

RESEARCH

Open Access



Gender differences in problematic gaming among Chinese adolescents and young adults

Zhenjiang Liao^{1†}, Juan Le^{1†}, Xinxin Chen¹, Ying Tang¹, Hongxian Shen^{1*} and Qiuping Huang^{1,2*}

Abstract

Background This study aimed to evaluate the prevalence of problematic gaming among Chinese adolescents and young adults (CAYAs) and identify potential gender-specific risk variables.

Methods 6,014 CAYAs were selected for this cross-sectional study using online convenience sampling. To evaluate their sociodemographic qualities, gaming practices, problematic gaming (as measured by the Video Game Dependency Scale), gaming motivations, and personality traits (as measured by the Chinese Big Five Personality Inventory abbreviated version), participants filled out a self-report questionnaire. To identify the common and distinct variables associated with problematic gaming, stepwise logistic regression analyses were conducted independently for males and females.

Results The study comprised 5,593 CAYAs in all (3326 males and 2267 females). Males were more likely than females to have problematic gaming (21.5% vs. 14.1%, $p < 0.001$). Problematic gaming among male and female CAYAs was substantially correlated with gaming patterns (monthly spending, daily time), gaming motivations (escaping reality, sensation seeking), and personality traits (conscientiousness, neuroticism). Additionally, among male CAYAs, problematic gaming was linked to the family structure of being an only child (OR: 0.715, 95%CI: 0.588–0.869, $p = 0.001$), lower than undergraduate (OR: 0.735, 95%CI: 0.603–0.896, $P = 0.002$), and the gaming motivation for coping with negative emotion ((N vs. Y, OR: 0.794, 95%CI: 0.653–0.965, $p = 0.021$). Problematic gaming was independently linked to the BRS gaming genre among female CAYAs (OR: 4.989, 95%CI: 2.728–9.125, $p < 0.001$). Female CAYAs with problematic gaming exhibit distinct characteristics.

Conclusions Compared to female CAYAs, problematic gaming is much more common among male CAYAs. Cross-gender risks in gaming include extended playtime, excessive spending, high neuroticism, and low conscientiousness. Highly educated singles are at higher risk of problematic gaming. Playing BRS games was a specific risk factor for females. This study revealed significant gender disparities in the prevalence and risk factors of problematic gaming among CAYAs, underscoring the significance of gender-specific screening and interventions for CAYAs to prevent problematic gaming and its negative effects.

[†]Zhenjiang Liao and Juan Le contributed equally to this work and share first authorship.

*Correspondence:
Hongxian Shen
Shenhx2018@csu.edu.cn
Qiuping Huang
004834@hnucm.edu.cn

Full list of author information is available at the end of the article



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

Clinical trial number Not applicable.

Keywords Problematic gaming, Gender difference, Gaming motivation, Game genre, Gaming pattern, Personality traits

Introduction

Overview and epidemiology of gaming disorder

In the rapidly evolving digital age, problematic gaming has emerged as a significant public health concern. The condition was first recognized in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as Internet Gaming Disorder (IGD) in 2013 [1], and was subsequently included in the 11th edition of the International Classification of Diseases (ICD-11) as a mental health disorder [2]. Recent meta-analyses indicate that the global prevalence of problematic gaming ranges from 0.3 to 17.7% [3], with approximately 10% of youth worldwide experiencing gaming-related problems [4]. The manifestation of this health problem varies significantly among various gender groups, the prevalence of problematic gaming in males is approximately 2 times higher than in females [5]. The prevalence shows notable geographical variation, with the highest rates (12%) observed in Asian populations, while representative samples indicate a lower prevalence of 6% [6]. In China specifically, studies suggest that 17.0% of adolescent gamers engage in problematic gaming [7, 8].

Adverse impact of gaming disorder

Problematic gaming can have severe personal and societal implications, particularly among adolescents and young adults. The physical consequences often manifest as musculoskeletal discomfort, including upper limb strain, cervical issues, visual problems, and overall deterioration in physical wellbeing [9]. Over time, these physical strains contribute to a general deterioration in overall physical well-being, potentially leading to chronic health conditions if left unaddressed. Mental health impacts are equally concerning, with strong associations found between problematic gaming and various psychological issues including depression, anxiety, insomnia, and suicidal ideation [10–12]. Clinical observations indicate frequent comorbidity between gaming-related behavioral problems and various psychological disorders, including depressive disorders, anxiety disorders, and Attention Deficit Hyperactivity Disorder (ADHD) [13–15]. The societal ramifications of problematic gaming extend beyond the individual level. The societal impact extends to antisocial behaviors, telecommunication scams, and violence [16], which can have broader implications for community safety and well-being. Long-term consequences can be particularly severe, with research indicating that prolonged immersion in virtual worlds can lead to diminished social skills, academic stagnation,

skill deficits, limited professional development prospects, and increased likelihood of unemployment [17, 18]. In summary, problematic gaming is a multifaceted issue with profound implications for physical health, mental well-being, clinical comorbidities, societal stability, and long-term development. To lower their risk of negative effects, it is imperative to early detect problematic gaming among CAYAs.

Personality traits and gaming disorder

Personality traits are integral to understanding the development and persistence of problematic gaming behaviors. Neuroticism, a trait marked by emotional instability and negative emotionality, correlates positively with problematic gaming behavior. Individuals with heightened neuroticism frequently experience anxiety and depression, potentially driving maladaptive gaming as an emotional escape mechanism. Conscientiousness, marked by self-discipline and goal-orientation, inversely correlates with problematic gaming. Individuals scoring high in this trait demonstrate greater self-regulation and commitment to long-term objectives, characteristics that help prevent excessive gaming through structured habit management [8, 19]. Openness predicts broader gaming genre preferences, particularly for novel experiences, though its association with problematic gaming remains weaker than neuroticism and conscientiousness. Extraversion correlates with social gaming preferences but shows ambivalent problematic associations - while fostering community engagement, it may concurrently mitigate risks through social support. Lower agreeableness escalates gaming risks through in-game aggression patterns [20, 21]. Studies have also indicated that personality traits may influence gaming preferences and motivations, potentially mediating the relationship between individual characteristics and problematic gaming behaviors [22]. Understanding these dynamics is crucial for developing targeted interventions that address the underlying psychological drivers of problematic gaming.

Gaming motivations and problem gaming

Gaming motivations are crucial for understanding the development of problematic gaming. Yee's model laid the foundation for this field by identifying 10 gaming motives and categorizing them into three main groups: (1) achievement (advancement, mechanics, competition), (2) social (socializing, relationships, teamwork), and (3) immersion (discovery, role-playing, customization, escapism) [23]. Building on this framework, subsequent

research has introduced additional scales to assess gaming motivations, such as the Motives for Gaming Motivation Inventory (GMI) [24], the Gaming Instinctual Motivation Scale (GIMS) [25], and the Psychological Motivations for Playing Video Games Scale (PMPVGs). The PMPVGs, in particular, focuses on intrinsic motivation and psychological drivers, providing deeper insights into the psychological factors that drive video game usage [26]. Different motivational patterns have been associated with varying risks of developing gaming-related problems. Research has shown that escapism, achievement seeking, and social interaction are particularly relevant motivational factors [22]. Escapism, the use of games as a means of escaping psychological stress, is a major contributing factor to gaming addiction. Those with high stress or poor emotional control may deeply engage in virtual worlds for relief. Some people prioritize gaming over real-life responsibilities like work or socializing since achievement seeking entails pursuing in-game incentives and recognition. Strong online communities created through social interaction in games can serve as a stand-in for folks who lack social support in the real world [27, 28]. Additionally, the relationship between gaming motivations and problematic use may be influenced by various factors, including stress levels, emotional regulation capabilities, and social support networks. High levels of stress can exacerbate the negative impact of escapism, making it more likely for individuals to develop problematic gaming behaviors. Similarly, poor emotional regulation capabilities can intensify the reliance on gaming as a coping mechanism, particularly for those motivated by escapism [29, 30]. On the other hand, strong social support networks outside of gaming can act as a protective factor, reducing the likelihood of problematic gaming even in the presence of high-risk motivations such as escapism or achievement seeking.

Gender differences in gaming behavior

Research findings consistently reveal distinct patterns between males and females in their gaming behaviors and associated risks. Studies on individual characteristics have shown that an individual's propensity for excessive gaming is often linked to specific behavioral patterns [22, 31]. For instance, male gamers are more likely to experience game-related issues if they exhibit higher levels of behavioral reactivity. This tendency may be exacerbated by the content of many popular online games, which often include violent elements. Frequent engagement with such games can lead to the emergence of aggressive feelings and behaviors [32–34]. Males are typically more motivated to play than females, especially in terms of achievement-seeking and social interactions. In contrast, female players often use gaming as a strategy for emotional regulation, particularly during times

of psychological distress. This pattern differs from the motivations of male players and suggests that depression may be more closely associated with problematic gaming in females than in males [35, 36]. Furthermore, different game genres attract varying demographic trends, with certain gaming formats drawing different gender distributions [37]. For example, one study found that the brain and skill (BRS) genre had a higher proportion of female players compared to male players [7]. These findings highlight the importance of considering gender differences when examining gaming behaviors and associated risks.

Research gaps and study objectives

While existing literature has explored various aspects of problematic gaming, there remains gaps in understanding gender-specific risk factors, particularly regarding the interplay between gaming motivations, game genres, and personality traits.

This study aims to:

- (1) Evaluate the prevalence of problematic gaming among CAYAs.
- (2) Identify gender-specific risk factors associated with problematic gaming.
- (3) Examine how gaming motivations, game genres, and personality traits differently influence problematic gaming across genders.
- (4) Explore the characteristics of problematic gaming manifestation in different gender groups.

These objectives will contribute to developing more effective, gender-informed screening and intervention strategies for problematic gaming among CAYAs.

Materials and methods

Study design and participants

In late 2019, this study used a digital survey approach administered via the web platform Questionnaire Star. WeChat's pre-existing social networks were used to recruit participants, and cascading sharing mechanisms were used to distribute the poll. Any 15 years of age or older student, who can read Chinese, understood the survey's content and is willing to participate, can take part in this survey, with no additional exclusion criteria set. The digital portal provided comprehensive information about the study's goals and confidentiality protocols to all possible participants.

Procedures

Access to the survey was made possible with QR code scanning technology. Comprehensive study details, such as the goals, research background, voluntary participation guidelines, and data protection procedures, were

displayed in the first interface. In order to access the poll, individuals under the age of eighteen had to have their parents' or guardians' express consent. Informed consent has to be actively confirmed before the survey could proceed.

Measures

Four components made up the online survey: (1) sociodemographic information, (2) gaming characteristics and behaviors, (3) problematic gaming assessment, and (4) personality traits. Demographic Profile gathered essential participant characteristics including age stratification, gender identification, educational attainment, relationship status, and family composition patterns. Gaming characteristics included primary gaming platforms utilized, temporal investment in gaming activities, financial allocation to gaming pursuits and preferred gaming categories (ranked selection of top three genres).

The video gaming dependency scale (VGDS)

The Chinese version of Video Gaming Dependency Scale (VGDS) (Cronbach's $\alpha = 0.92$), which was revised from the English version developed by Rehbein et al. and includes paired assessment items for each diagnostic sign listed in the DSM-5, was utilized to evaluate problematic gaming [38]. It offers a thorough analysis of behavioral patterns related to gaming. Based on previous 12-month behavioral patterns, the scale had 18 items with four-point responses ranging from strong disagreement to strong agreement. If at least one of the two items received a rating of four (strongly agree), the criterion was deemed to be "agreed" with. According to DSM-5 guidelines, participants who satisfied five or more criteria were classified as problematic gamers. Sample items: "Do you feel anxious, irritable or unhappy when you stop or reduce playing online games?" and "Do you feel out of control of your game's uptime".

The Chinese big five personality inventory brief version (CBF-PI-B)

Personality traits were assessed using the Chinese Big Five Personality Inventory Brief Version (CBF-PI-B) [39–42], a culturally adapted measurement tool that examines five core dimensions of personality structure within the Chinese context. The inventory contains 40 items, and each dimension was measured using eight items. Conscientiousness, extraversion, agreeableness, neuroticism, and openness were all thoroughly assessed using a six-point rating system, which ranges from strongly disagree to strongly agree. Previous studies have shown that the CBF-PI-B demonstrates good reliability and validity for assessing personality traits among the Chinese population (Cronbach's $\alpha = 0.87$) [40]. Sample items for each dimension of the CBF-PI-B: Conscientiousness:

"I am always prepared"; Extraversion: "I feel comfortable around people"; Neuroticism: "I get stressed out easily"; Agreeableness: "I sympathize with others' feelings"; Openness: "I have a vivid imagination".

Gaming motivation assessment

Participants selected from predetermined categories of gaming motivations. Each motivation was assessed using a specific question: "What is your primary reason for playing video games?" Options included: Sensation seeking; Escaping reality; Coping negative emotion; Making friends. Participants could select multiple motivations.

Data quality control and bias

In this study, to ensure data quality and minimize bias, a series of measures were implemented. Technical controls incorporated automated time-stamp monitoring, with response durations rigorously filtered using a $\mu \pm 3SD$ threshold relative to the mean completion time. Each IP address was restricted to submitting the questionnaire only once, effectively preventing duplicate data collection. Systematic validation mechanisms included: (1) algorithmic detection of repetitive response patterns (e.g., ≥ 10 consecutive identical answers), (2) embedded attention checks via verification questions (e.g., "5 + 5 = ?"), and (3) independent auditing of data cleaning procedures to eliminate procedural bias. Real-time quality reports were generated throughout data collection to enable prompt anomaly resolution. Additionally, the criteria for invalid questionnaires were established in advance by the researcher. The sample size was larger than the minimum required, ensuring that the impact of deleting invalid questionnaires on the study results was negligible.

Statistical analysis

Standard descriptive statistics were used to characterize the responding participants. To screen out the independent variables linked to problematic gaming in the male and female groups, differences in demographics, Internet gaming use characteristics, gaming motivations, and CBF-PI-B scores between the two gender groups were compared and analyzed using either chi-square (χ^2) tests (categorical variables) or analysis of variance (continuous variables). For the post hoc analysis, the least significant difference t-test was employed. A multivariable logistic regression model was further constructed using variables that showed significant inter-group differences in the univariate analysis ($p < 0.05$). In order to determine the personality, game, and demographic factors associated with problematic gaming in the various gender groups, binary logistic regression analyses were also employed. The correlations between the factors and problematic gaming were measured using odds ratios (ORs) and 95%

confidence intervals (CIs). SPSS 26.0 was used for all statistical analyses, and the significance threshold was set at $p < 0.05$.

Ethics

The study protocol (code number: 2020004) was approved by the Second Xiangya Hospital's Ethics Committee at Central South University. The study followed accepted guidelines for research involving human subjects. All participants gave their digital informed consent before completing the survey, and for participants under 18 years of age, explicit parental or guardian consent was required and obtained through the digital platform before proceeding with the survey. Throughout the course of the study, participant anonymity and data confidentiality were preserved.

Results

Sample characteristics

A total of 6014 people participated in this online survey. After checking dates, 5593 data were included in the analysis (Table 1). There were 3326 (59.5%) males and 2267 (40.5%) females. The majority were 18–21 years old (84.8%), had siblings (50.8%), were single (97.7%), and had undergraduate or higher education (59.0%). In the studied population, 18.5% of adolescents and young adults met the criteria for problematic gaming. The average daily gaming time was 1.88 ± 1.321 h, the average money spent on gaming per month was 68.26 ± 151.107 yuan, the leading gaming device was the mobile phone (73%), and the top gaming motivation was passing time (66.9%). The popularity of game genres role-playing games (RPGs), strategy games (STR), action shooter games (ACS), and brain and skill games (BRS) was 12.7%, 59.2%, 12.2%, and 15.9%, respectively.

Gender differences in problematic gaming and related factors

Males showed a significantly higher prevalence of problematic gaming than females (21.5% vs. 14.1%, $p < 0.001$; Table 2). This gender difference remained significant after controlling for demographics, gaming patterns, personality traits, and gaming motivations in logistic regression (OR: 1.663, 95%CI: 1.44–1.921). Males had higher VGDS scores, preferred STR games, and were more likely to play for sensation seeking, coping with negative emotion, and making friends compared to females. Females were more likely to play for passing the time. Regarding personality traits, males scored higher on conscientiousness and extraversion while females scored higher on neuroticism and agreeableness.

Comparison between males and females with problematic games

Among the 5,593 participants, 1,034 (18.5%) individuals were identified as having problematic gaming, including 714 males and 320 females. Regarding family structure, females with problematic gaming were more likely to be only children (54.4%), while males tended to have siblings (53.2%). The majority of both males and females with problematic gaming were single and had a bachelor's degree or above. In terms of game genre preferences, both females and males predominantly preferred STR games, with 47.8% and 75.4% respectively (Table 3). Notably, females with problematic gaming spent more time and money on gaming compared to their male counterparts. Comparing gaming motivation distributions between males and females with problematic gaming, males were sensation seeking and passing time, whereas females were mainly driven by escaping reality and making friends (Fig. 1). About personality traits, males with problematic gaming scored higher on agreeableness, while females scored higher on neuroticism.

Table 1 Demographic characteristics of participants

	Total N=5593	Male N=3326	Female N=2267	$\chi^2/Z/t$	P
Age				3.296	0.192
15–17	275(4.9%)	154(4.6%)	121(5.3%)		
18–21	4741(84.8%)	2843(85.5%)	1898(83.7%)		
>=22	577(10.3%)	329(9.9%)	248(10.9%)		
Family structure				8.228	0.004
being an only child	2750(49.2%)	1688(50.8%)	1062(46.8%)		
having siblings	2843(50.8%)	1638(49.2%)	1205(53.2%)		
Relationship status				12.124	< 0.001
Single	5465(97.7%)	3269(98.3%)	2196(96.9%)		
Couple	128(2.3%)	57(1.7%)	71(3.1%)		
Highest education				3.385	0.066
Lower than undergraduate	2295(41.0%)	1398(42.0%)	897(39.6%)		
Undergraduate or higher	3298(59.0%)	1928(58.0%)	1370(60.4%)		

Table 2 Within-group comparisons of VGD-S scores, gaming patterns, personality traits, and gaming motivations

	Total N= 5593	Male N= 3326	Female N= 2267	$\chi^2/Z/t$	P
PG	1034(18.5%)	714(21.5%)	320(14.1%)		
Without PG	4559(81.5%)	2612(78.5%)	1947(85.9%)		
Gaming use characteristics					
game genre				918.553	< 0.001
RPGs	713(12.7%)	360(10.8%)	353(15.6%)	27.317	< 0.001
STR	3311(59.2%)	2438(73.3%)	873(38.5%)	675.629	< 0.001
ACS	680(12.2%)	360(10.8%)	320(14.1%)	13.678	< 0.001
BRS	889(15.9%)	168(5.1%)	721(31.8%)	712.765	< 0.001
Gaming patterns					
Daily gaming time(hours)	1.88 ± 1.32	2.04 ± 1.27	1.64 ± 1.34	11.073	< 0.001
Money spent on gaming/month(yuan)	68.26 ± 151.10	68.43 ± 146.61	67.99 ± 157.49	0.106	0.916
VGD-S		2.71 ± 2.49	1.97 ± 2.47	11.012	< 0.001
Device				524.674	< 0.001
PC	1511(27%)	1272(38.2%)	239(10.5%)		
Mobile	4082(73%)	2054(61.8%)	2028(89.5%)		
Gaming motivations					
Seeking				224.622	< 0.001
N	3838(68.6%)	2027(60.9%)	1811(79.9%)		
Y	1755(31.4%)	1299(39.1%)	456(20.1%)		
Escaping				3.362	0.067
N	4955(88.6%)	2968(89.2%)	1987(87.6%)		
Y	638(11.4%)	358(10.8%)	280(12.4%)		
Coping				62.297	< 0.001
N	3214(57.5%)	1768(53.2%)	1446(63.8%)		
Y	2379(42.5%)	1558(46.8%)	821(36.2%)		
Passing time				47.472	< 0.001
N	1853(33.1%)	1221(36.7%)	632(27.9%)		
Y	3740(66.9%)	2105(63.3%)	1635(72.1%)		
Making friends				24.539	< 0.001
N	4505(80.5%)	2607(78.4%)	1898(83.7%)		
Y	1088(19.5%)	719(21.6%)	369(16.3%)		
Personality traits					
Neuroticism		24.82 ± 8.03	26.92 ± 7.62	-9.906	< 0.001
Conscientiousness		33.23 ± 6.52	32.82 ± 5.96	2.468	0.014
Openness		33.40 ± 7.31	33.08 ± 6.37	1.747	0.081
Agreeableness		34.89 ± 6.27	35.29 ± 5.81	-2.404	0.016
Extraversion		29.92 ± 7.39	29.48 ± 6.66	2.203	0.021

PG: problematic gaming PC: personal computer. game genre: role-playing games (RPGs), strategy games(STR), action shooter games(ACS), and brain and skill games(BRS). Motives: Seeking, Sensation seeking; Escaping, Escaping reality; Coping, Coping negative emotion; Friends, Making friends

Factors associated with problematic gaming in males

A comparative analysis of demographic and gaming behavioral characteristics between male CAYAs with problematic gaming and their non-problematic counterparts revealed significant intergroup differences. The problematic gaming cohort demonstrated distinct demographic patterns, exhibiting higher rates of having siblings, single marital status, and the highest education of undergraduate or higher. Regarding gaming patterns, the problematic gaming group showed marked preferences for BRS game genres, spending more time and money on gaming on a daily basis. In terms of gaming motivation,

they mainly showed sensation seeking and Escaping reality, and in terms of personality traits, showed higher neuroticism, lower conscientiousness, openness, agreeableness and extraversion. (all $p < 0.05$, Table 3). We then performed a multivariate logistic regression and variables with $p < 0.05$ in the univariate analysis were included in this model (Table 4). The results.

of the Hosmer–Lemeshow goodness-of-fit test showed that $\chi^2 = 6.42$, $P = 0.6$, indicating that the model fit was good. Multivariate logistic regression indicated that male CAYAs with problematic gaming was associated with daily gaming time(hours)(OR: 1.372, 95%CI: 1.275–1.477,

Table 3 Characteristics of male and female Chinese adolescents and young adults with and without problematic gaming

Characteristics	Male		Female		χ^2/Z	Male		Female		χ^2/Z
	Without PG(N = 2612)	With PG (N = 714)	Without PG(N = 1947)	With PG (N = 320)		With PG(N = 714)	With PG(N = 320)	With PG(N = 714)	With PG(N = 320)	
Age					5.945					90.362***
15–17	115(4.4%)	39(5.5%)	110(5.6%)	11(3.4%)		39(5.5%)	11(3.4%)	11(3.4%)		33.950***
18–21	2253(86.3%)	590(82.6%)	1673(85.9%)	225(70.3%)		590(82.6%)	225(70.3%)	225(70.3%)		
>=22	244(9.3%)	85(11.9%)	164(8.4%)	84(26.3%)		85(11.9%)	84(26.3%)	84(26.3%)		
Family structure					5.742*					8.482**
being an only child	1354(51.8%)	334(46.8%)	888(45.6%)	174(54.4%)		334(46.8%)	174(54.4%)	174(54.4%)		5.102*
having siblings	1258(48.2%)	380(53.2%)	1059(54.4%)	146(45.6%)		380(53.2%)	146(45.6%)	146(45.6%)		
Relationship status					45.647***					191.685***
Single	2588(99.1%)	681(95.4%)	1926(98.9%)	270(84.4%)		681(95.4%)	270(84.4%)	270(84.4%)		36.236***
Couple	24(0.9%)	33(4.6%)	21(1.1%)	50(15.6%)		33(4.6%)	50(15.6%)	50(15.6%)		10.862**
Highest education					18.381***					34.502***
Lower than undergraduate	1148(44.0%)	250(35.0%)	818(42.0%)	79(24.7%)		250(35.0%)	79(24.7%)	79(24.7%)		
Undergraduate or higher	1464(56%)	464(65.0%)	1129(58.0%)	241(75.3%)		464(65.0%)	241(75.3%)	241(75.3%)		
Gaming use characteristics										
game genre										
RPGs	271(10.4%)	89(12.5%)	255(13.1%)	98(30.6%)	2.537	89(12.5%)	98(30.6%)	98(30.6%)		49.190***
STR	1900(72.7%)	538(75.4%)	720(37%)	153(47.8%)	1.950	538(75.4%)	153(47.8%)	153(47.8%)		75.588***
ACS	286(10.9%)	74(10.4%)	264(13.6%)	56(17.5%)	0.199	74(10.4%)	56(17.5%)	56(17.5%)		10.236***
BRS	155(5.9%)	13(1.8%)	708(36.4%)	13(4.1%)	19.782**	13(1.8%)	13(4.1%)	13(4.1%)		4.530*
Gaming patterns										
Daily gaming time(hours)	1.85 ± 1.11	2.72 ± 1.57	1.38 ± 0.89	3.27 ± 2.24	-16.810***	2.72 ± 1.57	3.27 ± 2.24	3.27 ± 2.24		-4.458***
Money spent on gaming/month(yuan)	49.68 ± 112.61	137.05 ± 218.62	31.10 ± 87.12	292.48 ± 266.53	-14.552***	137.05 ± 218.62	292.48 ± 266.50	292.48 ± 266.50		-9.853***
Device					0.009					2.662
PC	1000(38.3%)	272(38.1%)	134(6.9%)	105(32.8%)		272(38.1%)	105(32.8%)	105(32.8%)		
Mobile	1612(61.7%)	442(61.9%)	1813(93.1%)	215(67.2%)		442(61.9%)	215(67.2%)	215(67.2%)		
Motives										
Seeking					145.058***					17.093***
N	1731(66.3%)	296(41.5%)	1634(83.9%)	177(55.3%)		296(41.5%)	177(55.3%)	177(55.3%)		
Y	881(33.7%)	418(58.5%)	313(16.1%)	143(44.7%)		418(58.5%)	143(44.7%)	143(44.7%)		
Escaping					272.506***					21.151***
N	2452(93.9%)	516(72.3%)	1802(92.6%)	185(57.8%)		516(72.3%)	185(57.8%)	185(57.8%)		
Y	160(6.1%)	198(27.7%)	145(7.4%)	135(42.2%)		198(27.7%)	135(42.2%)	135(42.2%)		
Coping					27.125***					0.019
N	1450(55.5%)	318(44.5%)	1302(66.9%)	144(45%)		318(44.5%)	144(45%)	144(45%)		
Y	1162(44.5%)	396(55.5%)	645(33.1%)	176(55.0%)		396(55.5%)	176(55.5%)	176(55.5%)		
Passing time					0.266					5.572*
N	953(36.5%)	268(37.5%)	487(25.0%)	145(45.3%)		268(37.5%)	145(45.3%)	145(45.3%)		

Table 3 (continued)

Characteristics	Male		χ^2/Z		Female		χ^2/Z		Male		Female		χ^2/Z
	Without PG(N = 2612)	With PG(N = 714)	Without PG(N = 1947)	With PG(N = 320)	Without PG(N = 1947)	With PG(N = 320)	Without PG(N = 1947)	With PG(N = 320)	Without PG(N = 714)	With PG(N = 714)	Without PG(N = 320)	With PG(N = 320)	
Y	1659(63.5%)	446(62.5%)	1460(75.0%)	175(54.7%)	1460(75.0%)	175(54.7%)	1460(75.0%)	175(54.7%)	446(62.5%)	175(54.7%)	446(62.5%)	175(54.7%)	4.195*
Making friends			1.684										
N	2060(78.9%)	547(76.6%)	1672(85.9%)	226(70.6%)	1672(85.9%)	226(70.6%)	1672(85.9%)	226(70.6%)	547(76.6%)	226(70.6%)	547(76.6%)	226(70.6%)	
Y	552(21.1%)	167(23.4%)	275(14.1%)	94(29.4%)	275(14.1%)	94(29.4%)	275(14.1%)	94(29.4%)	167(23.4%)	94(29.4%)	167(23.4%)	94(29.4%)	
Personality traits													
Neuroticism	23.69±8.03	28.94±6.53	-16.072***	31.13±5.85	26.23±7.65	31.13±5.85	26.23±7.65	31.13±5.85	28.94±6.53	31.13±5.85	28.94±6.53	31.13±5.85	-5.135***
Conscientiousness	33.93±6.62	30.69±5.46	12.004***	30.10±5.32	33.26±5.94	30.10±5.32	33.26±5.94	30.10±5.32	30.69±5.46	30.10±5.32	30.69±5.46	30.10±5.32	1.612(
Openness	33.74±7.51	32.18±6.40	5.054***	32.69±5.71	33.14±6.47	32.69±5.71	33.14±6.47	32.69±5.71	32.18±6.40	32.69±5.71	32.18±6.40	32.69±5.71	-1.23
Agreeableness	35.35±6.32	33.23±5.79	8.079***	31.92±5.87	35.84±5.61	31.92±5.87	35.84±5.61	31.92±5.87	33.23±5.79	31.92±5.87	33.23±5.79	31.92±5.87	3.35**
Extraversion	30.32±7.52	28.43±6.73	6.082***	29.18±5.99	29.53±6.76	29.18±5.99	29.53±6.76	29.18±5.99	28.43±6.73	29.18±5.99	28.43±6.73	29.18±5.99	-1.704

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

$p < 0.001$), money spent on gaming/month(yuan)(OR: 1.002, 95%CI:1.002–1.003, $p < 0.001$), neuroticism (OR: 1.079, 95%CI: 1.064–1.093, $p < 0.001$), conscientiousness (OR: 0.927, 95%CI: 0.912–0.942, $p < 0.001$) and the gaming motivation of sensation seeking(N vs. Y, OR: 0.437, 95%CI: 0.36–0.53, $p < 0.001$), the gaming motivation of escaping reality (N vs. Y, OR:0.385, 95%CI: 0.295–0.504, $p < 0.001$), the gaming motivation of coping negative emotion (N vs. Y, OR: 0.794, 95%CI: 0.653–0.965, $p = 0.021$). Demographic variables independently associated with problematic gaming included the family structure of being an only child (vs. having siblings, OR: 0.715, 95%CI: 0.588–0.869, $p = 0.001$) and highest education (lower than undergraduate vs. undergraduate or higher, OR: 0.735, 95%CI: 0.603–0.896, $P = 0.002$).

Factors associated with problematic gaming in females

A comparative analysis of demographic and gaming behavioral characteristics between female CAYAs with problematic gaming and their non-problematic counterparts revealed significant intergroup differences. The problematic gaming was associated with family structure of being an only child, couple marital status, and the highest education of undergraduate or higher. Regarding gaming patterns, the problematic gaming group showed spending more time and money on gaming and marked preferences for PC game device. In terms of gaming motivation, they mainly showed sensation seeking, escaping reality, coping with negative emotion and making friends, and in terms of personality traits, showed higher neuroticism, lower conscientiousness, and agreeableness (all $p < 0.05$, Table 3). Then a multivariate logistic regression was performed (Table 4). The results of the Hosmer–Lemeshow goodness-of-fit test showed that $\chi^2 = 9.276$, $P = 0.320$, indicating that the model fit was good. Multivariate logistic regression indicated that female CAYAs with problematic gaming was associated with daily gaming time(hours)(OR: 1.441, 95%CI: 1.288–1.612, $p < 0.001$), money spent on gaming/month(yuan)(OR: 1.005, 95%CI:1.004–1.006, $p < 0.001$), neuroticism (OR: 1.07, 95%CI: 1.044–1.098, $p < 0.001$), conscientiousness (OR: 0.912, 95%CI: 0.886–0.938, $p < 0.001$) and the gaming motivation of sensation seeking(N vs. Y, OR: 0.397, 95%CI: 0.281–0.562, $p < 0.001$), the gaming motivation of escaping reality (N vs. Y, OR:0.429, 95%CI: 0.287–0.642, $p < 0.001$), the gaming genre of BRS (OR: 4.989, 95%CI: 2.728–9.125, $p < 0.001$).

Discussion

Main findings

As far as we are aware, this is one of the few studies that examines the prevalence of problematic gaming and the risk variables that are specific to gender in a sizable sample of CAYAs. Overall, 18.5% of people had behavioral

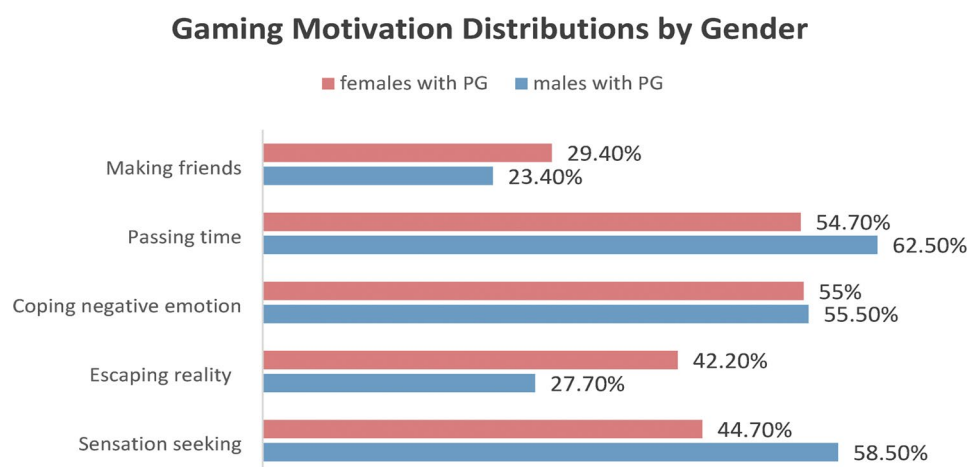


Fig. 1 Bar graph comparing gaming motivation distributions between males and females with problematic gaming

Table 4 Characteristics of male and female Chinese adolescents and young adults with problematic gaming (logistic regression model)

	Characteristics	B	Wald statistic	p	OR	95%CI
Male	Daily gaming time(hours)	0.316	71.296	< 0.001	1.372	1.275–1.477
	Money spent on gaming/month(yuan)	0.002	44.999	< 0.001	1.002	1.002–1.003
	Seeking	-0.829	70.728	< 0.001	0.437	0.360–0.530
	Escaping	-0.953	48.574	< 0.001	0.385	0.295–0.504
	Coping	-0.230	5.359	0.021	0.794	0.653–0.965
	Neuroticism	0.076	123.990	< 0.001	1.079	1.064–1.093
	Conscientiousness	-0.076	87.858	< 0.001	0.927	0.912–0.942
	Family structure	-0.335	11.299	0.001	0.715	0.588–0.869
	Highest education	-0.308	9.261	0.002	0.735	0.603–0.896
Female	Daily gaming time(hours)	0.365	40.710	< 0.001	1.441	1.288–1.612
	Money spent on gaming/month(yuan)	0.005	107.385	< 0.001	1.005	1.004–1.006
	Seeking	-0.923	27.347	< 0.001	0.397	0.281–0.562
	Escaping	-0.846	16.938	< 0.001	0.429	0.287–0.642
	Neuroticism	0.068	28.169	< 0.001	1.070	1.044–1.098
	Conscientiousness	-0.093	40.484	< 0.001	0.912	0.886–0.938
	BRS	1.607	27.227	< 0.001	4.989	2.728–9.125

problems connected to gaming, with males having significantly higher rates than females (21.5% vs. 14.1%) (Fig. 1). Our study revealed both gender-specific and common risk variables. Extended gaming duration, substantial monetary investment, elevated neuroticism scores, and reduced conscientiousness levels were identified as common risk factors across genders. Playing BRS games was a specific risk factor for females. Highly educated single males and females are prone to problematic gaming. Males exhibit higher levels of agreeableness and females exhibit higher levels of neuroticism when it comes to problematic gaming. The majority of STR games were played by males as a way of passing the time and sensation seeking. Compared to males, females spent more time and money gaming, played games to escape reality and make friends, and mostly favored RPGs, ACS, and BRS games. In order to minimize problematic gaming

and associated consequences in CAYAs, these findings emphasize the necessity of gender-specific screening and interventions.

Gender differences in prevalence of problematic gaming

Our findings that problematic gaming is more common in males are consistent with earlier research [3, 6]. Neurobiological study shows potential disparities in reward processing systems across genders [43, 44]. Furthermore, the ways that males and females engage in gaming are influenced by distinct social and cultural contexts. These differences might have been exacerbated by the gaming industry's historical emphasis on male-oriented material [45, 46]. This gender difference may be related to the more male-dominated social environment of the gaming culture, where males may be exposed to gaming earlier and engage in gaming activities more frequently

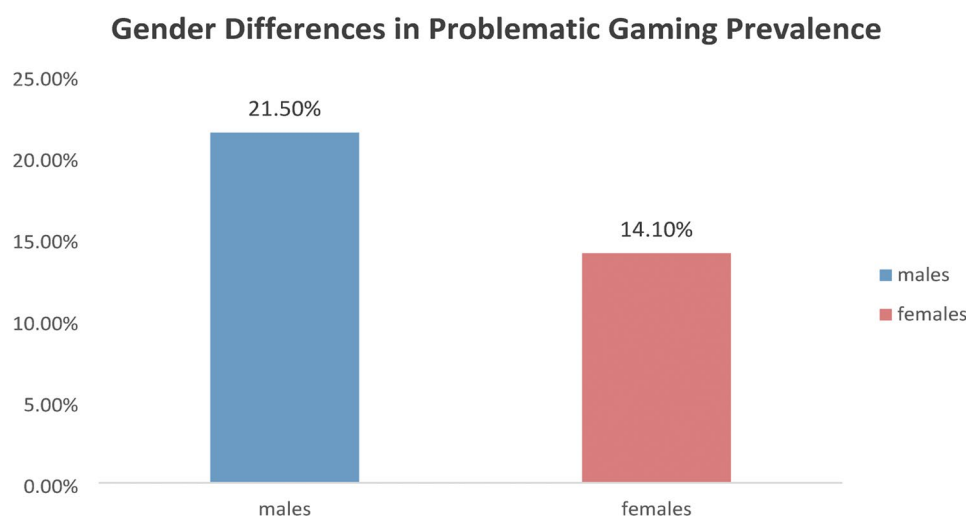


Fig. 2 Bar graph showing gender differences in problematic gaming prevalence

[47]. Males may therefore be more prone to spend a lot of time gaming and form harmful usage habits. Nonetheless, current trends show that gender-specific gaming participation patterns are changing, especially as gaming platforms and content become more varied [48]. Continued monitoring of gender-specific prevalence trends is warranted.

Differences between male and female with problematic gaming

Different gender-specific traits in gaming engagement patterns were identified by our investigation. Both females and males showed a preference for STR, but the percentage of males' preference was significantly higher than that of females. This result is consistent with previous research suggesting that STR are more popular with males due to their complexity and competitiveness [49, 50]. Problematic gaming behaviors exhibit notable gender differences across marital, educational, and familial contexts. Single individuals with bachelor's degrees or higher are disproportionately affected, potentially due to limited social-emotional support, driving gaming as a coping mechanism for isolation [51]. Gender-specific motivations emerge: males prioritize thrill-seeking and time-passing, aligning with achievement-oriented social expectations, while females lean toward escapism and social connection, reflecting emotional needs [27]. Personality traits further differentiate these groups—males show higher agreeableness, enabling in-game social bonding but escapism under stress, whereas females with elevated neuroticism may use gaming to mitigate emotional distress [8, 21]. In terms of family structure, females with problematic gaming were more likely to come from one-child families (54.4%), while males were more likely to have siblings (53.2%). This result may suggest that the lack of peer playmates in one-child families

may increase the risk of gaming addiction as women may be more likely to use gaming as an alternative form of socialization or entertainment. In multi-sister families, males may have deficits in emotional support and attention, leading to males seeking emotional fulfillment and escapism through gaming [52]. Interestingly, our findings diverge from previous studies in that females with problematic gaming invested more time and money into gaming than their male counterparts. While males are generally more susceptible to gaming addiction, our results suggest that once addicted, females may exhibit more severe problematic gaming patterns. This emphasizes the need for more investigation into any gender disparities in the progression and outcome of problematic gaming.

Risk factors in male CAYAs

Among male participants, gaming behavior patterns showed significant associations with time investment, financial allocation, and emotional regulation strategies. The evidence indicates that sustained engagement can be enhanced through psychological reinforcement loops involving dopamine-driven reward cycles [53]. Males with problematic gaming behaviors are more likely to spend more time and money playing games due to the excitement it offers. We also found that males in families with multiple siblings were more likely to exhibit problematic gaming behaviors, potentially due to the lack of effective supervision and guidance of their gaming behaviors as a result of parental energy being diverted [33, 52]. In addition, unlike previous studies, this study found that highly educated males are more likely to be addicted to gaming. Rho et al. found there was no significant difference on education between the problematic gaming and control group [54]. The opposite results in this study may be due to the unbalanced age (3172 people ≥ 18 years vs. 154

people < 18 years) of these participants, which influenced the outcomes. Educational background emerged as a distinctive factor, with higher education levels showing unexpected correlations with gaming intensity. This finding suggests complex interactions between academic achievement, stress management, and gaming behaviors in this demographic group [50, 55], and it is possible that highly educated males further exacerbate the risk of addiction due to high-pressure life and work environments [51, 56]. East Asian cultural factors, such as the Confucian ideal of achievement, place a great degree of pressure on males and demand that they be accomplished. This relationship suggests that many young males may turn to gaming as an escape mechanism when facing emotional difficulties or stress [51]. Further research indicates that these individuals often use gaming as a maladaptive coping strategy to temporarily alleviate feelings of anxiety, depression, or social isolation [57]. Therefore, an in-depth analysis of the multiple causes of problematic gaming will provide strong theoretical support and practical basis for the precise formulation of targeted prevention and intervention strategies.

Risk factors in female CAYAs

The present study also showed that when more time and money is invested in playing games, female gamers are more likely to have problematic gaming. Furthermore, female participants exhibited unique risk patterns, particularly regarding game genre preferences and personality traits [17, 20]. A previous finding that when highly neurotic individuals consider the real world threatening, they often turn to digital worlds, where they feel in control and safe. The conscientiousness indicates one has the commitment to personal goals, organizing and following a schedule [8, 58]. CAYAs with problematic gaming are characterized by high neuroticism or low conscientiousness [59]. This is consistent with the results of the male CAYAs with problematic gaming study. The gaming motivation of escaping reality and sensation seeking were related to problematic gaming among female CAYAs. In addition, our study found that only female CAYAs showed strong association between problematic gaming and the game genres of BRS. Male CAYAs prefer to play action and shooting games, while females prefer to play casual intellectual games [7]. This may be due to differences in emotions and ways of thinking between males and females, with male CAYAs preferring challenge and competition, while female CAYAs may prefer emotional expression and visual aesthetics. Researchers should also be cautious about the risk of developing problematic gaming in female players of BRS games.

Limitations of the study

A The following are several limitations that warrant attention. Firstly, given the cross-sectional nature of the study, causality cannot be determined. To better understand the temporal relationship between risk factors and the onset of problematic gaming, longitudinal research is essential. In addition, future studies should employ mixed-methods approaches, such as combining behavioral tracking with qualitative interviews. Secondly, self-reported data may lead to reporting biases. The findings would be more robust if future longitudinal studies incorporated objective measurements and clinical assessments. Thirdly, considering environmental influences and a broader range of psychosocial variables could enhance our understanding of how gaming behavior evolves. Lastly, a self-report scale was utilized to assess problematic gaming, rather than the gold - standard clinical interviews. A crucial next step is to replicate our findings using the DSM-5 or ICD-11 criteria for gaming disorder. When it comes to measuring game motivation, scales like the PMPVGs can be used.

Conclusion

According to this study, problematic gaming is very prevalent among CAYAs, especially among males. We found risk factors for gaming patterns, personality traits, motivations, and demographics that were both gender-specific and common. Cross-gender risks in gaming include extended playtime, excessive spending, high neuroticism, and low conscientiousness, underscoring self-regulation and emotional management as common intervention targets. Males gravitate toward STR, driven by thrill-seeking and time-passing, with heightened agreeableness. Females prefer RPG, ACS, and BRS, motivated by escapism and social needs, coupled with elevated neuroticism. Single, highly educated individuals face elevated risks, potentially using gaming to compensate for lacking real-world social support. Socio-culturally, evolving game diversity may shift gender engagement trends, though male-dominated cultural norms persist. These findings emphasize integrating gender-specific motivations and preferences into targeted prevention and intervention strategies. When addressing gaming-related behaviors, educators and healthcare professionals should take gender into account. Future research should combine longitudinal designs, objective measures of gaming behaviors, and clinical diagnostic assessments to study the temporal links between risk variables and problematic gaming onset and course can enrich etiological models and early intervention targets. This results can help guide clinical procedures, public health regulations, and future studies that try to lessen the adverse consequences of problematic gaming in this digital age.

Acknowledgements

The authors would like to thank all the study participants.

Author contributions

All authors made substantial contributions to this study. LZ, LJ and SH conceptualized and designed the research, wrote the first draft of the manuscript, and contributed to the final manuscript. HQ prepared the assessment tools. CX, and TY performed the data collection. HQ, CX and TY undertook the statistics and analysis.

Funding

This study was supported by Hunan Provincial Natural Science Foundation [No.2023JJ40476] and Hunan Provincial Social Science Achievement Evaluation Committee [No.XSP24YBZ185].

Data availability

The data presented in this study are available obtained through corresponding author if necessary.

Declarations

Ethics approval and consent to participate

The Ethics Committee of the Second Xiangya Hospital of Central South University approved the study protocol (code number:2020004). All research procedures involving human participants are in accordance with the ethical standards of the agency and / or the National Research Council, as well as the 1964 Helsinki Declaration and its subsequent amendments or similar ethical standards. Before completing the questionnaire, participants had to indicate whether they refuse or agree to participate in the research. Those under age of 18 must obtain consent from a parent or guardian before proceeding with the survey. Only those willing to participate and parents or guardian agreed to participant could continue to answer the questionnaire. Informed consent was obtained from all subjects.

Consent for publication

The manuscript is an original work that has not been published elsewhere and has not been submitted to other journals simultaneously. We hold the full copyright to the content of the manuscript. All data and information in the manuscript are accurate. The identities of all participants in the manuscript have been anonymized, and their explicit informed consent has been obtained. We understand and agree to the copyright policy and publication license agreement of BMC Psychiatry.

Competing interests

The authors declare no competing interests.

Author details

¹Department of Psychiatry, National Clinical Research Center for Mental Disorders, The Second Xiangya Hospital of Central South University, Changsha, Hunan, China

²Department of Psychology, School of Humanities and Management, Hunan University of Chinese Medicine, Changsha, Hunan, China

Received: 30 November 2024 / Accepted: 15 May 2025

Published online: 22 May 2025

References

1. First MB. Diagnostic and statistical manual of mental disorders, 5th edition, and clinical utility[J]. *J Nerv Ment Dis*. 2013;201(9):727–729. <https://doi.org/10.1097/NMD.0b013e3182a2168a>
2. Saunders JB, Chan G, Leung J, et al. The nature and characteristics of problem gaming, with a focus on ICD-11 diagnoses[J]. *Curr Opin Psychiatry*. 2024;37(4):292–300. <https://doi.org/10.1097/YCO.0000000000000949>
3. Kim HS, Son G, Roh EB, et al. Prevalence of gaming disorder: A meta-analysis[J]. *Addict Behav*. 2022;126. <https://doi.org/10.1016/j.addbeh.2021.107183>
4. Gao YX, Wang JY, Dong GH. The prevalence and possible risk factors of internet gaming disorder among adolescents and young adults: systematic reviews and meta-analyses[J]. *J Psychiatr Res*. 2022;154:35–43. <https://doi.org/10.1016/j.jpsychires.2022.06.049>
5. Stevens MW, Dorstyn D, Delfabbro PH, King DL. Global prevalence of gaming disorder: A systematic review and meta-analysis. *Aust N Z J Psychiatry*. 2021;55(6):553–68. Epub 2020 Oct 7.
6. Liao Z, Chen X, Huang Q, et al. Prevalence of gaming disorder in East Asia: A comprehensive meta-analysis[J]. *J Behav Addict*. 2022;11(3):727–38. <https://doi.org/10.1556/2006.2022.00050>
7. Liao Z, Chen X, Huang S, et al. Exploring the associated characteristics of internet gaming disorder from the perspective of various game genres[J]. *Front Psychiatry*. 2022;13:1103816. <https://doi.org/10.3389/fpsy.2022.1103816>
8. Liao Z, Huang Q, Huang S, et al. Prevalence of internet gaming disorder and its association with personality traits and gaming characteristics among Chinese adolescent Gamers[J]. *Front Psychiatry*. 2020;11:598585. <https://doi.org/10.3389/fpsy.2020.598585>
9. Mylona I, Deres ES, Dere GS, et al. The impact of internet and videogaming addiction on adolescent vision: A review of the Literature[J]. *Front Public Health*. 2020;8:63. <https://doi.org/10.3389/fpubh.2020.00063>
10. Wong HY, Mo HY, Potenza MN, et al. Relationships between severity of internet gaming disorder, severity of problematic social media use, sleep quality and psychological Distress[J]. *Int J Environ Res Public Health*. 2020;17(6). <http://doi.org/10.3390/ijerph17061879>
11. Fong T, Junus A, Wen M, et al. Comorbidity among symptoms of internet gaming disorder, social withdrawal, and depression in 3430 young people in Hong Kong: A network analysis[J]. *J Affect Disord*. 2024;359:319–26. <https://doi.org/10.1016/j.jad.2024.05.091>
12. Caumo GH, Spritzer D, Carissimi A, et al. Exposure to electronic devices and sleep quality in adolescents: a matter of type, duration, and timing[J]. *Sleep Health*. 2020;6(2):172–8. <https://doi.org/10.1016/j.sleh.2019.12.004>
13. Tuncurk M, Karacetin G, Ermiş C, et al. Internet gaming disorder and problematic internet use: the links between cyberbullying, aggression, loneliness and psychiatric comorbidities[J]. *Psychiatr Danub*. 2023;35(3):395–406. <https://doi.org/10.24869/psyd.2023.395>
14. Fekih-Romdhane F, Lamloum E, Loch AA, et al. The relationship between internet gaming disorder and psychotic experiences: cyberbullying and insomnia severity as mediators[J]. *BMC Psychiatry*. 2023;23(1):857. <https://doi.org/10.1186/s12888-023-05363-x>
15. Lin YJ, Yen JY, Lin PC, et al. Circadian typologies and insomnia in individuals with internet gaming disorder comorbid with attention deficit/hyperactivity disorder[J]. *Sci Rep*. 2023;13(1):12764. <https://doi.org/10.1038/s41598-023-39462-2>
16. Minami H, Shirai T, Okada S, et al. Comprehensive analysis including in-game spending and violent game playing in patients with internet gaming disorder[J]. *Neuropsychopharmacol Rep*. 2024;44(3):631–8. <https://doi.org/10.1002/npr.2.12470>
17. Muller KW, Beutel ME, Wolfling K. A contribution to the clinical characterization of internet addiction in a sample of treatment seekers: validity of assessment, severity of psychopathology and type of co-morbidity[J]. *Compr Psychiatry*. 2014;55(4):770–7. <https://doi.org/10.1016/j.comppsy.2014.01.010>
18. Joo A, Park I. [Effects of an empowerment education program in the prevention of internet games addiction in middle school students][J]. *J Korean Acad Nurs*. 2010;40(2):255–63. <https://doi.org/10.4040/jkan.2010.40.2.255>
19. Hao J, Liao Z, Huang Q, et al. Classifying problematic gaming using a latent profile approach based on personality traits in Chinese young adolescent. *BMC Psychiatry*. 2025;25:104. <https://doi.org/10.1186/s12888-025-06561-5>
20. Yao MZ, He J, Ko DM, et al. The influence of personality, parental behaviors, and self-esteem on internet addiction: a study of Chinese college students[J]. *Cyberpsychol Behav Soc Netw*. 2014;17(2):104–10. <https://doi.org/10.1089/cyber.2012.0710>
21. van der Aa N, Overbeek G, Engels RC, et al. Daily and compulsive internet use and well-being in adolescence: a diathesis-stress model based on big five personality traits[J]. *J Youth Adolesc*. 2009;38(6):765–76. <https://doi.org/10.1007/s10964-008-9298-3>
22. Martucci A, Gursesli MC, Duradoni M, Guazzini A. Overviewing gaming motivation and its associated psychological and sociodemographic variables: A PRISMA systematic review. *Hum Behav Emerg Technol*. 2023;2023(e5640258). <https://doi.org/10.1155/2023/5640258>
23. Yee N. The Demographics, Motivations, and Derived Experiences of Users of Massively Multi-User Online Graphical Environments, in Presence, 2006;15(3):pp. 309–329, 1 June. <https://doi.org/10.1162/pres.15.3.309>

24. Király O, Billieux J, King DL, Urbán R, Koncz P, Polgár E, Demetrovics Z. A comprehensive model to understand and assess the motivational background of video game use: the gaming motivation inventory (GMI). *J Behav Addict*. 2022;11(3):796–819. PMID: 35939353; PMCID: PMC9872527.
25. Teoh AN, Dillon R, Kaur D. The validation and psychometric properties of the gaming instinctual motivation scale. *Eur J Invest Health Psychol Educ*. 2023;13(9):1895–908. <https://doi.org/10.3390/ejihpe13090137>. PMID: 37754476; PMCID: PMC10527710.
26. Gursesli MC, Martucci A, Alan DA, Mattiassi M, Duradoni, Guazzini A. 2024. Development and Validation of the Psychological Motivations for Playing Video Games scale (PMPVGs). *Simul. Gaming* 55, 5 (Oct 2024), 856–885. <https://doi.org/10.1177/10468781241260861>
27. Moge CE, Romano DM. Contextualising video game engagement and addiction in mental health: the mediating roles of coping and social support[J]. *Heliyon*. 2020;6(11):e5340. <https://doi.org/10.1016/j.heliyon.2020.e05340>.
28. Marino C, Canale N, Vieno A, Caselli G, Scacchi L, Spada MM. Social anxiety and internet gaming disorder: the role of motives and metacognitions. *J Behav Addict*. 2020;9(3):617–28. PMID: 32750032; PMCID: PMC8943663.
29. Kim DJ, Kim K, Lee HW, et al. Internet game addiction, depression, and escape from negative emotions in adulthood: A nationwide community sample of Korea[J]. *J Nerv Ment Dis*. 2017;205(7):568–73. <https://doi.org/10.1097/NMD.0000000000000698>.
30. Lin S, Tan L, Chen X, Liao Z, Li Y, Tang Y, Shi Y, Hao J, Wang X, Huang Q, Shen H. Emotion dysregulation and internet gaming disorder in young people: mediating effects of negative affect and metacognitions. *J Affect Disord*. 2023;341:104–11. Epub 2023 Aug 18. PMID: 37597784.
31. Gentile DA, Bailey K, Bavelier D, et al. Internet gaming disorder in children and Adolescents[J]. *Pediatrics*. 2017;140(Suppl 2):S81–5. <https://doi.org/10.1542/peds.2016-1758H>.
32. Yen JY, Liu TL, Wang PW, et al. Association between internet gaming disorder and adult attention deficit and hyperactivity disorder and their correlates: impulsivity and hostility[J]. *Addict Behav*. 2017;64:308–13. <https://doi.org/10.1016/j.addbeh.2016.04.024>.
33. Jiali YING, Xiuqin CHEN, Chen YANG, Limei HUANG, Yan YU, Xuemei GAO. Moderating role of personality traits in the influence of violent video games on adolescent aggressive behavior[J]. *Chin J Child Health Care*. 2023;31(6):684–8.
34. Kühn S, Kugler DT, Schmalen K, et al. Does playing violent video games cause aggression? A longitudinal intervention study[J]. *Mol Psychiatry*. 2019;24(8):1220–34. <https://doi.org/10.1038/s41380-018-0031-7>.
35. Anderson CA, Shibuya A, Ihori N, et al. Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries: a meta-analytic review[J]. *Psychol Bull*. 2010;136(2):151–73. <https://doi.org/10.1037/a0018251>.
36. Muller KW, Dreier M, Duvén E, et al. Adding clinical validity to the statistical power of Large-Scale epidemiological surveys on internet addiction in adolescence: A combined approach to investigate psychopathology and Development-Specific personality traits associated with internet addiction[J]. *J Clin Psychiatry*. 2017;78(3):e244–51. <https://doi.org/10.4088/JCP.15m10447>.
37. King DL, Delfabbro PH, Perales JC et al. Maladaptive player-game relationships in problematic gaming and gaming disorder: A systematic review[J]. *Clin Psychol Rev*. 2019;73:101777. <https://doi.org/10.1016/j.cpr.2019.101777>
38. Rehbein F, Kliem S, Baier D, et al. Prevalence of internet gaming disorder in German adolescents: diagnostic contribution of the nine DSM-5 criteria in a state-wide representative sample[J]. *Addiction*. 2015;110(5):842–51. <https://doi.org/10.1111/add.12849>.
39. Zhang X, Wang MC, He L, et al. The development and psychometric evaluation of the Chinese big five personality inventory-15[J]. *PLoS ONE*. 2019;14(8):e221621. <https://doi.org/10.1371/journal.pone.0221621>.
40. Wang MC, Dai XY, Yao SQ. Development of Chinese big five personality inventory (CBF-PI) I: theoretical framework and reliability analysis. *Chin J Clin Psychol*. 2010;18:545–8. <https://doi.org/10.16128/j.cnki.1005-3611.2015.03.001>.
41. Wang MC, Dai XY, Yao SQ. Development of the Chinese big five personality inventory (CBF-PI) III: psychometric properties of CBF-PI brief version. *Chin J Clin Psychol*. 2011;19:454–7. <https://link.cnki.net/doi/10.16128/j.cnki.1005-3611.2011.04.004>
42. Wang MC, Dai XY, Yao SQ. Development of the Chinese big five personality inventory (CBF-PI) II: validity analysis. *Chin J Clin Psychol*. 2010;18:687–90. <http://doi.org/10.16128/j.cnki.1005-3611.2015.04.001>.
43. Dong G, Wang M, Liu X, et al. Cue-elicited craving-related lentiform activation during gaming deprivation is associated with the emergence of internet gaming disorder[J]. *Addict Biol*. 2020;25(1):e12713. <https://doi.org/10.1111/adb.12713>.
44. Zhang J, Hu Y, Wang Z, et al. Males are more sensitive to reward and less sensitive to loss than females among people with internet gaming disorder: fMRI evidence from a card-guessing task[J]. *BMC Psychiatry*. 2020;20(1):357. <https://doi.org/10.1186/s12888-020-02771-1>.
45. Wang L, Zheng H, Wang M, et al. Sex differences in neural substrates of risk taking: implications for sex-specific vulnerabilities to internet gaming disorder[J]. *J Behav Addict*. 2022;11(3):778–95. <https://doi.org/10.1556/2006.2022.00057>.
46. Maxwell AM, Brucar LR, Zilverstand A. A systematic review of sex/gender differences in the multi-dimensional Neurobiological mechanisms in addiction and their relevance to impulsivity[J]. *Curr Addict Rep*. 2023;10(4):770–92. <https://doi.org/10.1007/s40429-023-00529-9>.
47. Varchetta M, Tagliaferri G, Mari E, Quagliari A, Cricenti C, Giannini AM, Marti-Vilar M. Exploring gender differences in internet addiction and psychological factors: A study in a Spanish sample. *Brain Sci*. 2024;14(10):1037. <https://doi.org/10.3390/brainsci14101037>. PMID: 39452049; PMCID: PMC11505988.
48. Mestre-Bach G, Fernandez-Aranda F, Jiménez-Murcia S. Exploring internet gaming disorder: an updated perspective of empirical evidence (from 2016 to 2021)[J]. *Compr Psychiatry*. 2022;116:152319. <https://doi.org/10.1016/j.cpmppsy.2022.152319>.
49. Nie Q, Griffiths MD, Teng Z. The role of Self-Esteem in protecting against Cyber-Victimization and gaming disorder symptoms among adolescents: A Temporal dynamics analysis. *J Youth Adolesc*. 2024;53(4):863–76. <https://doi.org/10.1007/s10964-023-01890-8>. Epub 2023 Oct 30. PMID: 37904058.
50. Stevens MW, Dorstyn D, Delfabbro PH, et al. Global prevalence of gaming disorder: A systematic review and meta-analysis[J]. *Aust N Z J Psychiatry*. 2021;55(6):553–68. <https://doi.org/10.1177/0004867420962851>.
51. Chiang C, Zhang M, Ho R. Prevalence of internet gaming disorder in medical students: A Meta-Analysis[J]. *Front Psychiatry*. 2021;12:760911DOI. <https://doi.org/10.3389/fpsy.2021.760911>.
52. Huageng YANG, Fang SUN, Huanhuan LI. A latent profile analysis of multiple family factors and its association with internet gaming disorder among middle school students: the mediating effect of maladaptive Cognition[J]. *Volume 22. Studies of Psychology and Behavior*; 2024. pp. 329–37. 3.
53. King DL, Delfabbro PH. The cognitive psychology of internet gaming disorder. *Clin Psychol Rev*. 2014;34(4):298–308. <https://doi.org/10.1016/j.cpr.2014.03.006>. Epub 2014 Apr 13. PMID: 24786896.
54. Rho MJ, Lee H, Lee TH, et al. Risk factors for internet gaming disorder: psychological factors and internet gaming Characteristics[J]. *Int J Environ Res Public Health*. 2017;15(1). <https://doi.org/10.3390/ijerph15010040>.
55. Chia D, Ng C, Kandasami G, et al. Prevalence of internet addiction and gaming disorders in Southeast Asia: A Meta-Analysis[J]. *Int J Environ Res Public Health*. 2020;17(7). <https://doi.org/10.3390/ijerph17072582>.
56. Donati MA, Chiesi F, Ammannato G, et al. Versatility and addiction in gaming: the number of video-game genres played is associated with pathological gaming in male adolescents[J]. *Cyberpsychol Behav Soc Netw*. 2015;18(2):129–32. <https://doi.org/10.1089/cyber.2014.0342>.
57. Gu X, Mao EZ. The impacts of academic stress on college students' problematic smartphone use and internet gaming disorder under the background of Neijuan: hierarchical regressions with mediational analysis on escape and coping motives. *Front Psychiatry*. 2023;13:1032700. <https://doi.org/10.3389/fpsy.2022.1032700>. PMID: 36683982; PMCID: PMC9849911.
58. Ciarrochi J, Parker P, Sahdra B, Marshall S, Jackson C, Gloster AT, Heaven P. The development of compulsive internet use and mental health: A four-year study of adolescence. *Dev Psychol*. 2016;52(2):272–83. <https://doi.org/10.1037/dev0000070>. PMID: 26595355.
59. Dong GH, Potenza MN. Considering gender differences in the study and treatment of internet gaming disorder. *J Psychiatr Res*. 2022;153:25–9. <https://doi.org/10.1016/j.jpsychires.2022.06.057>. Epub 2022 Jun 30. PMID: 35793576.

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.