

# Prevalence and Correlates of Internet Gaming Disorder Among an Advanced Level Student Population from Colombo, Sri Lanka

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## Abstract

**Background:** Internet Gaming Disorder (IGD) is rising in many low and middle-income countries owing to the increasing popularity of electronic gaming and technology availability among adolescents. However, the epidemiology of IGD in South Asia remains largely unknown. We aimed to determine IGD's prevalence and associations, including motivations for gaming, among a Sri Lankan school-going population. **Methods:** A cross-sectional study was conducted among Advanced Level students aged 16-18 attending four Colombo Educational Zone schools. Of the 412 randomly sampled recruits, 395 consenting participants filled a pretested questionnaire exploring gaming habits, motivations, and psychosocial factors. English and Sinhala versions of the Internet Gaming Disorder Scale Short-Form (IGDS9-SF) were used, and IGD was identified if  $\geq 5$  items in the scale were endorsed. The Sinhala IGDS9-SF demonstrated acceptable internal consistency reliability, and its factorial validity was affirmed via Confirmatory Factor Analysis. **Results:** Among the sample, 81.5% (n=322) were gamers. A majority of these gamers preferred mobile gaming (64.0%) and Multiplayer Battle Royale games (27.0%). The prevalence of IGD was 5.06% (95% CI = 2.90–7.22) and was significantly higher ( $p < 0.05$ ) among males, who constituted 52.4% of the sample. Daily weekday gaming for  $\geq 6$ h, low involvement in student societies, poor relationship with parents, escape motive, and fantasy motive were positively associated with IGD, and the Competition motive was negatively associated with IGD in multivariable analyses. **Conclusion:** The prevalence of IGD was considerably high in our student population and is associated with specific motives, poor parent-child relationships, and low extra-curricular involvement.

**Key Words:** Internet Gaming Disorder; Addictive Behavior; Motivation; Adolescent Psychiatry; Community Psychiatry (Source: MeSH-NLM).

## Introduction

Electronic gaming is a healthy recreational activity which confers several cognitive, motivational, emotional, and social benefits and is gaining popularity as a source of entertainment among adolescents.<sup>1</sup> Pathological gaming, however, is a type of maladaptive behavior and is described as "Internet Gaming Disorder" (IGD) under Section III of the Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> Edition (DSM-5), where it is defined as a pattern of persistent and recurrent participation in electronic gaming leading to significant impairment or distress as indicated by five or more of nine core symptoms exhibited over a year. The specified symptoms include pre-occupation with games, withdrawal, tolerance, lack of control, loss of interest in previous hobbies, continued excessive use despite knowledge of psychosocial problems, deception of family members and/or others, use of games to gain relief from negative emotions and jeopardizing important relationships or opportunities due to gaming behavior. The condition was also recognized by the World Health Organization and described as "Gaming Disorder" in the latest International Classification of Diseases (ICD-11).<sup>2</sup>

Despite its name, IGD applies to both online and offline gaming activity.<sup>3</sup> It should be noted that Internet Addiction Disorder (Problematic Internet Use) and IGD are two distinct entities.<sup>4,5</sup>

IGD is a debilitating condition with consequences spanning the physical, mental, and social aspects of a person's wellbeing.<sup>6</sup> Depressive symptoms, lower academic achievement,<sup>7</sup> and increased physical aggression are consequences of pathological gaming.<sup>8</sup> Other associated comorbid psychopathologies include attention deficit hyperactive disorder, obsessive-compulsive disorder, and anxiety.<sup>6,9</sup> Psychosocial issues such as peer problems,<sup>10</sup> poor relationship with parents and teachers,<sup>11</sup> and low self-esteem<sup>12,13</sup> are higher among gamers with IGD. Poor sleep quality and sleep-related problems,<sup>14</sup> reduced interest in schoolwork,<sup>15,16</sup> and extra-curricular activities are also linked to IGD.<sup>17</sup> Gamers with IGD are more likely to prefer massively multiplayer online role-playing games (MMORPGs) and first-person shooter (FPS) games among other genres.<sup>18</sup> Case reports suggest that problematic gaming may be associated with a preference for newer genres such as Battle Royale (BR) games as

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well.<sup>19</sup> Increased gaming time<sup>15,20,21</sup> and low involvement in sports and exercise<sup>22</sup> adds to the risk of developing IGD. Furthermore, the possession of gaming consoles, a powerful internet connection,<sup>20</sup> and an earlier age of first playing games are also implicated.<sup>23</sup> Gaming motives are important predictors<sup>12,24</sup> and mediators of psychopathology in gamers with IGD.<sup>25</sup> Seven motives have been identified, namely: escape, fantasy, coping, skill development, recreation, competition and social.<sup>26</sup>

The global pooled prevalence of IGD is 3.05%,<sup>27</sup> and the prevalence rates reported range from 0.21-57.5%.<sup>28</sup> IGD is predominantly seen in males and is higher among adults than younger adolescents, although the prevalence decreases with increasing age among adults.<sup>29</sup> The prevalence is lower among European populations compared to South-East Asian populations, with rates as low as 1.6% reported from representative European samples<sup>17</sup> and as high as 10.1% in South-East Asia.<sup>30</sup> The prevalence of IGD was 3.5% in a study done among a sample of 15-19-year-old school-going adolescents<sup>31</sup> and 3.6% among a sample of medical students from India.<sup>32</sup>

The literature pertaining to the psychological aspects of electronic gaming is scarce in the South Asian region. Evidence from Sri Lanka has thus far been limited to case reports such as that done by Chandradasa and Rodrigo in 2017, where IGD was described in four adolescents aged 13-16 years presenting to a Sri Lankan tertiary care hospital.<sup>33</sup> In this light, we aim to address this regional evidence gap by investigating the prevalence of IGD in a Sri Lankan school-going adolescent population, using a simple validated screening tool that can be used in native settings. We also aim to describe the role of interindividual and student-specific factors and the role of gaming motivations which have not been adequately explored in the extant literature.

## Methods

### Study Design and Setting

A descriptive cross-sectional study with an analytical component was conducted among four conveniently selected national schools located in Colombo, the commercial capital of Sri Lanka. Being national schools, the students hail from around the country and therefore the population is diverse, and representative of the multi-ethnic demographic of Sri Lanka. Ethics approval was obtained from the Ethics Review Committee of the Faculty of Medicine, the University of Colombo, prior to the recruitment of participants (Reference No. MFC/AL/2016/911).

### Sample Size

A sample size of 355 was deemed necessary at a confidence level of 95% and a 5% margin of error for a finite population of 4500 students. An estimated proportion of 50% was considered in the calculation to arrive at a maximum sample size.<sup>34</sup>

### Participants

Sri Lankan school education is offered in four stages which are namely: Primary (Grades 1-5), Junior Secondary (Grades 6-9),

Senior Secondary (Grades 10-11) and Collegiate or Advanced Level (A/L) (Grades 12-13). At the end of Grade 13, students face the General Certificate of Education (A/L) examination in their preferred stream (e.g., Biological Science, Physical Science, Commerce, Arts, etc.), which also serves as the entrance test to state universities. For our study, we recruited a total of 412 students aged 16-18 years studying in the A/L classes of the respective schools. Random cluster sampling was used in order to prevent selection bias, with a class of students constituting a cluster. The exclusion criteria included absence on the day of data collection, failure to provide informed written consent and assent, presence of known cognitive impairment/ co-morbid psychopathology interfering with the reliability of responses and filling the questionnaire incompletely/incoherently. Based on these criteria, 17 participants were excluded due to absence (n=4), failure to return the consent and assent forms (n=2) and incompletely/incoherently filled questionnaires (n=11), with 395 students finally included in the study, resulting in a response rate of 95.87%.

### Study Procedure

Data collection was done throughout September 2020. Permission was initially obtained from the Zonal Education Director and Principals of the selected schools before approaching the selected classes for data collection. The investigators approached the students during the free timeslots in their academic timetables. The study's objectives and procedure were described before distributing the consent forms, which were to be signed by the parents. Informed assent was obtained from participating students. Students who returned the completed consent and assent forms were given the questionnaire in their preferred language (English/Sinhala). Personal details such as name and residential address were not requested to ensure anonymity. The investigators were present at the time of data collection to answer any queries raised by the participants, although the participants were not allowed to discuss the contents of the questionnaire amongst themselves to prevent information bias.

### Measures and Variables

The study employed a self-administered questionnaire, which was pre-tested among 32 A/L students from the Galle district. The questionnaire consisted of three sections.

Section A explored sociodemographic and academic characteristics, as well as the average hours of sleep obtained each night in the past week. Extra-curricular involvements, including sports, aesthetics and student societies, were assessed on a scale of 0-3, with higher values implying greater levels of involvement. Involvement in online learning activities, positive attitude regarding parent-child and teacher-student relationships, lack of satisfaction with one's physical appearance and the presence of few/no friends were assessed by single items graded on a five-point Likert scale, with higher values indicating greater levels of agreement. Self-esteem was assessed with a

Single-Item Self-esteem Scale graded on a similar five-point scale.<sup>35</sup> Gaming habits and preferences, including the preferred genre and device, were also explored in this section. The game that was played for the longest duration over the past year was used to identify the preferred gaming genre.

Section B consisted of the Internet Gaming Disorder Scale–Short Form (IGDS9-SF), which consists of nine items graded on a five-point Likert scale. Each item corresponds to one of nine DSM-5 diagnostic criteria.<sup>36</sup> A forward-backward translation protocol was used to develop the Sinhala IGDS9-SF, and content validity was assessed by a panel of experts from the National Institute of Mental Health, Sri Lanka ([Supplementary material](#)). Positive cases of IGD were identified based on the endorsement of five or more items in the IGDS9-SF scale, with a score of 4/5 or 5/5 considered an item's endorsement.

Section C incorporated the Motives for Online Gaming Questionnaire (MOGQ). The items are divided into seven subscales which correspond to the seven gaming motives.<sup>26</sup> Each item is graded on a five-point scale, and scores of the relevant items were tallied to provide a subscale score, with higher scores denoting greater degrees of motivation.

### Statistical Analysis

The internal consistency of all scales was assessed using the Cronbach's alpha test and  $\alpha \geq 0.7$  was considered acceptable. Factorial, validity of the Sinhala IGDS9-SF scale was assessed via factor analyses. Mean, standard deviation (SD), counts and proportions were used to describe the general characteristics of the sample.

Bivariate analyses were conducted using chi-square and Fisher's exact tests to identify associations of IGD status. A p-value of  $<0.05$  was considered statistically significant at a confidence level of 95%. The Shapiro-Wilk and Kolmogorov-Smirnov tests revealed a non-normal distribution of the IGDS9-SF scores, and so correlational analyses of the IGD score and MOGQ subscale scores were done using Spearman's Rank ( $r_s$ ) coefficients.

Multivariable analyses were then conducted using binary logistic regression with the IGD status as the dependent variable. All significant bivariate associations were initially entered into the initial model, and a forward method of entry was used to obtain the final model, which retained only significant variables. To verify the linearity assumption, the continuous variables were tested via the Box-Tidwell test. Multicollinearity was excluded by assessing the Variance Inflation Factors, which were  $<2.5$ . Exponentiated beta coefficients were presented as odds ratios with a 95% confidence interval (CI) for each variable. Statistical analyses were conducted using Version 26.0 of the Statistical Package for the Social Sciences and Version 1.2.27.0 of jamovi.

## Results

### Validity and Reliability of Scales

The English and Sinhala questionnaires were filled by 183 and 139 gamers, respectively. The internal consistency reliability of the

Sinhala IGDS9-SF was good ( $\alpha=0.854$ ) and acceptable ( $\alpha=0.77$ ) in the English IGDS9-SF. The alpha estimates were not significantly increased by excluding any of the items, and inter-item correlations were acceptable (0.15–0.5). The Cronbach's Alpha values of the MOGQ subscales were acceptable (0.763–0.818 for the Sinhala version and 0.663–0.803 for the English version).

The Factorial Validity of the Sinhala IGDS9-SF scale was assessed using factor analyses. The adequacy of the sample size was initially verified with the Keiser-Meyer-Olkin measurement, which was acceptable at 0.886. The Bartlett's Test of Sphericity was significant ( $\chi^2=412$ ,  $df=36$ ,  $p<0.001$ ). The Exploratory Factor Analysis done with a Varimax rotation on the nine items revealed a one-factor solution with an Eigenvalue threshold of one. This was further affirmed by examination of the Scree plot. The unidimensional structure was further assessed by Confirmatory Factor Analysis. The test for exact fit was significant ( $\chi^2=44.9$ ,  $df=27$ ,  $p<0.05$ ) and other fit indices were acceptable (Comparative Fit Index = 0.954, Tucker-Lewis Index = 0.939 and Root Mean Square Error of Approximation = 0.069). All factor loadings were statistically significant ( $p<0.001$ ) and ranged from 0.455–0.733.

These results affirm that the Sinhala IGDS9-SF scale measures a unidimensional construct, like its validated English counterpart.

### Descriptive Analysis of Sample Characteristics

The general and gaming-related characteristics of the sample are described in **Table 1**. The mean age was 17.22 years (SD=0.54), and 52.4% of the participants were male. Most participants reported a monthly income of LKR 100,000–199,999 (31.6%,  $n=125$ ) and had one sibling in the family (53.4%,  $n=211$ ). Most of the students studied in the English medium (51.6%,  $n=204$ ) and followed commerce subjects (32.9%,  $n=130$ ). A majority reported high involvement in online learning activities (60.0%,  $n=237$ ) and slept 6–7 hours every night (57.0%,  $n=225$ ).

Of the 395 participants, 322 identified themselves as "gamers" (81.5%). A gamer was defined as an individual who had intentionally played electronic games for any duration of time, offline/online, using any device during the past 12 months. A majority played games for  $\leq 1$ h every day during the weekdays (53.4%,  $n=172$ ) and weekends (40.7%,  $n=131$ ). Most of the students started to play games when they were 8–10 years old (24.8%,  $n=80$ ) and preferred online multiplayer games (50.9%,  $n=164$ ) and gaming on mobile phones (64.0%,  $n=206$ ). The favorite genre was Multiplayer Battle Royale (27.0%,  $n=87$ ) among 11 identified gaming genres (**Figure 1**).

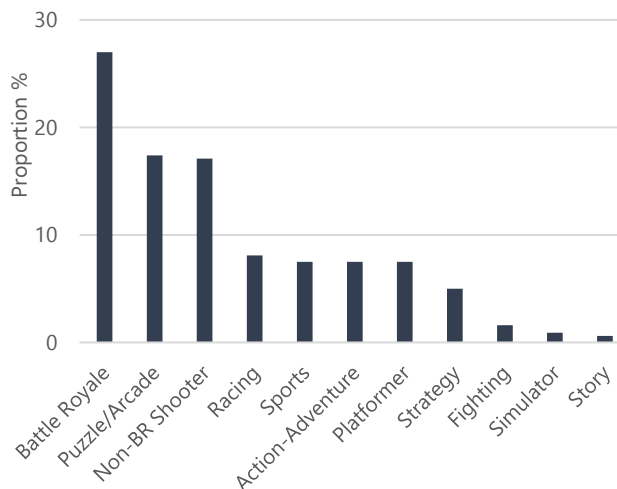
### Prevalence of IGD and Bivariate Analyses

The prevalence of IGD was 5.06% (95% CI = 2.90–7.22) among the total study population and 6.21% (95% CI = 3.58–8.85) among the gamers. **Table 2** presents the cross-tabulated characteristics associated with IGD.

**Table 1.** Frequency Distribution of Sample Characteristics.

	Count	%
<b>Ethnicity (n=395)</b>		
Sinhala	306	77.5
Tamil	46	11.6
Muslim	37	9.4
Burgher	6	1.5
<b>Monthly Income in LKR (n=395)</b>		
<20,000	8	2.0
20,000 – 49,999	41	10.4
50,000 – 99,999	111	28.1
100,000 – 199,999	125	31.6
200,000 or more	110	27.8
<b>Number of siblings (n=395)</b>		
None	49	12.4
One	211	53.4
Two	104	26.3
Three or more	31	7.8
<b>Stream of study (n=395)</b>		
Biological Science	88	22.3
Physical Science	97	24.6
Commerce	130	32.9
Arts	70	17.7
Other (Miscellaneous)	10	2.5
<b>Hours of sleep per day (n=395)</b>		
Less than four	14	3.5
Four to five	118	29.9
Six to seven	225	57.0
Eight or more	38	9.6
<b>Weekday gaming hours (n=322)</b>		
One or less	172	53.4
Two to three	91	28.3
Four to five	39	12.1
Six to seven	18	5.6
Eight to ten	2	0.6
<b>Weekend gaming hours (n=322)</b>		
One or less	131	40.7
Two to three	101	31.4
Four to five	55	17.1
Six to seven	23	7.1
Eight to ten	9	2.8
Eleven or more	3	0.9
<b>Starting age of gaming (n=322)</b>		
Less than five years old	26	8.1
Five to seven years old	35	10.9
Eight to ten years old	80	24.8
11 to 13 years old	76	23.6
14 to 16 years old	69	21.4
Started recently	36	11.2
<b>Preferred Device (n=322)</b>		
Personal Computer	63	19.5
Mobile Phone	206	64.0
Tablet	24	7.5
Gaming Console	29	9.0
<b>Type of Games (n=322)</b>		
Online Multiplayer	164	50.9
Online Single Player	49	15.2
Offline Single Player	109	33.9

**Figure 1.** Distribution of gamers in the sample according to the preferred game genre (n=322).



IGD was significantly higher ( $\chi^2=7.04, p<0.05$ ) among males. The proportion of Sinhala medium students with IGD (9.2%, n=14) was significantly higher ( $\chi^2=4.45, p<0.05$ ) than that among English medium students (3.5%, n=6). The only extra-curricular activity associated with IGD was involved in student societies. Students reporting no/minor involvement in such activities (8.8%, n=17) were significantly more likely to have IGD ( $\chi^2=5.46, p<0.05$ ) than those reporting moderate/major involvements (2.3%, n=3). Poor quality of relationships with parents and teachers were also significantly linked to IGD ( $p<0.001$ ). Furthermore, the proportion of IGD gamers who were dissatisfied with their physical appearances (14.9%, n=10) was found to be significantly higher ( $\chi^2=12.66, p<0.05$ ) than those who were satisfied/neutral. Playing games for  $\geq 6h$  during the weekdays and weekends was significantly associated with IGD ( $p<0.001$ ). Furthermore, gamers who preferred BR games (13.8%, n=12) were more likely to have IGD ( $\chi^2=11.76, p<0.05$ ) than those who preferred other genres (3.4%, n=8). Associations pertaining to the preferred type of games, gaming device, and starting age were not significant.

All correlations between the IGDS9-SF score and the MOGQ subscales were significant ( $p<0.001$ ). The Escape motive correlated strongly with the IGD score ( $r_s = 0.616$ ). There were moderate positive correlations between IGD score and the social ( $r_s = 0.514$ ), coping ( $r_s = 0.513$ ) and fantasy ( $r_s = 0.451$ ) motives, while the correlations with the skill development ( $r_s = 0.398$ ), recreation ( $r_s = 0.389$ ) and competition motives ( $r_s = 0.367$ ), were positive but weak.

**Table 2.** Bivariate Analysis of Factors Associated with Internet Gaming Disorder.

Characteristic	No IGD		IGD		Total n=322	Significance
	n=302	%	n=20	%		
Age						$\chi^2 = 0.768$
16 - 17	214	93.0	16	7.0	230	p = 0.381
18	88	95.7	4	4.3	92	
Sex						$\chi^2 = 7.037$ <b>p = 0.008</b>
Male	165	90.7	17	9.3	182	
Female	137	97.9	3	2.1	140	
Ethnicity						p = 0.582*
Sinhala	232	93.2	17	6.8	249	
Other	70	95.9	3	4.1	73	
Income (LKR)						$\chi^2 = 0.20$ p = 0.888
<100,000	116	93.5	8	6.5	124	
≥100,000	186	93.9	12	6.1	198	
No. of Siblings						$\chi^2 = 1.721$ p = 0.19
One or less	195	95.1	10	4.9	205	
Two or more	107	91.5	10	8.5	117	
Medium						$\chi^2 = 4.446$ <b>p = 0.035</b>
Sinhala	138	89.8	14	9.2	152	
English	164	96.4	6	3.5	170	
Stream						$\chi^2 = 0.084$ p = 0.772
Science	146	94.2	9	5.8	155	
Non-science	156	93.4	11	6.6	167	
Hours of sleep						$\chi^2 = 0.439$ p = 0.507
Five or less	97	95.1	5	4.9	102	
More than five	205	93.2	15	6.8	220	
Sports						$\chi^2 = 0.02$ p = 0.888
None/Minor	186	93.9	12	6.1	198	
Moderate/Major	116	93.5	8	6.5	124	
Unions						$\chi^2 = 5.455$ <b>p = 0.02</b>
None/Minor	177	91.2	17	8.8	194	
Moderate/Major	125	97.7	3	2.3	128	
Aesthetics						$\chi^2 = 1.689$ p = 0.194
None/Minor	151	92.1	13	7.9	164	
Moderate/Major	151	95.6	7	4.4	158	
Online Learning						$\chi^2 = 0.956$ p = 0.620
Low	42	95.5	2	4.5	44	
Moderate	77	91.7	7	8.3	84	
High	183	94.3	11	5.7	194	
Parent-Child						<b>p = 0.001*</b>
Poor relationship	8	61.5	5	38.5	13	
Neutral	36	97.3	1	2.7	37	
Good relationship	258	94.9	14	5.1	272	
Teacher-Student						<b>p = 0.001*</b>
Poor relationship	12	75.0	6	33.3	18	
Neutral	67	97.0	2	2.9	69	
Good relationship	223	94.1	12	5.1	235	
Self-appearance						$\chi^2 = 12.66$ <b>p = 0.002</b>
Satisfied	136	97.8	3	2.2	121	
Neutral	109	94.0	7	6.0	105	
Not satisfied	57	85.1	10	14.9	61	
Number of friends						$\chi^2 = 1.341$ p = 0.512
Many	225	94.5	13	5.5	238	
Moderate	42	93.3	3	6.7	45	
None/Few	35	89.7	4	10.3	39	
Self-esteem						$\chi^2 = 3.501$ df = 2 p = 0.174
Low	27	100	0	0	27	
Moderate	88	90.7	9	9.3	97	
High	187	94.4	11	5.6	198	



**Table 2 (continued).** Bivariate Analysis of Factors Associated with Internet Gaming Disorder.

Characteristic	No IGD		IGD		Total n=322	Significance
	n=302	%	n=20	%		
Weekday gaming hours						
Less than 6h per day	290	96.0	12	4.0	302	<b>p &lt; 0.001*</b>
6h or more per day	12	60.0	8	40.0	20	
Weekend gaming hours						
Less than 6h per day	276	96.2	11	3.8	287	<b>p &lt; 0.001*</b>
6h or more per day	26	74.3	9	25.7	35	
Preferred type						$\chi^2 = 0.819$
Online Multiplayer	152	93.1	12	7.3	164	p = 0.664
Online Single Player	47	95.6	2	4.1	49	
Offline Single Player	103	93.8	6	5.5	109	
Preferred genre						$\chi^2 = 11.76$
Battle Royale	75	86.2	12	13.8	87	<b>p = 0.001</b>
Other	227	96.6	8	3.4	235	
Preferred device						$\chi^2 = 0.745$
Mobile Phone	195	94.7	11	5.3	206	p = 0.388
Other	107	92.2	9	7.8	116	
Starting age of gaming						$\chi^2 = 0.013$
10 years or less	132	93.6	9	6.4	141	p = 0.91
Older than 10 years	170	93.9	11	6.1	181	

**Legend:** \*Fisher's exact test was conducted. Significant associations (p<0.05) are given in bold.

### Multivariable analysis

The factors retained in the final binary logistic regression model are shown in **Table 3**. The Hosmer and Lemeshow test revealed an acceptable fit of the data ( $\chi^2=4.24$ ; df=8; p=0.835). The model was found to be significant ( $\chi^2=63.64$ ; df=7; p<.001) and explained 48.4% (Nagelkerke  $R^2$ ) of the variance in IGD status. Gaming daily for six hours or more during the weekdays was associated with almost seven-fold higher odds of having IGD (95% CI = 1.735 – 27.569). Furthermore, no/minor involvement in student-based societies and poor parent-child relationships positively predictive IGD status. While the escape and fantasy motives were positively predictive, every unit increase of the competition motive score was associated with 17.6% lesser odds of having IGD (95% CI = 0.703–0.967).

### Discussion

To our knowledge, this is the first study which describes the prevalence of IGD in a Sri Lankan adolescent population and is one of few conducted in the South Asian region. In addition to the disease burden, we have discussed IGD from the perspective of school-going students by focusing on interindividual factors such as the parent-child, teacher-child relationships, and the role of academic and extra-curricular activities, which are unique to this population and often overlooked by researchers. Understanding the interplay between motivation and addiction enables early identification of at-risk gamers at a community level. However, previous studies have described these motivations in relation to adult populations,<sup>12,24,25</sup> and so, our study

**Table 3.** Multivariable Logistic Regression Model Retaining Significant Associations of Internet Gaming Disorder (n=322).

Variable	$\beta$	Odds Ratio (95% CI)	p value
Involvement in student societies <sup>a</sup> : None/Minor	1.985	7.277 (1.420 – 37.288) *	0.017
Parent-Child Relationship <sup>b</sup>			0.003
Poor	2.625	13.81 (2.571 – 74.174) **	0.002
Neutral	-2.058	0.128 (0.009 – 1.85)	0.131
Escape	0.283	1.327 (1.108 – 1.588) **	0.002
Competition	-0.183	0.833 (0.713 – 0.973) *	0.021
Fantasy	0.190	1.209 (1.058 – 1.382) **	0.005
Daily Weekday Gaming Hours <sup>c</sup> : 6 hours or more	1.934	6.917 (1.735 – 27.569) **	0.006

**Legend:** \* Significant at p<0.05. \*\* Significant at p<0.01. <sup>a</sup> Reference category is Moderate/Major involvement. <sup>b</sup> Reference category is Good Relationship. <sup>c</sup> Reference category is Less than 6 hours.

further the field by describing the specific motivations that drive gaming addiction among an adolescent population. Furthermore, the Sinhala IGDS9-SF, translated from the original English version, was found to be a potentially valid and reliable tool that can be used among native speakers in future studies.

The prevalence of IGD in our study was 5.06%, which is greater than the global pooled prevalence of 3.05%,<sup>27</sup> but is lower than the pooled South-East Asian prevalence of 10.1%.<sup>30</sup> It is also higher than the prevalence reported from India, i.e., 3.5-3.6%,<sup>31,32</sup> although this may be explained by the strict diagnostic criteria adopted in these studies. Our prevalence resembles that among Thai high-school students, which is 5.4%.<sup>37</sup>

Male gamers were significantly more likely to have IGD than females, which is consistent with the existing research.<sup>29</sup> This is partly explained by the fact that males spend more time gaming and prefer high-risk genres, whereas most female gamers favor low-risk casual games. Maladaptive cognitions such as the overvaluation of virtual rewards may also explain the higher prevalence of IGD among males.<sup>38</sup>

Of the academic characteristics explored, the only significant association was the language of study, with Sinhala medium students being more likely to have IGD. Poor sleep is a known association of IGD.<sup>20</sup> In our study, however, reduced sleep hours was not linked to IGD. In fact, some studies report higher sleep hours among IGD gamers in high-school student populations.<sup>37</sup> This could be explained by the regular sleep schedules students are compelled to adhere to, owing to early school commencement hours.

Although low exercise is cited as a risk factor,<sup>22</sup> a low involvement in sports was not associated with IGD in our study, which may be explained by the lack of opportunities for sports activities owing to lockdowns amid the COVID-19 pandemic. A lack of interest in recreational activities is a known correlate,<sup>17</sup> and our findings reflect this as IGD gamers were more likely to report low involvement in student societies.

Gamers with IGD also had poor interpersonal relationships with their parents and teachers. These interindividual factors, which are associated with internet addiction,<sup>11</sup> appear to be linked to IGD. We did not find the number of friends to be a significant association with IGD, which supports the notion that despite real-life social exclusion, online gaming can facilitate social interactions,<sup>39</sup> with IGD gamers reporting more friends than non-IGD counterparts in some studies.<sup>16</sup>

We also found that IGD gamers were significantly more likely to be dissatisfied with their self-appearance, which may explain the tendency to idolize in-game avatars with idealized physical forms.<sup>40</sup> Although low self-esteem is commonly described among IGD gamers,<sup>12,13</sup> this was not a significant association in our study,

and so, it is conceivable that the feeling of virtual achievement may have a positive influence on a gamer's self-esteem.

Daily weekday gaming for  $\geq 6$ h daily was retained as a significant association in multivariable analyses, highlighting the role of excessive gameplay in disordered gaming. Excessive gaming, however, is not tantamount to disordered gaming, with certain studies failing to show increased gameplay as a significant association.<sup>12</sup> Although MMORPG and FPS games are traditionally implicated with disordered gaming,<sup>18</sup> in our study, most of the gamers (27.0%) preferred Multiplayer Battle Royale games such as "PUBG" and "Fortnite," which was also linked to IGD. Most gamers in our study (64.0%) preferred mobile phones to traditional gaming devices such as personal computers and consoles.<sup>20</sup> The mobile phone is indeed an emerging gaming device in middle-income countries like Sri Lanka, with the number of mobile connections increasing by 2.2 million from January 2019 to January 2020,<sup>41</sup> although a preference for mobile gaming was not associated with IGD.

Escape and fantasy were positively predictive of IGD, which echoes existing work on gaming motivations.<sup>12</sup> However, competitiveness had a negative effect in our model, which is, described as a positive predictor among women in the cited study. Escape refers to "escaping from problems in the real world" and fantasy entails "stepping out of one's usual identity, trying new identities in a different fantasy world", while competition represents the motive of "competing with and defeating others to feel a sense of achievement".<sup>26</sup>

### Limitations

Our findings should be interpreted with caution. First, we acknowledge the limited generalizability of our results which may apply to the four selected national schools. The study's cross-sectional design does not allow temporal interpretation of associations as true predictors or consequences of disordered gaming. IGD was diagnosed using the IGDS9-SF scale, a validated psychometric tool. This is less accurate than the structured clinical interview, which is the gold standard of diagnosis. We also admit the possibility of recall bias and reduced answering accuracy as participants were expected to report gaming practices over a period of 12 months. Furthermore, the study was conducted amid the COVID-19 pandemic, so the data presented here may not reflect the "pre-COVID normal" where students were not compelled to follow online lessons owing to countrywide lockdowns. Despite these limitations, our study has set an important precedent for future studies both nationally and regionally.

### Conclusions

Gaming addiction is an emerging public health challenge in our student population. The Sinhala IGDS9-SF was found to be a potentially valid and reliable tool. IGD was significantly higher among male gamers and was associated with a poor parent-child relationship, low extra-curricular involvement, increased daily

weekday gaming and specific gaming motives. These associations should be considered when planning preventive interventions and awareness programs targeting high-risk groups. The inclusion of gaming motivations in the psychological assessment of at-risk gamers will facilitate screening efforts, as gaming time alone is insufficient in distinguishing disordered gaming from non-pathological high involvement. IGD should be considered a serious public health problem that is emergent in school-going adolescent populations and we recommend further studies exploring this condition in nationally/regionally representative samples.

### Summary – Accelerating Translation

නව යොවුන් වියේ දරුවන් අතර ඉලෙක්ට්‍රොනික/විද්‍යුත් ක්‍රීඩා ජනප්‍රිය වීම සහ තාක්ෂණික මෙවලම් වැඩියෙන් සතුව තිබීම හේතුවෙන් බොහෝ අඩු සහ මධ්‍යම ආදායම් ලබන රටවල විද්‍යුත් ක්‍රීඩා ආබාධය (Internet Gaming Disorder/IGD) වැඩිවෙමින් පවතී. IGD යනු ඇමරිකානු මනෝවිකිත්සක සංගමයේ (American Psychiatric Association) DSM-5 වර්ගීකරණයේ සහ ලෝක සෞඛ්‍ය සංවිධානයේ ICD-11 වර්ගීකරණයේ (Gaming Disorder ලෙස) සඳහන් වී ඇති මානසික ආබාධයකි. මෙම තත්වය හේතුවෙන් බොහෝ දරුවෝ මානසික අවපීඩනය, කාංසාව හා නින්ද ආශ්‍රිත ගැටලු වලින් පෙළෙති. තවද ඔවුන්ගේ අධ්‍යාපනික කටයුතු මෙම තත්වය නිසා අඩාල විය හැකියි. දකුණු ආසියාවේ IGD හි ව්‍යාප්තිය තොදන්නා තරම් ය. එබැවින්, ශ්‍රී ලංකාවේ පාසල් යන සිසුන් අතර IGD හි ව්‍යාප්තිය සහ ඒ හා ආශ්‍රිත පෙළඹවීම් (Motivations) ඇතුළු සාධක කිහිපයක් අපගේ පර්යේෂණය තුළින් නිර්ණය කිරීම අපගේ අරමුණයි.

කොළඹ අධ්‍යාපන කලාපයේ ජාතික පාසල් හතරක ඉගෙනුම ලබන, වයස අවුරුදු 16-18 අතර උසස් පෙළ සිසුන් මෙම පර්යේෂණය සිදු කිරීම සඳහා

තෝරාගන්නා ලදී. අහඹු ලෙස බඳවා ගත් සිසුන් 412 දෙනෙකුගෙන්, සිසුන් 395ක් පර්යේෂණයට සහභාගි වීමට කැමැත්ත පල කළේ ය. එසේ කැමැත්ත පල කළ සිසුන් විසින් විද්‍යුත් ක්‍රීඩා ක්‍රියාකාරකම් හා සබැඳි පුරුදු (ක්‍රීඩාවන්හි යෙදෙන කාලය, කැමති ක්‍රීඩා වර්ග, ආදිය), පෙළඹවීම් සහ මනෝ සාධක රාශියක් ගවේෂණය වන ප්‍රශ්නාවලි පුරවන ලදී. විද්‍යුත් ක්‍රීඩා ආබාධය හඳුනා ගැනීම සඳහා Internet Gaming Disorder Scale – Short Form (IGDS9-SF) නැමැති ප්‍රශ්නාවලිය අප යොදා ගත් අතර එම ප්‍රශ්නාවලියේ වගන්ති 9න් වගන්ති 5කට 4/5 හෝ 5/5 ලෙස ප්‍රතිචාර දැක්වුවහොත් එම සිසුවාට විද්‍යුත් ක්‍රීඩා ආබාධය තිබෙනු යැයි අප විසින් තීරණය කරන ලදී.

සහභාගි වූ සිසුන්ගෙන් 81.5% ක් විද්‍යුත් ක්‍රීඩා වල යෙදී තිබුණේය. ඉන් බහුතරයක් ජංගම දුරකථනයෙන් (64.0%) ක්‍රීඩා කළ අතර, PUBG® වැනි "Battle Royale" වර්ගයේ ක්‍රීඩාවන්ට (27.0%) වැඩිපුර කැමැත්තක් පල කරන ලදී. සහභාගි වූ වන්ගෙන් 5.06% කට අන්තර්ජාල ක්‍රීඩා ආබාධය (IGD) තිබෙනු යැයි අප විසින් සොයාගන්නා ලදී. විද්‍යුත් ක්‍රීඩාවන්හි යෙදෙන සිසුන් අතර එහි ව්‍යාප්තිය 6.21% කි. මෙම තත්වය පිරිමි සිසුන් අතර වැඩියෙන් දැකගැනීමට හැකිවීම විශේෂත්වයකි. තවද දිනකට පැය 6කට වඩා ක්‍රීඩා කිරීම, දෙමව්පියන් හා සමග දුර්වල සම්බන්ධතාවයක් තිබීම, ශිෂ්‍ය සංගම් ආශ්‍රිත කටයුතු වල අඩුවෙන් නියැලීම යනාදිය IGD හා සබැඳි සාධක ලෙස අප විසින් සොයාගන්නා ලදී. ජීවිතයේ ගැටලු සහගත තත්වයන්ගෙන් මිදීමට හෝ ෆැන්ටසි ලෝකයකට පලායෑමේ වේගවත්වන්නේ ක්‍රීඩා කරන සිසුන් අතර මෙම තත්වය වැඩියෙන් දැකගැනීමට හැකි වූ අතර තරගකාරී මනෝභාවයකින් ක්‍රීඩා කරන සිසුන් අතර මෙම තත්වය අඩුවෙන් දැකගැනීමට අපට හැකි විය.

IGD යනු සමාජයේ අලුතින් පැන නැගී ඇති මනෝසෞඛ්‍ය ගැටලුවකි. විද්‍යුත් ක්‍රීඩාවන්හි නියැලෙන සුලුතරයකට පමණක් IGD ඇති විය හැකි වුවද, ශිෂ්‍යයන් වැඩිවෙන විද්‍යුත් ක්‍රීඩක ප්‍රජාව හමුවේ මෙය සැලකිය යුතු කාරණාවකි. එබැවින්, මෙම පර්යේෂණය තුළින් සොයාගෙන ඇති සාධක ඉලක්ක වන ලෙස ප්‍රජා සෞඛ්‍ය වැඩපිළිවෙත් නිර්මාණය විය යුතු යැයි අපේ නිර්දේශය යි.

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### Author Contributions

Conceptualization; Formal Analysis; Software: MMM. Project Administration; Supervision: MMM, DJ. Resources: TGMM, AMV. Validation: DJ. Data Curation; Investigation; Visualization; Writing – Original Draft Preparation: MMM, TGMM, AMV. Methodology; Writing – Review & Editing: MMM, TGMM, AMV, DJ.

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## Supplementary Material

### The English Internet Gaming Disorder Scale – Short Form (IGDS9-SF)

These questions will ask about your gaming activity during the **past year** (i.e., the **last 12 months**). By gaming activity, we understand any gaming-related activity played either from a computer/laptop or a gaming console or any other kind of device (e.g., mobile phone, tablet, etc.), both online and/or offline. There are no right or wrong answers.

Read each of the given statements and put an "X" on the appropriate number. **1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Very Often**

1.	Do you feel preoccupied with your gaming behavior? (Some examples: Do you think about previous gaming activity or anticipate the next gaming session? Do you think gaming has become the dominant activity in your daily life?)	1	2	3	4	5
2.	Do you feel more irritability, anxiety or even sadness trying to either reduce or stop your gaming activity?	1	2	3	4	5
3.	Do you feel the need to spend increasing amounts of time engaged in gaming in order to achieve satisfaction or pleasure?	1	2	3	4	5
4.	Do you systematically fail when trying to control or stop your gaming activity?	1	2	3	4	5
5.	Have you lost interest in previous hobbies and other entertainment activities due to your engagement with the game?	1	2	3	4	5
6.	Have you continued your gaming activity despite knowing it was causing problems between you and others?	1	2	3	4	5
7.	Have you deceived any of your family members or others because of the amount of your gaming activity?	1	2	3	4	5
8.	Do you play in order to temporarily escape or relieve a negative mood (e.g., helplessness, guilt, anxiety)?	1	2	3	4	5
9.	Have you jeopardized or lost an important relationship, job or an educational opportunity because of your gaming activity?	1	2	3	4	5

### The Sinhala Internet Gaming Disorder Scale – Short Form (IGDS9-SF)

පසුගිය වසර තුළ (එනම් පසුගිය මාස 12 තුළ) ඔබගේ විද්‍යුත් ක්‍රීඩා ක්‍රියාකාරකම් (Electronic Gaming Habits) පිළිබඳව මෙම ප්‍රශ්න මාලාවෙන් අසනු ලැබේ. මෙහිදී විද්‍යුත් ක්‍රීඩා ක්‍රියාකාරකම් ලෙස පරිගණක/ ලැප්ටොප් හෝ PlayStation®, X-box® වැනි කොන්සෝලයකින් හෝ ඕනෑම උපකරණයකින් (උදා: ජංගම දුරකථන, ටැබ්ලට් ආදිය මගින්) සිදු කරන ක්‍රීඩා සැලකිල්ලට ගනිමු. මෙහිදී අන්තර්ජාලයට සම්බන්ධ වී හෝ නොවී සිදු කරන ක්‍රීඩා දෙවර්ගයම සැලකිල්ලට ගනිමු. මෙම ප්‍රශ්න වලට නිවැරදි හෝ වැරදි පිළිතුරු නොමැත.

ලබා දී ඇති සෑම ප්‍රකාශයකටම කියවා සුදුසු අංකයට "X" ලකුණ යොදන්න. **1 = කිසිවිටක නැත, 2 = කලාතුරකින්, 3 = සමහර අවස්ථා වලදී, 4 = බොහෝ අවස්ථා වලදී, 5 = සෑමවිටම පාහේ**

1	ඔබ විද්‍යුත් ක්‍රීඩා (පරිගණක/ ලැප්ටොප් හෝ කොන්සෝලයකින් හෝ ජංගම දුරකථන, ටැබ්ලට් ආදිය මගින් සිදු කරන ක්‍රීඩා) වලට වුවමනාවට වඩා අවධානය යොමු කරන්නේද? (උදාහරණ කිහිපයක්: ඔබ පෙර යොමු වූ ක්‍රීඩා වාර ගැන සිතන්නේද? නැතහොත් ඊළඟ ක්‍රීඩා වාරය අපේක්ෂාවෙන් සිටින්නේද? ඔබේ දෛනික ජීවිතයේ ඉලෙක්ට්‍රොනික ක්‍රීඩා වල යෙදීම ප්‍රමුඛතම ක්‍රියාකාරකම බවට පත්ව ඇතැයි ඔබ සිතනවාද?)	1	2	3	4	5
2	ඔබගේ විද්‍යුත් ක්‍රීඩා ක්‍රියාකාරකම් අඩු කිරීමට හෝ නැවත්වීමට උත්සාහ කරන විට වැඩි කෝපයක්, කාංසාවක් හෝ දුකක් දැනෙනවාද?	1	2	3	4	5
3	තෘප්තියක් හෝ සතුටක් ලබා ගැනීම සඳහා විද්‍යුත් ක්‍රීඩාවන්හි වැඩි වැඩියෙන් කාලය ගත කිරීමේ අවශ්‍යතාවය ඔබට දැනෙනවාද?	1	2	3	4	5
4	ඔබගේ විද්‍යුත් ක්‍රීඩා ක්‍රියාකාරකම් පාලනය කිරීමට හෝ නැවැත්වීමට උත්සාහ කිරීමේදී ඔබ අසමත් වෙනවාද?	1	2	3	4	5
5	විද්‍යුත් ක්‍රීඩාවන්හි යෙදීමේ ප්‍රතිඵලයක් ලෙස පෙර විනෝදාංශ සහ වෙනත් විනෝදාත්මක ක්‍රියාකාරකම් කෙරෙහි ඇති උනන්දුව ඔබට අහිමි වී තිබේද?	1	2	3	4	5
6	ඔබ විද්‍යුත් ක්‍රීඩාවන්හි යෙදෙන නිසා ඔබ සහ අනෙක් පුද්ගලයින් අතර ගැටලු ඇති වන බව ඔබ දැන සිටියද ඔබ විද්‍යුත් ක්‍රීඩාවන්හි දිගටම නියැලී සිටියේද?	1	2	3	4	5
7	ඔබ විද්‍යුත් ක්‍රීඩාවන්හි යෙදෙන කාලය පිළිබඳව ඔබගේ පවුලේ සාමාජිකයන් හෝ වෙනත් අය ඔබ රවටා තිබේද?	1	2	3	4	5
8	ඔබ විද්‍යුත් ක්‍රීඩාවන්හි යෙදෙන්නේ සෘණාත්මක මනෝභාවයකින් (උදා: අසරණභාවය, වරදකාරී හැඟීම්, කාංසාව ආදියෙන්) තාවකාලීව පැන යාමට හෝ සහනයක් ලබා ගැනීමටද?	1	2	3	4	5
9	ඔබ විද්‍යුත් ක්‍රීඩා හේතුවෙන් වැදගත් පුද්ගල සම්බන්ධතාවයන් හෝ අධ්‍යාපනික අවස්ථා හෝ රැකියා අවස්ථා අහිමි කරගෙන හෝ අවදානමට ලක් කරගෙන තිබේද?	1	2	3	4	5