to determine depression among the respondents. According to Beck's Depression Inventory the respondents fall into six categories - normal students (29%), mild mood

disturbance (16.5%), borderline clinical depression (7.8%) while students suffering from mild, moderate, and extreme depression were 24.4%, 17.1% and 4.6%, respectively. These figures give us an insight that at least 55.41% ( $n=128$ , 95%CI=48.75-61.93) students are suffering from depressive illness. Using Beck's Depression Inventory, a study from medical colleges of Iran also reported that 52% of the students were suffering from depression.<sup>33</sup> Another Turkish investigation reported that prevalence of depression was 39% in their study population.<sup>34</sup>

Literature review has demonstrated that depression and Internet Addiction Disorder happens together roughly twice as would be anticipated alone.<sup>10</sup> Both factors might be driven by shared fundamental psychological and social mechanisms. For example, nervousness, helplessness, rest aggravation, latent style of life, helpless dietary propensities, and ecological and social hazard factors.<sup>35</sup> Research on depression and Internet addiction showed that the misuse of the Internet brings an interruption of the ordinary life of an individual and also affects the people around them, which was related to an increase in the frequency of depression.<sup>36</sup> Besides, in 2005 it was proposed that depression is the distal fundamental reason for Internet addiction.<sup>37</sup> A major scale investigation among undergraduate students found that Internet addiction was identified with indications of attention deficit hyperactivity disorder (ADHD) and burdensome disorders. However, it is conceivable that they may spend more time on the Internet and progress to addiction if the depression was not well treated.<sup>38</sup> Current investigation has demonstrated that Internet addiction and depression are correlated; Internet addicts suffered from more depression than average Internet users. The current study reported that odds ratio (OR) for depression with Internet addiction was 1.34 (95% CI=0.53-3.37) but without statistical significance. However, the multivariate logistic regression model exhibits that increase in YIAT scores resulted in decreased academic scores with a  $p$ -value of 0.06 which is close to the significance level. Still, we could identify an inverse relationship between internet addiction and academic performance. Similar but significant outcomes were found from an exploratory study led by Japanese researchers where it was found an OR of 2.8 (95% CI=2.4-3.3).<sup>39</sup> Another international study reported a statistically significant association between Internet addiction and depression with OR = 1.9 (95% CI= 1.3-2.7).<sup>40</sup> Correlation analysis also provided that there is positive association between Internet addiction and depression. same was reported by various national and international studies.<sup>22,27</sup> A reason why our results were not significant could be attributed to the sample size calculation which was planned to identify prevalence and not for multivariate analysis. Further research is required to shed light on this issue locally.

As manifested by various empirical studies, Internet addiction has a negative outcome on the academic performance of the students; more time spent online for non-educational purposes result in short attendance, distractive behaviour, lack of interest in studies, difficulty in grasping concepts, and cognitive decline which ultimately results in low grades.<sup>42,43</sup> The current study has explored that there was not a significant relationship between Internet addiction and academic performance given that Internet addiction (OR=0.54, 95%CI=0.2-1.49,  $p$ -value=0.23) was associated with low grades. However, multivariate logistic regression model show that increase in YIAT scores decreased the academic scores. These results cannot conclude that either academic performance is related with Internet addiction or not. However, results from other settings demonstrated significant results. They expressed that predominance of pathological web use was significantly higher in students with declining grades.<sup>43</sup> A recent investigation among dental students also revealed that there was a strong association (OR=6 95%CI=2.29-15.67) between scholastic grades and frequency of Internet addiction.<sup>29</sup> The possible reason for the discrepancy in these results with comparison to other investigations might be the study design we have used, which is a limitation of our study. However, the Pearson chi-squared test reveals that pervasiveness of Internet addiction was significantly higher in the group of students who obtained low grades in their final professional examination. Various other investigations likewise gave similar outcomes which are in accordance with our outcomes.<sup>23,42,44</sup>

Web fixation can likewise cause despondency, introversion, hopelessness and different other psychosocial conditions.<sup>11</sup> These variables seriously affect the daily life of an individual including important duties of daily routine like social interaction with peers, family and educational or employment supervisors.<sup>28</sup> Sometimes severe addiction can spawn permanent damage to career besides physical and emotional health. Moreover, web abuse may introduce youngsters towards pornographic addiction, non-ethical hacking, spamming, phishing, and intrusion into security networks which can no doubt endangers the integrity of personal health and finances, but can also lead to legal proceedings against the subject.<sup>45</sup> Some analysts have even cautioned that Internet addiction may turn into a twenty-first-century scourge and may bring a significant global public health issue.<sup>46</sup> All these statistics and analysis raise worries and concerns for educational experts and public health policymakers. The increasing inescapability of Internet addiction should be considered as an emerging public health problem, and proper mitigatory measures should be taken well ahead of time.

### Limitations

Potential limitations of the current study may be its single centered nature as only students from one private medical school of Peshawar have been selected. One strength is that our participation rate increased our sample size above the one calculated to reach up to 97% confidence in the calculations. However, this sample cannot be considered as representative for all other medical colleges and multivariate analysis did not account for the calculation limiting the reliability of the regressions. Besides, the study design is also a limitation to the associations described, as the setting of the current study is a private sector medical school. Further research should be carried out at public sector medical colleges to compare the outcomes.

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#### Author Contributions

Conceptualization, Data Curation, Investigation, Resources & Validation: FA, WA, AZ, NM, SZ, HI. Formal Analysis & Software: FA. Methodology, Project Administration, Supervision, & Writing – Original Draft Preparation: FA, WA. Writing – Review & Editing: FA, WA, AZ.

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