



Unmasking a potential crisis: An exploration of gaming addiction and depression in adolescents and young adults through a cross-sectional survey.

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Vimukthi Asahara Samaranada ¹ - A,B,C,E,F,L,M,O.  ORCID www.orcid.org/0000-0001-5677-9752

Shishanthi Anuradha Perera ¹ - A,B,C,E,F,L,M,O.  ORCID www.orcid.org/0009-0006-6700-1480

Koralage Tanika Gayani Kanchana ² - F,J,K,N,O.  ORCID www.orcid.org/0000-0002-3629-5061

Mark D. Griffiths ³ - F,J,K,N,O.  ORCID www.orcid.org/0000-0001-8880-6524

¹ Faculty of Medicine, Lincoln University College, Malaysia.

² Faculty of Nursing, KIU Campus, Sri Lanka.

³ International Gaming Research Unit, Department of Psychology, Nottingham Trent University, United Kingdom

Address for correspondence:

Vimukthi Asahara Samaranada, DAOM, BSc(Hons) Med.Sc. Acu., Faculty of Medicine, Lincoln University College, Malaysia; e-mail: asaharavm@gmail.com

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ABSTRACT

INTRODUCTION: Gaming disorder is defined as a pattern of gaming behaviour characterised by impaired control over gaming, prioritisation of gaming over other activities to the point where gaming takes precedence over other interests and daily activities, and persistence or escalation of gaming despite negative consequences. Given the increasing global interest in videogames, particularly among adolescents and young adults, this study investigated the prevalence of gaming disorder and its associated factors among Sri Lankan adolescents and young adults, with a focus on factors associated with gaming addiction.

MATERIALS AND METHODS: A cross-sectional survey was conducted involving 401 Sri Lankan adolescents and young adults who played video games, through an anonymous online survey using snowball sampling. The survey comprised four sections: demographic data, influencing factors for game playing, the seven-item Game Addiction Scale and a validated depression scale (nine-item Patient Health Questionnaire). SPSS IBM (version 27) was used for data analysis, which includes means, standard deviations, frequencies, percentages, Pearson's correlation and chi-square tests.

RESULTS: A total of 401 gamers participated, comprising adolescents (10-18 years; 9.5%) and young adults (19-35 years; 90.5%). The majority were non-gaming addicts (71.57%), and among the gaming addicts, 8.48% were classified as monothetic gaming addicts, while 19.5% were classified polythetic gaming addicts. Slightly more males were game addicts (52.63%) than females. There was a low positive correlation between videogame addiction and depression ($r=0.321$). More than half of the sample believed that visual triggers (58.6%) and frequent reward systems (56.1%) influenced their gameplay. There was a significant association ($p < 0.05$) between gaming addiction and the three observed characteristics: visual triggers, audio triggers, and frequent rewards.

CONCLUSIONS: Just under one-tenth of the study population sampled was classified as having a gaming addiction, with males having a slightly higher prevalence than females. The positive correlation between gaming disorder and depression suggests a consequential and potentially life-threatening outcome, wherein depression emerges as a serious consequence of addiction to gaming. When the structural characteristics of videogames, such as auditory, visual and frequent reward systems were considered, game addicts were more influenced by them.

KEY WORDS: Gaming disorder, gaming addiction, videogames, depression, Sri Lanka.

INTRODUCTION

The surge in video game popularity has been remarkable, with its appeal spanning across various demographics and motivations. The global gaming market is projected to increase from \$175.8 billion in 2021 to surpass \$200 billion by 2024, encompassing nearly 3 billion gamers [1]. The relationship between excessive video game and internet use and adolescent suicidality constitutes a comprehensive exploration of the impact of video gaming, with a predominant focus on the association between playing violent videogames and mental health outcomes [2]. While most studies in this domain have focused on the link between video gaming and aggression in the world [3-6], there exists a notable research gap in the investigation of the relationship between video gaming and depression, particularly among adolescents in Sri Lanka.

Despite the popularity of gaming, and due to increased attention on the negative impact of video game play, the American Psychiatric Association (2013) included 'Internet Gaming Disorder' as a tentative disorder in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), and 'Gaming Disorder' was officially included in the 11th revision of the *International Classification of Diseases* by the World Health Organisation [7]. Gaming disorder is defined by clinical signs of loss of control over playing videogames, as well as an increase in the frequency and length of time spent playing. Furthermore, gaming disorder comprises a higher prioritisation for gaming over other basic activities of daily living and the individual continues to engage in gaming disregarding the deterioration of their life in personal, family life, social, educational work, and career aspects [8].

In a recent meta-analytic study, gaming disorder was reported to affect 3.05% globally although a lower prevalence rate of 1.96% was reported when taking into account only higher quality studies [3]. Gaming disorder appears to affect individuals of all ages, but is more prevalent among teenagers and young adults due to their enthusiastic attitude towards novel technologies [9]. The duration criteria for diagnosing gaming disorder (lasting at least 12 months) underscores the chronic and persistent nature of problematic gaming behaviours that significantly affect daily life and create a wide range of potential crises such as depression, suicide, and suicidal thoughts [2,7,10].

Many studies worldwide have observed the different factors associated with the development of gaming disorder in relation to biological, psychological, and/or social aspects. The structural characteristics inherent in game design can have a significant impact on player behaviour and engagement. Game elements such as rewards, progression systems, social interaction features, and overall design can influence how individuals engage in gaming and potentially contribute to addictive behaviours. However, only a limited number of studies have been conducted on the association between the structural characteristics inherent in the design of the games and gaming disorder [6]. It is apparent that structural aspects of videogames can be pervasive and appear to have progressed significantly over the past decade.

An early study conducted on the structural characteristics of video games showed that there are various structural characteristics of videogames that are designed to engage players in repetitive gaming, such as the sounds within the game, the graphics of the game, background and setting, the duration of the game, rate of play, the winning and losing features, character development of the game, etc. This study asserted that further research was needed to determine which structural traits are most likely to influence actual video game playing behaviour [11]. For instance, it is possible that colour, visual graphics, and sound effects all contribute to the enhancement of videogame play's baseline levels. The structural components within games, especially those related to reward systems and motivational strategies, play a pivotal role in engaging players. Game designers often employ various techniques to create an immersive and rewarding experience, catering to different motivations and preferences among players [12,13].

The concept of gaming disorder and associated research is relatively new in Sri Lanka, where the present study was conducted. However, in a research study conducted on Internet Gaming Disorder among adolescents, instances of Internet Gaming Disorder (IGD) were reported among four adolescents who sought treatment in a tertiary care hospital in Sri Lanka. The findings of this study highlighted the prolonged use of smart devices for gaming, difficulties in controlling this behaviour, and instances of heightened aggression when access to gaming was restricted [14]. Following the recent suicides of two boys (one was 16-years old and had been addicted to videogames and the other whom was 15-years old and committed suicide after his parents confiscated his smartphone due to his addiction to online gaming), many parents' concerns about gaming addiction among adolescents surfaced across the country [15]. As a result of these incidents, a particular women's association requested the Sri Lankan Telecommunications Regulatory Commission to ban videogames within the country which often stem from concerns about the perceived negative impacts of video gaming, especially among the younger generation [16].

In fact, videogames can serve as an escape for some people, providing a temporary reprieve from real-world stressors or challenges. For those with lower psychological well-being or who are facing difficulties in their daily lives, the immersive nature of videogames can offer a sense of control, achievement, and a break from reality [17]. On the other hand, young adults addicted to videogames showed increased depression and anxiety and felt more socially isolated [18]. Therefore, it is clear that gaming addiction could lead for poor mental health [19,20]. More research is needed on the gaming disorder and its various aspects, particularly in Sri Lanka where there is a paucity of empirical studies. Therefore, the present exploratory study aimed to determine the prevalence of gaming disorder and its associated factors among a group of adolescents and young adults in Sri Lanka.

MATERIALS AND METHODS

Design and setting

A cross-sectional anonymous online survey was conducted among adolescents and young adults who play videogames in Sri Lanka from June to August 2021.

Procedure

Data collection for this study targeted adolescents and young adults who engage in videogames. Using a snowball sampling technique facilitated by email and various social media networks, we reached out to potential participants. Only completed survey forms were included for analysis. The survey consisted of four sections: demographic data, factors that influence gaming behaviour, the Game Addiction Scale (GAS), and a Sri Lankan Depression Scale (Patient Health Questionnaire [PHQ-9]). The GAS, adapted for non-English speakers through a rigorous translation process, assessed the addiction to gaming. Participants rated each of the seven items on a five-point scale. The PHQ-9, used to assess depression, featured nine items rated on a scale from 0 to 3. Data analysis involved descriptive statistics, Pearson's correlation, chi-square tests, and linear regression models to explore the associations between gaming addiction, depression, and relevant factors while controlling for potential confounders.

Sample size calculation

A calculated sample size of 384 participants was determined using Cochran's formula, considering a 50% estimated prevalence, a 95% confidence level, and a high degree of variability. Moreover, 401 cleaned data were collected during the data collection period.

Ethical approval

The present study was ethically approved by the Ethics Review Committee of KIU, Sri Lanka (KIU/ERC/21/106). Informed consent was obtained online from all study participants and confidentiality was guaranteed, with the data being used exclusively for research purposes. There were no identifiers, therefore, the privacy of the personal information collected from the participants was ensured.

Measures

Demographic data - In the current study, demographic data was collected from two distinct age groups, which included adolescents between 10 and 18 years and young adults within the 19 to 35-year age range. Gender information was collected, distinguishing between female and male participants. Income levels were classified into four groups, including those earning more than 182 US dollars (60,000 LKR), less than 60 US\$ (20,000 LKR), between 60-121 US dollars (20,000 and 40,000 LKR), and between 121-182 US dollars (40,000 and 60,000 LKR). Educational levels were identified, ranging from individuals with GCE A/L and GCE O/L qualifications to graduates, postgraduates, and undergraduates. In addition, the province of residence was documented. This comprehensive collection of demographic data served as a foundational element of the study, enabling a complete understanding of the diverse characteristics and backgrounds of the research participants.

Influencing factors of the game playing - Audio triggers, visual triggers, and frequent reward systems were considered as influencing factors of game play.

Game Addiction Scale - The seven-item GAS was used to assess gaming addiction [21]. A forward and backward translation process through an expert committee for non-English speakers to ensure the reliability of the scale following an internationally recognised and standardized protocol [22]. In the GAS, each item concerns behaviour in the last six months (e.g. „During the last six months, how often have you neglected your duties due to gaming?“). The items are rated on a five-point scale (1=never, 2=rarely, 3=occasionally, 4=often, and 5=very often). The recommended two methods were used to determine the presence of game addiction: a monothetic format (all items scoring above 3) and a polythetic format (at least half of the items scoring 3 or higher) [5]. Those who scored ‘sometimes’ or more on all seven items were defined as monothetic players with a “pathological gaming” condition and those who scored “sometimes” or more on at least half of the items (four to six of seven items) were defined as polythetic gamers (excessive gaming) [21]. The Cronbach alpha was 0.81 in the present study.

Patient Health Questionnaire (PHQ-9) - The nine item PHQ-9 [23,24], which is a widely used tool to assess the severity of depressive symptoms in clinical and research settings, was used. It consists of nine items that correspond to the nine diagnostic criteria for major depressive disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Participants rated the frequency of their experiences during the past two weeks on a scale ranging from 0 (not at all) to 3 (nearly every day), where total scores can range from 0 to 27, with higher scores indicating a higher severity of depressive symptoms. The Cronbach alpha for PHQ-9 in the present study was 0.90.

Data Analysis

Data were analyzed in SPSS IBM (version 27) using descriptive statistics, including means, standard deviations, frequencies, and percentages. Pearson’s correlation and the chi-square were used to determine the nature and significance of the relationship between the two outcome measures. After controlling for possible confounders using two linear regression models, the factors significantly associated with gaming addiction and depression were calculated.

RESULTS

Participants

The survey was completed by 401 participants, of which 9.5% of the population were adolescents (10-18 years) and 90.5% of the population were young adults (19-35 years). The mean age was 23.71 years (SD± 4.69 years), with females accounting for the majority of the sample (55.4%). The Western province had the highest proportion of participants (53.12%), while 56.9% were undergraduates. The majority of the participants (47.4%) had a family income of more than 184 US\$ (60000 LKR) (Table 1).

Table 1. Demographic characteristics of the total sample (n=401).

Characteristics	Frequency	Percentage
Age in years (mean \pm SD)	23.71 \pm 4.69	
Adolescents (10-18 years)	38	9.47
Young Adults (19-35 years)	363	90.52
Gender		
<i>Female</i>	179	44.6
<i>Male</i>	222	55.4
Income		
<i>Above 182 US\$ (60000LKR)</i>	190	47.4
<i>Below 60 US\$ (20000 LKR)</i>	43	10.7
<i>Between 60-121 US\$ (20000-40000 LKR)</i>	65	16.2
<i>Between 121-182 US\$ (40000 - 60000LKR)</i>	103	25.7
Educational level		
<i>GCE A/L</i>	92	22.9
<i>GCE O/L</i>	26	6.5
<i>Graduates</i>	47	11.7
<i>Postgraduates</i>	08	2
<i>Undergraduates</i>	228	56.9
Province		
<i>Central</i>	26	6.48
<i>North Central</i>	44	10.97
<i>Northwestern</i>	30	7.48
<i>Northern</i>	05	1.25
<i>Eastern</i>	03	0.75
<i>Uva</i>	14	3.49
<i>Sabaragamuwa</i>	22	5.49
<i>Southern</i>	44	10.97
<i>Western</i>	213	53.12

Prevalence of Gaming Disorder

Based on the GAS, the majority of the sample were non-gaming addicts (71.57%). When gaming addicts were considered separately, 8.48% of them were monothetic gaming addicts (pathological gaming) and 19.95% were polythetic gaming addicts (excessive gaming).

Participants' perspectives on influencing factors for game playing

When asked if auditory triggers influenced videogame play, 37.91% responded they did not. More than half of the sample responded that visual triggers (58.6%) and frequent reward system (56.1%) influenced their own game playing. Consequently, participants mostly believed that auditory triggers had minimal influence on their game-playing decisions, while visual triggers and frequent rewards had a significant influence (Figure 1).

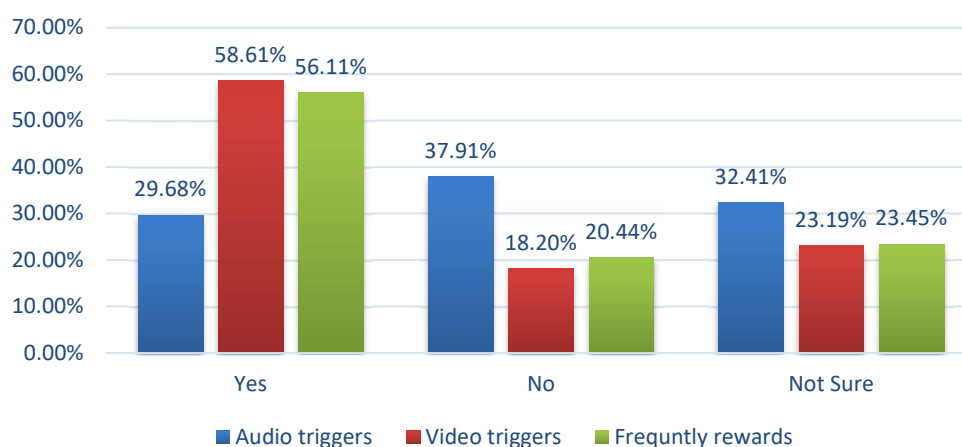


Figure 1. Participants' perspectives on influencing factors for game playing.

When responses for the influence of audio triggers, visual triggers and frequent reward systems on the game-playing population were considered, the percentage of game addicts who agreed on the presence of these three influences was greater than that of nonaddicts (Figure 2).

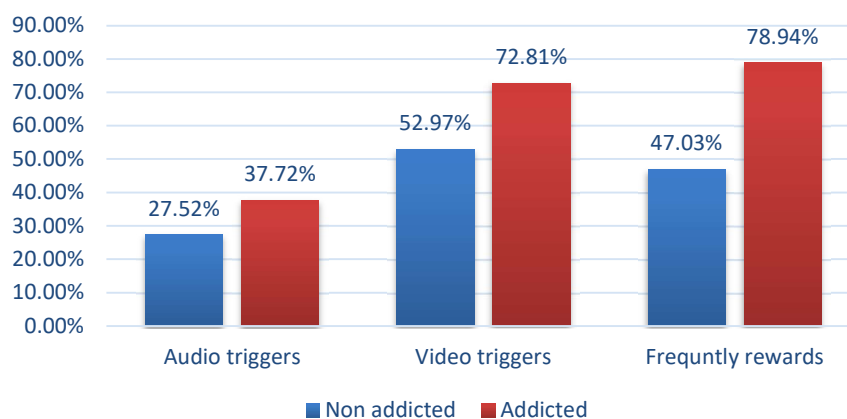


Figure 2. Effect of influencing factors of the game playing over addictive and *nonaddictive* nature of the videogames.

Associations with Gaming Disorder

Slightly more males were game addicts (52.63%) than females. Of the sociodemographic factors, the only statistically significant association was observed for gender and gaming disorder ($p=0.042$). In evaluating the association of the gaming disorder and the influencing factors of the game, of the three influencing factors (visual triggers, audio triggers and the frequent reward systems), significant associations were observed between all of them and gaming disorder: audio triggers ($p=0.008$), visual triggers ($p<0.001$), frequently rewards ($p<0.001$) (Table 2).

Table 2. Association of demographic factors with gaming disorder.

Factor	p -value
Gender	0.042*
Level of education	0.131
Income	0.497
Civil status	0.928
The source which introduced the game	0.678
Audio triggers	0.008*
Visual triggers	0.001*
Frequent rewards	0.001*

CI=95%, * $p<0.05$

Level of depression among video game addicts

According to PHQ-9, 71.68 % of the gamers had mild depression or a depression level greater than that (Figure 3).

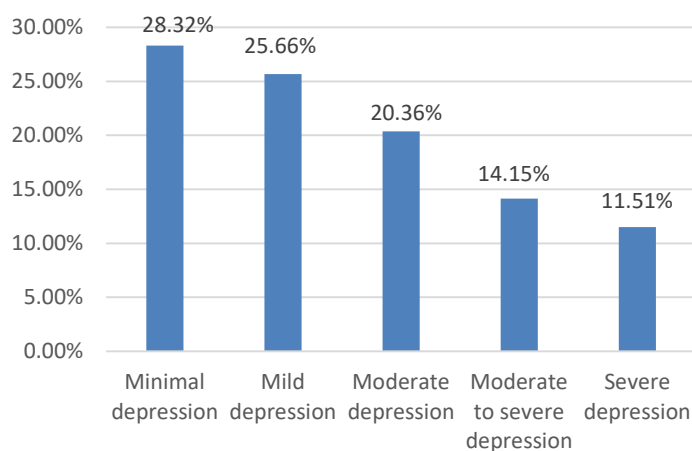


Figure 3. Level of depression among video game addicts.

Association between depression and gaming disorder

The results indicated a significant association between depression and gaming disorder (χ^2 [df= 58.45, $p=0.001$]). Gaming addiction and depression were positively correlated ($r = 0.321$) (Table 3).

Table 3. Videogame players based on the two variables (addiction to videogames and depression).

	Depressed Individuals	Non-depressed individuals	Totals
Addicted gamers	84	30	114
Non-addicted gamers	91	196	287
Totals	175	226	401 (Grand Total)

DISCUSSION

The study findings, assessed using the Game Addiction Scale (GAS), revealed that most of the sample did not exhibit gaming addiction. It was observed that auditory triggers had a limited influence on video game engagement, while more than half of the sample acknowledged that visual triggers and frequent reward systems played a significant role in their gaming experiences. There was a notable gender disparity was identified, of gaming addicts being male. Statistically significant associations were observed between gaming disorder and gender, as well as the influencing factors of audio triggers, visual triggers, and frequent rewards. Analysis using the Patient Health Questionnaire-9 (PHQ-9) indicated that the majority of gamers experienced mild or more severe depression, and a significant positive correlation was identified between gaming addiction and depression.

Video gaming is a commonly popular leisure activity that has evolved and gained popularity as a result of technological evolution. With the growth of videogames, a major public health concern has evolved due to addiction to videogames [25]. Despite the fact that video gaming is popular among both adolescents and adults, adolescents are more likely to engage in video gaming due to their desire to try new things and keep up with the newest trends [26]. On the other hand, various studies have observed that adolescents are also more prone to disorders or complications relating to video gaming [27,28]. This is because adolescence is a vulnerable period in human life during which the development of the physical, social and psychological aspects of a human being occur in the process of growing in to an adult [29,30]. A slower cognitive development can also be observed among the adolescents demanding special attention and care during this transitional period [31].

The prevalence of video gaming and its potential negative consequences like problematic gaming does indeed show variations across different regions, particularly in Western and East Asian countries. These regions often have strong gaming cultures and infrastructure, contributing to higher rates of gaming

engagement [4]. The present study found that 28.43% of the gaming population were gaming addicts using the GAS. Of these addicted gamers, 70.17% of them were classified as pathological gamers. Sri Lanka has seen an upsurge in the prevalence of video gaming among adolescent and young adult populations over the last few years [14]. However, no previous Sri Lankan study has assessed the prevalence of gaming disorder in Sri Lanka, except the study reporting instances of IGD among four adolescents who sought treatment in a tertiary care hospital in Sri Lanka, which revealed prolonged usage of smart devices for gaming, difficulties controlling this behavior, and instances of increased aggression when access to gaming was restricted, by threatening their parents and by threatening self-harm [14]. During the COVID-19 pandemic in Sri Lanka, a growing number of adolescents and young adults gained access to computers, mobile phones and the internet, although some people continue to lack such access due to socioeconomic disparities or parental restrictions. Since there was a lot of boredom and loneliness during the COVID-19 pandemic, most young people in Europe [32], North America [33], and Asia [34] played videogames to alleviate these symptoms [35].

According to worldwide studies, a variety of factors influence gaming disorder, including gender-related factors, psychological factors, socioeconomic position of players, personality traits, and family-related issues [35,36]. When it comes to gender, being male has been proposed as a possible risk factor for gaming disorder in a majority of studies [37-39]. The majority of the study's participants were female, but there was a higher prevalence of gaming addiction among males (52.63%). This confirms similar findings of higher male prevalence of gaming disorder which has been observed in other studies in different countries [3,40].

Psychological factors influencing gaming disorder is another commonly studied aspect in this field, and depression is a frequently observed mental health problem among adolescents and young adults [41]. During the pandemic, a higher prevalence of depression has been observed among the general public worldwide [42]. The extant literature has identified a significant association between gaming disorder and depression. It is worth noting that the presence of depressive symptoms may have played a role in the unfortunate suicides. The relationship may be bidirectional in that depression may be a risk factor for gaming disorder, while gaming disorder may also lead to depression [10].

The visual and auditory features of videogames have developed significantly over the past decade and they now provide a more appealing, interesting, and realistic experience to game players [6]. This is one of the reasons why gamers have become increasingly immersed in videogames. The published literature that addresses the factors that affect gaming disorder with respect to the characteristics of games is arguably limited. In relation to the associations between visual and auditory signals of videogames and gaming disorder, the present study found a significant association between audio and visual triggers of the videogames and gaming disorder within the study population. Several studies reported that background music may be considered unnecessary or irritating by many players, while high-quality realistic graphics were assessed as an important attraction by four-fifths of gamers [11-13].

This could be the reason behind the observed significant association between gaming disorder and visual triggers, rather than audio triggers and gaming disorder. Additionally, another significant association was found between frequent rewards given to the players for game achievements and gaming addiction. Moreover, it is important to keep in mind that gaming disorder affects only a small population of gamers who play videogames [8]. It is also important to understand the prevalence of gaming disorder and the risk factors associated with it in order to make informed, evidence-based decisions about public education and public health interventions for the prevention and treatment. There is still a need to address this issue from the point of public health in the Sri Lankan context, and more research should be conducted to raise awareness among parents and teachers about problematic gaming.

Limitations

Several limitations apply to the present study. The sample size was small and a larger and more representative sample (of adolescents and young adults) is required to confirm the prevalence of gaming disorder and its association with demographic factors and depression. Due to the COVID-19 pandemic, personal contact with participants was not possible. Therefore, only those with internet access participated. To increase sample size and to avoid survey fatigue, only a small number of variables in relation to gaming disorder were examined. As far as the present authors are aware, most of the Sri Lankan adolescents do not own a device (eg, a smartphone) on which to play videogames and they play videogames on the devices of their elder siblings' devices. Consequently, the sample comprised a much smaller proportion of adolescents than was desired, and this was a significant constraint in reaching the intended group.

CONCLUSIONS

A total of the 8.48% of participants were identified as monothetic gaming addicts, showing pathological gaming behaviors, while 19.95% exhibited polythetic gaming addiction characterized by excessive gaming. This study further established a positive and significant association between gaming addiction and depression. In addition, the research identified a notable correlation between gaming disorder and various structural characteristics, such as auditory triggers, visual triggers, and frequent in-game rewards.

Given the ubiquity of video games on various media platforms, including the Internet, dedicated gaming consoles, and smartphones, the global player population has witnessed substantial growth, a trend also observed in Sri Lanka. As the prevalence of gaming addiction becomes increasingly apparent and considering the unfortunate instances of adolescent suicides in Sri Lanka, it is imperative to acknowledge potential life-threatening conditions associated with this phenomenon. Therefore, further investigations are required to thoroughly examine the clinical significance and impact of video gaming on mental well-being, particularly concerning the risk of severe consequences due to addiction.

SUPPLEMENTARY INFORMATION

Funding: Mark D. Griffith (MDG) has received research funding from Norsk Tipping. MDG has received funding for several research projects in the areas of gambling education for young people, social responsibility in gambling, and gambling treatment from Gamble Aware, a charitable body that funds its research program based on donations from the gambling industry. MDG also undertakes consultancy for various gambling companies in the areas of player protection and social responsibility in gambling.

Institutional Review Statement: The study was conducted according to the guidelines of the Declaration of Helsinki.

Informed Consent Statement: Not applicable

Data Availability Statement: The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest: The authors declare no conflicts of interest.

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