Measuring addiction to internet gaming among Indian medical students: Development and preliminary psychometric properties of a new scale

Background: Internet gaming disorder (IGD) is emerging as an important source of behavioral addiction in young people globally. Objective: The aim of this study was to assess addiction to internet gaming in medical students using a self designed research instrument. Materials and Methods: We conducted a cross-sectional study and enrolled 264 male and 160 female MBBS students (n = 424) in Delhi, India. The study instruments included: a 2-item Internet gaming screening questionnaire (IGSQ), a 14-item self-designed Internet gaming addiction scale (IGAS) to measure addiction-like behavior associated with multiplayer Internet gaming, and the Pittsburgh Sleep Quality Index to measure sleep quality. Results: After preliminary screening, 91 male and 6 female participants were found to be multiplayer Internet gamers, and were further assessed using the 14-item IGAS. The Cronbach’s alpha of the IGAS was 0.879. Principal component analysis revealed a three-component IGAS structure based on eigenvalue cutoff (>1), loading score >0.4, and inspection of the scree-plot that explained 66.71% of the total variance. The IGAS score and the average weekly gaming time of the participants showed a moderate positive correlation ($r = 0.45$, $P < 0.001$). Only 17 (4.0%) participants reported agreement/strong agreement across ≥5 domains of addiction. The mean (standard deviation) IGAS score was significantly higher in the participants reporting poor sleep quality (PQSI > 6) ($P = 0.047$). Conclusion: IGD has low prevalence among medical students, and the problem is negligible among female students. The 14-item IGAS, in conjunction with the 2-item IGSQ, are reliable and valid tools for the assessment of IGD.

Keywords: Behavioral addiction, internet gaming addiction, technological addiction

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control and escalating of gaming-related activities as a mental health disorder in the current 11th revision of the International classification of disease.[9]

The global prevalence of IGD in a systematic review ranged from 0.7% to 27.5%, with males and younger people experiencing significantly higher risk.[4] The Indian population is at considerable risk of all forms of technological addiction due to an exponentially increasing smartphone market, expanding Internet connectivity, and the largest population pool of adolescents and young people globally.[7] Compared to conventional gaming, Internet gaming carries a higher risk of addiction as it combines the addictive potential of the Internet through multiplayer gaming, which fosters virtual relationships on gaming-based social networks and an outlet to escape from the real world.[8,9] Furthermore, like gambling, which is the only APA certified technological and behavioral disorder, IGD can also induce impaired control, craving, and compulsive engagement despite adverse consequences on health and well-being.[10] However, there exists a paucity of studies that have focused on the problem of Internet gaming disorder in India. A recent study by Singh et al. reported a 3.6% prevalence of IGD among undergraduate and postgraduate medical students in Delhi.[11] However, to the best of our knowledge, no IGD assessment scale has been validated in Indian settings.

In this study, we assessed Internet gaming disorder in Indian medical students using a self-designed scale in conjunction with a screening questionnaire.

MATERIALS AND METHODS

Study setting and participants
We conducted a cross-sectional study among adult medical undergraduate (MBBS) students at a government medical college in Delhi during September–November 2019.

Study instruments
1. A 2-item Internet gaming screening questionnaire (IGSQ): After describing an Internet multiplayer game, a few examples of such gaming titles, based on total downloads and ratings on the Google (Android) Play Store and the Steam PC gaming platform, were mentioned to trigger easy understanding and recognition among the participants. Students who answered “Yes” to both the statements, “Playing an internet multiplayer game in the previous seven days” and “playing on average for ≥1 h any Internet multiplayer game on their mobile or laptop on a typical day” were further assessed for the presence of IGD. Those students who answered “No” to any of the statements were considered not having any potential for addiction-like behavior associated with Internet gaming.
2. A self-designed 14-item Internet gaming addiction scale (IGAS) based on the symptoms of IGD described by the APA[4] and application of the International Classification of Diseases–10 criteria for substance dependence syndrome.[12] The IGAS measures addiction across the following domains: (i) Intense desire (Q. 1, 5, 7) (ii). Withdrawal symptoms (Q. 3, 9, 10) (iii). Tolerance (Q. 4) (iv). Harmful use (Q. 6, 11, 12, 13) (v). Impaired control (Q. 2, 3, 4, 6, 14) and (vi). Reduced alternate pleasure (Q. 7, 8). The response to the each of the IGAS items were self-rated on a 6-point Likert scale with options being 1 (strongly disagree), 2 (disagree), 3 (weakly disagree), 4 (weakly agree), 5 (agree), and 6 (strongly agree). The total IGAS score was the sum of individual scores for all the 14 items of the questionnaire, with higher scores indicating a greater risk of addiction.

Pretesting of the instruments was conducted among 20-students inclusive of 10 male and 10 female students who were not part of the final study. It was observed that among the students who reported no to any of the items on the IGSQ, all had a total IGAS score ≤16, due to an absence of Internet gaming addiction. Content validity of the items included in the instruments was assessed at this stage by the investigators for accuracy, grammar, lack of bias, and avoiding leading questions.

Sample size
A respondent ratio of 5–10 per scale item is considered an adequate sample size in factor analysis.[13] We wanted to include a minimum of 100 and preferably 140 participants for conducting the factor analysis of the IGAS. However, despite screening 424 students with the IGSQ, only 97 were found at risk of Internet gaming addiction, and they were further screened using the IGAS.

Sampling and data collection
We selected MBBS students from five class batches. The final year students and the internship batch were considered as a single unit. Each class consisted of approximately 250 students. A total of 95 students were selected from each batch using the simple random sampling method with the sampling frame obtained from the batch’s attendance registers containing the names and roll numbers of the students. The student roll numbers were selected as a set of random numbers without replacement using the online research randomizer tool.[14] In case the selected student was absent on the day of the assessment, an additional student was selected using the same method.

Procedure
The study instruments were self-administered to the participants. Attempts were made by the investigators to normalize the risk behaviors by informing the participants.
before the survey administration that there were no correct or incorrect answers and reassuring them regarding the complete confidentiality and anonymization of their responses. An investigator was also present in the room when the participants submitted their instruments to assist them in case of any query and minimize interaction between the participants during this period to avoid any external influence and maintain survey integrity.

Handling of missing data
The dataset was cleaned by inspection of the cases for missing values. We excluded a total of 9 questionnaires having >2 incomplete entries on the IGAS. Missing items were imputed, taking the item median score as per the participant gender and age-group.

Statistical analysis
Data were entered in MS-Excel, cleaned, and imported into the Statistical Package for the Social Sciences (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY) for analysis. The independent samples t-test was applied to test for the significance of the mean difference between groups. A P < 0.05 was considered statistically significant. We also conducted a principal component analysis (PCA) on the responses to the IGAS for investigating its construct validity.

Ethical considerations
The study was approved with an exemption from full review by the Institutional Ethics Committee (F1/IEC/MAMC/68/03/2019/158). Written and informed consent was obtained from all the study participants.

RESULTS

Participant characteristics
We evaluate responses from 424 participants with mean (standard deviation [SD]) age of 19.83 (1.6) years and comprising 264 (62.3%) males and 160 (37%) female students.

After screening with the preliminary gaming questionnaire, we retained 97 participants including 91 (93.8%) boys and 6 (6.2%) girls who reported playing an online, social or multiplayer player in the previous 7 days, with the total time spent playing multiplayer games on an average day reported as ≥1 h.

Among multiplayer Internet gaming participants, the average weekly frequency of gaming was 4.58 (±1.6) days, and the mean (±SD) gaming time on a typical day was 2 (±0.8) hours.

Factor analysis of Internet gaming addiction scale
The dataset was found suitable for the application of the PCA having an adequate sample size. The correlation matrix showed that all variables had at least one correlation coefficient >0.3. The overall Kaiser–Meyer-Olkin (KMO) measure was 0.942, classifications of “marvellous” according to Kaiser, individual KMO measures were all >0.9, and Bartlett’s Test of Sphericity was statistically significant (χ² = 774.4) (P < 0.0001).

The PCA revealed a three-component structure based on eigenvalue cutoff ≥1, loading score ≥0.4, and inspection of the Scree Plot [Figure 1]. The total variance explained by the model was 66.71%, with component 1 (51.02%), component 2 (8.0%), and component 3 (7.6%). We observed strong loading of items relating to intense desire, withdrawal symptoms, tolerance, and reduced alternate pleasure on component 1, impaired control items on component 2, and the harmful use items on component 3 [Table 1].

Reliability of Internet gaming addiction scale
The distribution of participant responses to the IGAS is reported in Table 2. The Cronbach’s alpha of the IGAS was 0.924, indicating excellent reliability. The reliability analysis suggested that all the 14 items in the IGAS were to be retained.

Prevalence of IGD
The mean (SD) IGAS score in the participants was 44.2 (±17.3), whereas the maximum permissible score was 84. Positive agreements (item mean score >3) were reported for items 1, 2, 4, 6, 8, 9 and 10. Based on item loadings on the PCA, we observed only 17 (4%) participants who reported agreement/strong agreement across ≥5 domains of addiction (Q. 2, 4, 7, 8, 9, 12).

Construct validity of Internet gaming addiction scale
Scores on the IGAS were not significantly associated with participant age. However, the participants with poor sleep quality registered significantly higher IGAS scores compared to those with good sleep quality (P = 0.047) [Table 3]. The IGAS score and the average weekly gaming time of the participants also showed a moderate positive correlation that was statistically significant (r = 0.43, P < 0.001). The application of both the IGSQ and the IGAS showed that female students rarely participated in Internet gaming sessions that were of significant duration and were not at risk of IGD, unlike, one in four male students who pursued Internet gaming as a source for recreation.
Basu, et al.: Internet gaming disorder in medical students
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DISCUSSION

The present study indicates that nearly 23% of medical students that were predominantly male participated routinely in internet gaming activities, but only 17 (4%) students reported addiction-like symptoms suggestive of IGD. Our results are partially in agreement with another study conducted at a medical institute in Delhi that reported 3.6% of students meeting criteria for the diagnosis of IGD, although unlike our study, females were also reported to be at risk.[11] Large-population surveys in the Western world have reported IGD prevalence of ≤1% in the school-going adolescent population,[17] but a similar study in South Korea reported a higher IGD prevalence (5.6%).[18] The study also had a substantial proportion of adolescents, although their IGAS scores did not differ significantly from comparatively older participants. This was probably because college or university, unlike school, entails a lack of supervision and control of internet gaming activities of students by their parents and teachers.[11,19] Higher IGD scores were also associated with poor sleep quality, which corroborates the evidence from previous studies.[20]

Table 1: Rotated structure matrix for principal component analysis with varimax rotation of a 3-component Internet gaming addiction scale showing major loadings (≥0.4)

| Component | Communalities |
|-----------|---------------|
| 1 | 0.575 | 0.445 | 0.529 |
| 2 | 0.878 | 0.800 | 0.750 |
| 3 | 0.493 | 0.601 | 0.717 |
| 4 | 0.498 | 0.662 | 0.702 |
| 5 | 0.418 | 0.458 | 0.661 |
| 6 | 0.661 | 0.419 | 0.717 |
| 7 | 0.786 | 0.601 | 0.786 |
| 8 | 0.699 | 0.601 | 0.651 |
| 9 | 0.717 | 0.672 | 0.734 |
| 10 | 0.819 | 0.777 | 0.712 |
| 11 | 0.413 | 0.692 | 0.709 |
| 12 | 0.596 | 0.420 | 0.613 |
| 13 | 0.661 | 0.419 | 0.702 |
| 14 | 0.717 | 0.672 | 0.709 |

Extraction Method: Principal component analysis with varimax rotation

Table 2: Distribution of responses to the Internet gaming addiction scale in multiplayer Internet game playing participants (n=97)*

| Item | Question | Corrected-item total alpha correlation | Cronbach’s alpha if item deleted | Mean±SD |
|------|----------|-------------------------------------|---------------------------------|---------|
| 1    | Internet gaming is my favorite pass-time | 0.553 | 0.922 | 3.8±1.7 |
| 2    | Feel anxious or stressed when I’m unable to make rapid progress and attain high gaming achievements | 0.539 | 0.922 | 3.4±1.6 |
| 3    | Feel irritable and sad when I don’t have access to internet gaming | 0.782 | 0.914 | 2.9±1.5 |
| 4    | Feel I’m spending increasingly more time on Internet gaming | 0.773 | 0.915 | 3.1±1.5 |
| 5    | Enjoy Internet games right after waking up from sleep | 0.612 | 0.920 | 2.2±1.6 |
| 6    | Feel Internet gaming is diminishing my academic performance and productivity | 0.776 | 0.924 | 3.1±1.7 |
| 7    | Increasingly prefer internet gaming with my online buddies than spend time on outdoor games and activities with real-life friends | 0.706 | 0.916 | 2.9±1.8 |
| 8    | Internet gaming is gradually replacing my other hobbies or activities that I found previously enjoyable | 0.713 | 0.916 | 3.1±1.8 |
| 9    | Always think on reducing my internet gaming duration | 0.567 | 0.921 | 3.7±1.7 |
| 10   | Get annoyed at friends and family who ask me to decrease my time spent on internet gaming | 0.659 | 0.918 | 3.2±1.7 |
| 11   | Experiencing lightheadedness or blurred vision due to excessive Internet gaming | 0.534 | 0.922 | 2.7±1.6 |
| 12   | Feeling pain in the wrists or at the back of the neck due to Internet gaming | 0.604 | 0.920 | 2.7±1.7 |
| 13   | Feeling tired and lacking adequate sleep due to excessive Internet gaming | 0.680 | 0.917 | 3±1.7 |
| 14   | Feel stressed when I find my gaming records and scores are inferior compared to other players | 0.671 | 0.918 | 2.9±1.6 |

*327 students were excluded after assessment with the initial 2-item IGSQ. IGSQ – Internet gaming screening questionnaire; SD – Standard deviation
Table 3: Construct validity of the Internet gaming addiction scale in multiplayer Internet game playing participants (n=97)

| Variable                        | Total (n=97) | IGAS score, mean±SD | P    |
|---------------------------------|-------------|---------------------|------|
| Age (years)                     |             |                     |      |
| 18-19                           | 36 (37.1)   | 45.5±16             | 0.551|
| ≥20                             | 61 (62.9)   | 43.3±18             |      |
| Sleep quality                   |             |                     |      |
| Good                             | 57 (58.8)   | 41.2±15.4           | 0.047|
| Poor                             | 40 (41.2)   | 48.3±19.1           |      |
| Sex                             |             |                     |      |
| Male                             | n=424       | 91 (36.5)           | <0.001|
| Female                          | 160         | 6 (3.75)            |      |

IGSQ – Internet gaming screening questionnaire; IGD – Internet gaming addiction; IGAS – Internet gaming addiction scale; SD – Standard deviation

Furthermore, in this study, we restricted the assessment of addiction to Internet gaming or multiplayer online gaming, which is known to have a significantly higher addictive potential compared to conventional offline gaming. However, the study lacked qualitative perspectives to distinguish the gaming time of the participants that was spent exclusively on multiplayer games, and instead, the gaming time reported is likely to include a combination of both offline and online gaming. Moreover, multiplayer games may also have a single-player (offline) mode of play. Consequently, the study findings may not be generalizable in those gamers who predominantly play offline games. Another significant limitation of our study was the cross-sectional design, due to which temporal and causal relationships could not be established, like, the effect of long-standing IGD on academic performance or health outcomes, which require prospective evaluation.

Future studies using the IGAS should assess its validity in other student cohorts belonging to the general university, information technology, and school-going students. Furthermore, IGAS scores should be validated against other measures such as depression and anxiety.

CONCLUSION

IGD has low prevalence among medical students in India, and the problem is negligible among female students. The 14-item IGAS, in conjunction with the 2-item IGSQ, are reliable and valid tools for the assessment of IGD.

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Conflicts of interest
There are no conflicts of interest.

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