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ARTICLE

Internet Gaming Disorder and Mental Health of Children in China: A Latent Profile Analysis

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ABSTRACT

In recent years, speculation of an increase in Internet Gaming Disorder (IGD) has surfaced with the growing popularity of internet gaming among Chinese children and adolescents. The detrimental impact of IGD on mental health cannot be denied, even though only a small portion of the screen-dependent population exhibits psychopathological and behavioral symptoms. The present study aimed to explore a latent profile analysis (LPA) of Internet Gaming Disorder on the mental health of Chinese school students. The data were collected from a sample of 1005 Chinese school students (49.8% male; age $M = 13.32$, $SD = 1.34$ years) using a paper-pencil survey through convenience sampling. LPA explored three latent profiles of internet gamers: regular gamers (62.4%), moderate gamers (28.1%), and probable disordered gamers (9.4%). Results showed that the probable disordered gamers had significantly higher levels of depression, anxiety, emotional and conduct problems, hyperactivity, and peer problem symptoms as well as lower life satisfaction, and pro-social symptoms compared to regular and moderate gamers ($p < 0.05$). This study would be helpful to mental health professionals in designing interventions for gamers who present IGD symptoms. Future longitudinal studies should also be undertaken to assess whether mental health worsens for probable disordered gamers.

KEYWORDS

Internet gaming disorder; latent profile analysis; mental health; children and adolescents; China

Introduction

Internet and online gaming are omnipresent in the daily lives of Chinese children and adolescents [1]. Media involvement for youth has grown significantly during the last two decades. Children and adolescents perceive media presences (e.g., social media, messaging, gaming online) as essential for everyday life [2]. Newer generations of children in China are equipped with access to online and electronic games, making the connections they form less physically proximal [3]. In China, children and adolescents enjoy being online; a common experience of childhood that predecessors could not imagine or access. In 2019, approximately 175 million individuals below the age of 18 years, constituting 93.1% of the nation's minor demography, were online regularly and that rate is increasing alarmingly among minors below the age of 10 years old [4]. Screen time and online gaming increased unprecedently during the COVID-19 pandemic outbreak around the globe [5]. To curb the infection rate, shutdowns of schools and rigorous lockdown protocols forced the younger generation to depend on digital educational solutions. As a result, children and adolescents depend on the screen for educational, social connectivity, and entertainment purposes [6]. Unfortunately, this solution has a limitation, in that this age group could develop acute screen dependence since a majority of children and adolescents lack the prerequisite skills and expertise to maintain a safe online presence [7]. A common form of screen-based dependence is internet gaming disorder (IGD).

IGD was incorporated in the 5th version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) in 2013 for endorsing the negative consequences

of problematic online gaming as a disorder which ascertains comprehensive studies [8]. The International Classification of Diseases (ICD-11) classified problematic internet gaming as a disorder in 2018, characterized by a loss of self-control over gaming, a preference for gaming over other daily activities, and a profound willingness to continue or increase gaming in spite of aversive consequences. Clinical diagnosis of IGD endorses a minimum of five among the total of nine criteria: a. extreme preoccupation with gaming; b. unpleasant responses when withdrawn from gaming; c. increased gaming engagement; d. loss of control; e. giving up other interests or hobbies for gaming; f. continuation of excessive gaming despite knowing the negative psychosocial consequences; g. deceiving family members and others with the time spent on gaming; h. escaping negative moods by gaming; i. risking relations, occupation, and education for excessive gaming [9]. Although there is no denying that IGD has multifactorial mental health outcomes [1,10], there is not currently a sufficient assessment tool available for assessing its prevalence [11,12]. In prior studies, the prevalence rate of IGD varies depending on cultural differences and measuring instruments [1]. For example, Asian participants exhibited subsequently a higher prevalence rate of IGD (ranging from 1.6% to 48.4%) [13–15] than European participants (1.2% to 1.6%) [16,17]. The prevalence rate of IGD for Chinese participants has been reported ranging from 2% [15] to 17% [18]. According to the latest Statistical Report on China's Internet Development, the total number of internet users exceeds 1.7 billion people [19] with 666 million being online gamers [20]. The report also stated that internet usage and online gaming are getting significantly higher among youth than any other age group [19]. Usually, the majority of children and adolescents safely play internet games, which could be a conducive way of entertainment during this pandemic [21].

Nevertheless, evidence has demonstrated that there are a number of gamers who have excessive usage and can exhibit symptoms comparable to substance abuse users [22]. For example, excessive gaming can lead to aversive mental health outcomes, including poor sleep quality, insomnia, academic failure, depression, anxiety, dysfunctional family and peer relationships, and subsequent substance abuse disorders [23–26]. Previous literature has found an association between IGD and different mental health outcomes, including depressive symptoms, low self-esteem, phobias, among others [27–29]. Outcomes of longitudinal research have denoted that adverse mental health outcomes and IGD were significantly associated with each other [30,31]. In one study, researchers found that comorbid mental health problems were precursors to and precipitants of IGD [32]. Ho et al. [33] also found that those with IGD were more susceptible to developing depressive symptoms, even while their conditions were in remission. Similarly, individuals with IGD reported elevated levels of stress and depressive symptoms [31,34]; as well as a positive dichotomous correction with anxiety disorder [32]. Homogenous findings from the study of Wang et al. [35] suggest that individuals with comorbid IGD and Generalized Anxiety Disorder (GAD) tend to demonstrate higher depressive and anxiety symptoms and have an eight times higher likelihood of developing IGD. Reasonably, aversive life events cause stress, which often surfaces other associated mental health conditions (e.g., IGD). Previous research has also shown perceived stress among IGD-prone individuals was significantly higher, since their overall resilience was reported to be less than those without IGD [34,36].

It is reported that a wide range of behavioral problems, including impulsivity, stress, aggression, and hyperactivity are often induced by excessive internet gaming and IGD [37]. Additionally, due to excessive engagement in gaming, individuals with IGD have reported reduced social life and interactions, leading to loneliness [37], maladaptive coping [38], fewer friends [39] low self-esteem [37], and lower well-being [40]. Furthermore, previous studies have reported a sharp decline in life satisfaction among individuals with excessive internet gaming and IGD [40,41]. Excessive gaming time leads an individual to deal with negativity that causes dissatisfaction with life [42]. Lastly, IGD has been reported negatively with the fulfillment of elementary psychological needs [43].

Present study

Previously, a number of studies have examined mental health outcomes (depression, anxiety, stress) on excessive internet gaming and IGD mostly using a variable centered approach analysis. The present study aimed to assess the association between IGD and mental health outcomes through a person-centered approach: latent profile analysis (LPA). Intrinsically, LPA classifies the dynamics of homogenous sub-groups from a specific sample group based on predicting variables [44,45]. In particular, LPA is considered a model-based approach of latent variables that is robust to incorporating variables with multiple scales of measurement, accounts for measurement errors, and permits the integration of covariates [46]. To the best of our knowledge, for the first time, this present study attempted to reveal the association between IGD and mental health outcomes using LPA in Chinese children and adolescents.

Materials and Methods

Description of the participants

For the data collection, survey booklets were distributed among 16 high schools across five cities in China (Beijing, Dongguan, Kunming, Lanzhou, and Xi'an) using a convenience sampling technique. A total of 1200 survey booklets were distributed, and 1005 students completed the survey between 30 May 2023 and 15 June 2023, resulting in a response rate of 83.75%. The remaining 194 survey booklets were disregarded due to incomplete responses. Participants' ages ranged from 11 to 17 years, with a mean age of 13.32 years (SD = 1.34). The gender distribution was 49.8% male and 50.2% female. This present study complied with the Helsinki Declaration and its relevant all other amendments to collect data from human participants. The Ethical Committee of Zhejiang Normal University, Jinhua, China has approved the study (ERB No. ZSRT2023073, dated: 19/05/2023). Since the survey accumulated data from minor participants, the parents/guardians were approached

in advance prior to the conduction and explained the nature, intention, time, cost and benefits, and data confidentiality in detail. The survey was initiated once the parents/guardians provided informed consent. Detailed socio-demographic characteristics of the respondents are presented in Table 1.

Measures

All respondents in this research filled out a survey booklet including the following questionnaires: Beck Anxiety Inventory (BAI original version [47]; Chinese version [48]), the Beck Depression Inventory–II (BDI-II original version [49]; Chinese version [50]), Satisfaction with Life Scale (SWSL original version [51]; Chinese version [52]), Rosenberg Self-Esteem Scale (RSES original version [53]; Chinese version [54]), Internet Gaming Disorder Test (IGD original version [55]; Chinese version [56]), Strengths and Difficulties Questionnaire (SDQ original version [57]; Chinese version [58]), along with a section on socio-demographic information (respondent's age, gender, residence, number of family members, and daily gaming time).

BAI

BAI consists of 21 items to assess intensified anxiety symptoms (original version [47]; Chinese version [48]). Anxiety symptoms are measured using this instrument's physiological, emotional, and cognitive components. All participants are given a four-point rating scale ranging from 0 (*not at all*) to 3 (*severely-I could barely stand it*). For each statement they were asked how they have been affected in the last week, which includes the day they completed the BAI. The calculated total score of BAI ranges from 0 to 63, and the higher the total score denotes elevated anxiety of the respondents. The authors reported good internal consistency reliability and test-retest reliability. The Hamilton Rating Scale for Anxiety [59] has a relatively good correlation (0.51) with BAI. Furthermore, the Chinese version of BAI has demonstrated strong psychometric properties with Hamilton Rating Scale for Anxiety (internal consistency reliabilities ranging from 0.91 to 0.95; and a high correlation of 0.71). In the present study, the BAI had good model fits (χ^2 = 100.97, *df* = 189, *p* = 1.00, CFI = 1.00, TLI = 1.01, RMSEA = 0.00, SRMR = 0.05).

TABLE 1

Participants socio-demographic distribution

	Category	Percentage (*N* = 1005)
Age	11 year	0.3%
	12 year	40.1%
	13 year	19.2%
	14 year	13.4%
	15 year	22.5%
	16 year	3.9%
	17 year	0.7%
Gender	Male	49.8%
	Female	50.2%
Number of family members	2	1.0%
	3	43%
	4	37.3%
	5	14.2%
	6	4.5%
Daily gaming time	0–60 min	81.2%
	61–120 min	12.2%
	121–180 min	5.1%
	181–240 min	1.2%
	241 min and above	0.3%

BDI

The BDI was developed to screen the depression severity, consisting of 21 items [60] and later revised in 1996 [49] to be consistently better with the Diagnostic and Statistical Manual-IV (DMS-IV) criteria for depression severity [61]. On the four-point Likert scale (0 to 3), respondents are asked to rate their depressive state. The total score of BDI ranges from 0 to 63. It takes approximately 10 min to complete this screening tool. The original BDI has excellent psychometric properties (high internal consistency reliability: Cronbach's alpha = 0.92; test-retest reliability = 0.93). Internal consistency reliability of Chinese BDI was also demonstrated as good (Cronbach's alpha = 0.94) [51]. In the present study, the BDI had good model fits (χ^2 = 169.50, *df* = 189, *p* = 0.84, CFI = 1.00, TLI = 1.00, RMSEA = 0.00, SRMR = 0.04).

SWSL

SWSL (Original version [51]; Chinese version [52]) includes five items to screen individual satisfaction with life from a global cognitive judgmental outlook. Respondents rate their satisfaction level on each of the items (e.g., "In most ways my life is close to my ideal," "The conditions of my life are excellent") through a seven-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The total score of SWSL ranges from 5 to 35, where a higher total score denotes higher life satisfaction. In the present study, the SWSL had good model fits (χ^2 = 1.74, *df* = 5, *p* = 0.88, CFI = 1.00, TLI = 1.00, RMSEA = 0.00, SRMR = 0.01).

IGD-20 Test

IGD-20 Test (original version [55]; Chinese version [56]) was developed using diagnostic criteria for IGD mentioned in DSM-V [61]. This test has been designed and contains six key elements of addiction described by Griffiths [62]: salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse. Respondents rate their internet gaming intensity by the five-point-Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) with two (items 2 and 19) reverse items. The highest total score denotes elevated level of addiction to internet gaming. In the present study, the IGD-20 Test had good model fits (χ^2 = 177.44, *df* = 44, *p* = 0.09, CFI = 0.99, TLI = 0.99, RMSEA = 0.02, SRMR = 0.04).

SDQ

SDQ consists of 25 items to assess the behavioral problems of the youth (original version [57]; Chinese version [58]). Respondents are asked to rate their behavior to the five subscales for the last six months (emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behaviors) with a three-point Likert option ("Not true," "Somewhat true," or "Certainly true"). For each subscale, the total score ranging from 0 to 10 with the higher total score denoting greater problems except the prosocial sub scale. The internal consistency coefficient was satisfactory for the original SDQ total difficulties scale (α = 0.78). The Chinese version of SDQ also demonstrated satisfactory psychometric properties [58]. In the present study, the SDQ had good model fits (χ^2 = 707.92, *df* = 265, $p < 0.001$, CFI = 0.96, TLI = 0.95, RMSEA = 0.04, SRMR = 0.05).

Statistical analysis

LPA was run for the subscales of the IGD-20 Test. The LPA was run for two to five solutions. The Akaike information criterion (AIC), the Bayesian information criterion (BIC), and the sample-size-adjusted Bayesian information criterion (SSABIC), entropy, class size, and the Lo-Mendell-Rubin adjusted likelihood ratio test (LMRT) were examined to determine the number of latent groups. A One-Way Analysis of Variance (ANOVA) was performed to assess the differences in mental health outcomes among latent profiles. As ANOVA statistics provide overall differences among groups, a *post hoc* (i.e., Fisher's Least Significance Difference) analysis was performed to estimate the significant group differences in these variables. The $p < 0.05$ was considered statistically significant.

Results

Table A1 shows that skewness (ranging between −0.018 and 0.144) and kurtosis (ranging between −0.764 and −0.426) values are between the recommended ranges suggested by Kim (<2 for skewness and <7 for kurtosis) [63]. LPA results are presented in Table 2. Table 2 also shows the fit indices (AIC, BIC, SABIC, entropy, LMR Test value and its *p*-value, class size, and average class probabilities for most likely latent class membership by latent class) of the two-class to five-class solutions. In Table 2, the five-class solution had the lowest AIC (20498.75), BIC (20665.81), and SABIC (20557.83) values compared to other solutions. These values suggested five latent profiles. Regarding the entropy value, the four-class solution had the highest value (0.941), although all solutions had accepted level of entropy value (>0.80). Entropy value suggested a four-class solution would be better. However, the LMR test values did not support the four-class and five-class solutions, as LMR test values were non-significant (>0.05). LMR test values suggested three latent profiles. Class size values also rejected the four-class and five-class solutions as both contained a profile that had lower than a 5% observation (1.8% and 1.1%, respectively). Average class probabilities for most likely latent class membership by latent class values also showed that probability values of latent class membership were above 0.80 in the three-class solution. Therefore, the three-class solution (three latent profiles) was taken into consideration based on the above fit statistics and previous studies. Among participants, 628 were in the first profile, 283 in the second profile, and 94 in the third profile.

Table 3 presents the means and standard deviations of gaming disorder symptoms, the full IGD-20 Test, and daily

TABLE 2

Fit indices, class size and average class probabilities for most likely latent class membership by latent class

Solutions	AIC	BIC	SABIC	Entropy	LMRT (*p*-value)	Class size	Average class probabilities for most likely latent class membership by latent class				
							1	2	3	4	5
2	22074.01	22152.63	22101.81	0.923	2502.17 (<0.001)	743 (74.0%)	0.985	0.015			
						262 (26.0%)	0.046	0.954			
3	**21085.96**	**21194.06**	**21124.19**	**0.933**	**976.50 (0.013)**	**628 (62.4%)**	**0.983**	**0.017**	**0.000**		
						283 (28.1%)	**0.046**	**0.938**	**0.015**		
						94 (9.4%)	**0.000**	**0.030**	**0.970**		
4	20681.63	20819.21	20730.28	0.941	406.53 (0.140)	617 (61.3%)	0.982	0.000	0.018	0.000	
						104 (10.4%)	0.000	0.959	0.040	0.001	
						266 (26.4%)	0.040	0.025	0.935	0.000	
						18 (1.8%)	0.000	0.047	0.000	0.953	
5	20498.75	20665.81	20557.83	0.868	190.29 (0.199)	514 (51.1%)	0.934	0.066	0.000	0.000	0.000
						193 (19.3%)	0.111	0.822	0.000	0.067	0.000
						94 (9.3%)	0.000	0.000	0.948	0.050	0.001
						193 (19.2%)	0.000	0.065	0.015	0.920	0.000
						11 (1.1%)	0.000	0.000	0.007	0.000	0.993

Note: AIC = Akaike information criterion; BIC = Bayesian information criterion, SSABIC = Sample-size-adjusted Bayesian information criterion; LMRT = Lo-Mendell-Rubin adjusted likelihood ratio test.

gaming time. Profile 1 had the lowest scores in salience-tolerance, mood modification, withdrawal, conflict, and relapse than the other two profiles. Profile 3 also had the highest scores in these symptoms. Similar trends were found in the total score of the IGD-20 Test and time spent on daily gaming. Based on these scores, the first profile is labelled as a regular gamer, the second profile as a moderate gamer, and the third profile as a probable disordered gamer. Fig. 1 presents the distribution of gaming disorder symptom scores.

Table 4 presents the One-Way ANOVA results. Results showed significant mean differences among regular gamers, moderate gamers, and probable disordered gamers in depression (F = 19.157, p < 0.001, partial eta squared = 0.037), anxiety (F = 19.908, p < 0.001, partial eta squared = 0.038), life satisfaction (F = 7.146, p = 0.001, partial eta squared = 0.014), emotional problems (F = 7.138, p = 0.001, partial eta squared = 0.014), conduct problems (F = 8.162, p < 0.001, partial eta squared = 0.016), hyperactivity (F = 10.913, p < 0.001, partial eta squared = 0.021), peer problems (F = 6.796, p = 0.001, partial eta squared = 0.013), and pro-social behaviors (F = 3.217, p = 0.040, partial eta squared = 0.006). Probable disordered gamers had the highest scores in depression, anxiety, emotional problems, conduct problems, hyperactivity, and peer problems and the lowest scores in life satisfaction and pro-social behaviors compared to regular gamers and moderate gamers.

Table 5 presents regression analyses comparing the effects of regular, moderate, and problematic gaming on various psychological measures. For depression, moderate gaming is associated with significantly higher scores compared to regular gaming (β = 0.136, p < 0.001). Problematic gaming, compared to regular, has a larger effect on depression (β = 0.190, p < 0.001).

Similar patterns are also observed for anxiety, life satisfaction, emotional problems, conduct problems, hyperactivity, peer problems, and prosocial behaviors. Each measure shows significant differences between regular and problematic gaming, with lesser but still significant effects

TABLE 3

Descriptive statistics of gaming disorder symptoms, total IGD-20 Test score, and daily gaming time

Variable	Overall		Regular gamer		Moderate gamer		Probable disordered gamer	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Salience-tolerance	9.98	4.00	7.61	1.68	12.36	2.07	18.70	2.99
Mood modification	6.60	2.78	5.33	2.20	8.36	2.32	9.76	1.97
Withdrawal	4.65	2.06	3.52	0.74	5.69	1.41	9.13	1.99
Conflict	9.34	3.14	7.67	1.93	11.13	2.02	15.09	2.54
Relapse	4.91	2.25	3.55	0.84	6.46	1.55	9.28	1.93
IGD-20 Test	36.10	12.19	28.43	5.27	44.61	4.88	61.65	8.19
Daily gaming time	49.69	46.39	34.66	30.38	58.20	42.74	124.52	63.77

Note: M = Mean; *SD* = Standard deviation; IGD-20 Test = Internet Gaming Disorder-20 Test.

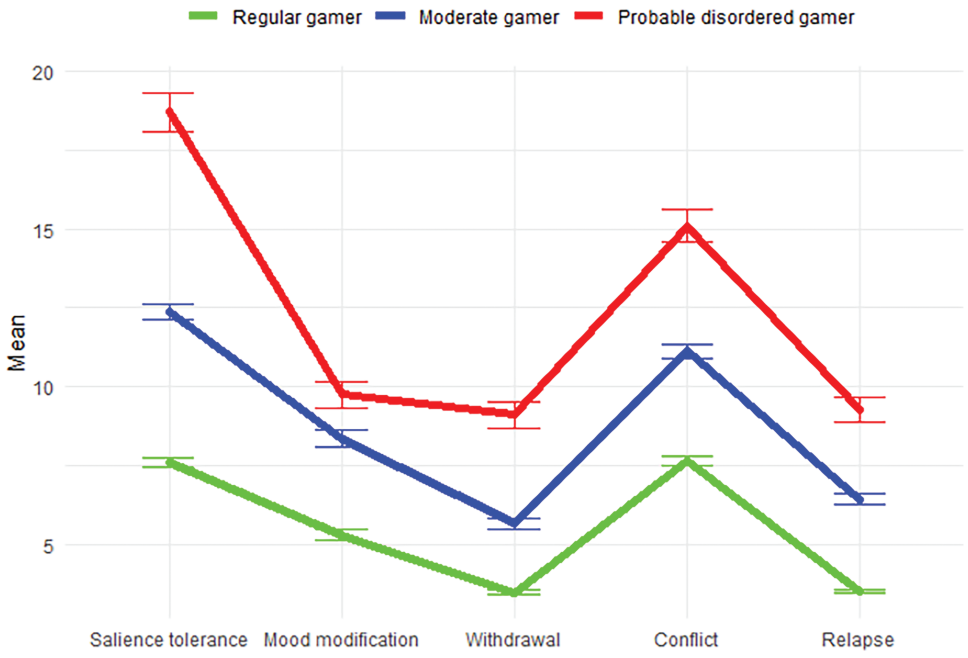

FIGURE 1. Mean comparison of three identified latent profiles.

TABLE 4

Descriptive statistics of gaming disorder symptoms, total IGD-20 Test score, and daily gaming

	Regular gamers *M (SD)*	Moderate gamers *M (SD)*	Probable disordered gamers *M (SD)*	*F*-value	*Sig.*	Partial eta squared
Depression	7.24 (7.65)	9.77 (9.68)	12.51 (12.30)	19.157	<0.001	0.037
Anxiety	24.67 (6.39)	26.18 (8.25)	29.64 (10.28)	19.908	<0.001	0.038
Life satisfaction	29.06 (6.49)	27.65 (7.07)	26.88 (7.23)	7.146	0.001	0.014
Emotional problems	2.60 (2.36)	2.87 (2.44)	3.57 (2.53)	7.138	0.001	0.014
Conduct problems	2.47 (2.19)	2.81 (2.14)	3.38 (2.25)	8.162	<0.001	0.016
Hyperactivity	2.86 (2.27)	3.45 (2.40)	3.80 (2.35)	10.913	<0.001	0.021
Peer problems	3.05 (2.27)	3.53 (2.23)	3.74 (2.24)	6.796	0.001	0.013
Prosocial behaviors	7.32 (2.39)	6.94 (2.42)	6.87 (2.48)	3.217	0.040	0.006

Note: *M* = Mean; *SD* = Standard deviation; *Sig.*= Significance.

TABLE 5

Regression analysis of the impact of internet gaming on mental health outcomes

Predictor	Unstandardized beta (B)		*β*	*p*-value	95% CI		R^2
	B	*SE*			Lower	Upper	
Depression							
Regular *vs*. moderate	2.691	0.629	0.136	<0.001	1.458	3.925	0.042
Regular *vs*. problematic	5.839	0.991	0.190	<0.001	3.894	7.783	
Anxiety							
Regular *vs*. moderate	1.572	0.530	0.094	0.003	0.531	2.612	0.040
Regular *vs*. problematic	5.223	0.836	0.202	<0.001	3.583	6.863	
Life satisfaction							
Regular *vs*. moderate	−1.431	0.486	−0.095	0.003	−2.385	−0.477	0.014
Regular *vs*. problematic	−2.261	0.766	−0.097	0.003	−3.764	−0.758	
Emotional problems							
Regular *vs*. moderate	0.255	0.172	0.048	0.139	−0.083	0.594	0.013
Regular *vs*. problematic	0.964	0.272	0.116	<0.001	0.430	1.497	
Conduct problems							
Regular *vs*. moderate	0.301	0.158	0.062	0.056	−0.008	0.611	0.011
Regular *vs*. problematic	0.785	0.248	0.104	0.002	0.297	1.272	
Hyperactivity							
Regular *vs*. moderate	0.593	0.167	0.114	<0.001	0.265	0.921	0.020
Regular *vs*. problematic	0.931	0.263	0.116	<0.001	0.414	1.448	
Peer problems							
Regular *vs*. moderate	0.502	0.163	0.100	0.002	0.182	0.821	0.015
Regular *vs*. problematic	0.777	0.257	0.100	0.003	0.274	1.281	
Prosocial behaviours							
Regular *vs*. moderate	−0.424	0.173	−0.079	0.015	−0.764	−0.084	0.008
Regular *vs*. problematic	−0.559	0.273	−0.068	0.041	−1.095	−0.024	

Note: SE = standard error; CI = confidence interval. Covariates for these analyses were age and gender.

between regular and moderate gaming. These results indicate that increased gaming severity is associated with worse outcomes across the range of mental health domains.

Table A2 presents the *post hoc* results of the One-Way ANOVA. From Table 5, probable disorders gamers had significantly higher depressive symptoms than regular

gamers (mean difference = −5.27, $p < 0.001$, 95% CI [−7.17, −3.36]) and moderate gamers (mean difference = −2.74, $p = 0.009$, 95% CI [−4.79, −0.69]). Moderate gamers also had higher depressive symptoms than regular gamers (mean difference = −2.52, $p < 0.001$, 95% CI [−3.75, −1.29]). Regarding anxiety symptoms, probable disordered gamers had significantly higher anxiety symptoms than regular gamers (mean difference = −4.97, $p < 0.001$, 95% CI [−6.57, −3.37]) and moderate gamers (mean difference = −3.46, $p < 0.001$, 95% CI [−5.19, −1.74]). Moderate gamers also had significantly higher anxiety symptoms than regular gamers (mean difference = −1.51, $p = 0.004$, 95% CI [−2.55, −0.47]).

Regarding life satisfaction, regular gamers had significantly higher life satisfaction scores compared to moderate gamers (mean difference = 1.41, $p = 0.003$, 95% CI [0.46, 2.36]) and probable disordered gamers (mean difference = 2.18, $p = 0.003$, 95% CI [0.72, 3.64]). Results regarding emotional problems showed disordered gamers had higher emotional problems than regular gamers (mean difference = −0.98, $p < 0.001$, 95% CI [−1.50, −0.46]) and moderate gamers (mean difference = −0.71, $p = 0.013$, 95% CI [−1.27, −0.15]). Regarding conduct problems, disordered gamers had higher conduct problems than regular gamers (mean difference = −0.91, $p < 0.001$, 95% CI [−1.38, −0.43]) and moderate gamers (mean difference = −0.56, $p = 0.031$, 95% CI [−1.07, −0.05]). Moderate gamers also had significantly higher conduct problems than regular gamers (mean difference = −0.31, $p = 0.028$, 95% CI [−0.65, −0.04]). Regarding hyperactivity, regular gamers had significantly lower hyperactivity compared to moderate gamers (mean difference = −0.059, $p < 0.001$, 95% CI [−0.92, −0.27]) and probable disordered gamers (mean difference = −0.94, $p < 0.001$, 95% CI [−1.44, −0.44]). Table 5 also shows that regular gamers had lower peer problems than moderate gamers (mean difference = −0.47, $p = 0.003$, 95% CI [−0.79, −0.16]) and probable disordered gamers (mean difference = −0.69, $p = 0.006$, 95% CI [−1.18, −0.21]). Regarding prosocial behaviors, regular gamers had significantly higher scores than moderate gamers (mean difference = 0.45, $p = 0.028$, 95% CI [0.04, 0.72]).

Discussion

This present cross-sectional study sought to explore mental health outcomes (anxiety, depression, stress, emotional and conduct problems, and life satisfaction) of IGD among the Chinese children and adolescents. Additionally, the comorbidity of IGD with mental health problems was examined. To the best of our knowledge, this study is among the few that have investigated the association between IGD and different mental health outcomes in Chinese children and adolescents through LPA. Comprehensive findings of the LPA confirmed three latent profiles of internet gamers.

Findings derived from the LMR test values demonstrated three latent profiles of the internet gamers, Profile 1 (Regular Gamer: 62.53%), Profile 2 (Moderate Gamer: 28.13%), and Profile 3 (Probable Disordered Gamer: 9.34%). The LPA demonstrated comorbidity of the addiction components (salience-tolerance, mood modification, withdrawal, conflict, and relapse), time spent on daily gaming, and IGD among probable disordered gamers; and higher depression, anxiety, emotional and conduct problems, hyperactivity, and peer problems as well as lower scores in life satisfaction and prosocial behaviors compared to regular gamers and moderate gamers. Specifically, greater time spent on gaming and IGD symptoms tends to increase the psychopathological and mental health risks among the probable disordered gamers than the other two profiles. Additionally, the findings suggest a positive association between increased gaming intensity and mental health problems prevail among the moderate and problematic gamers.

The respondents from Profile 3 have appraised an average of 124.52 min of daily gaming time, which is homogenous to previous studies [64,65]. Those with high daily gaming time tended to be synonymous with those classified as probable disordered gamers, determined by their total IGD-20 score. Although the term 'problematic gaming/gamer' varies in different literature, it has categorically been considered problematic playing surfaced with the elevated time of playing games [66]. The excessive use of gaming in this case results in social and emotional impairment and viewing the use of gaming as overindulgent [67].

Arguably, problematic or addictive gamers should experience six core components of addiction: salience, mood modification, tolerance, withdrawal, conflict, and relapse [68]. Most of these activities are based on these core components of addiction, where the presence of most symptoms denotes the potential problematic gaming [67]. This study's finding suggested low scores of salience-tolerances, mood modification, withdrawal, conflict, and relapse for regular gamers compared to the moderate and probable disordered gamers which is precisely in line with the existing literature.

Another important objective of this study was to elucidate the association between IGD and mental health and behavioral outcomes. Depicted from the Chinese sample, the results of this present study illustrated a positive association between probable disordered gamers and depression, anxiety, emotional and conduct problems, hyperactivity, peer problems and negative correlations with life satisfaction and pro-social behaviors. These relationships have all been found to be in alignment with previous research in terms of positive and negative associations with these outcomes [69–73]. Our presented results are also identically homogenous with the correlation between problematic gaming and anxiety [74], depression [71] and other psychological functioning. In addition, problematic gaming youth and adolescents report having low irritable or bad moods and feeling exhausted or grief than non-problematic gamers [66].

Often addictions are associated with pathological aggressive behaviors that impairs normal functioning and this finding is similar for gaming domains in the DSM-IV [63]. Therefore, it is expected that problematic gamers will demonstrate aggressive and hostile behavior resulting in significant emotional, conduct, and peer problems with

elevated hyperactivity. In conjunction with the existing literature, the results of this study shed light on aggression's negative association with prosocial behavior and simultaneous impaired normal functioning [75]. Hinsch et al. [76] found in their experimental study that a decrease in gaming helps to enhance and boost life satisfaction. Increasing gaming time has a positive correlation with lower life satisfaction because of declining well-being, poor social skills, and loneliness [77]. Probable disordered gamers often depend on their online connections rather than proximal social connection which can lead to crippling socialization, perceived social support, and resulting life satisfaction.

Behavioral addiction, especially the tendency of gaming has yet to be comprehended clearly in research. However, the DSM-5 [8] has recommended different categories of gaming on the basis of severity and their subsequent functional impairment. Previous studies have also suggested a correlation between the engagement and addictive behavioral outcomes [78,79]. According to the DSM standard, different functional impairments are contingent with gaming duration. Objectively, this study was not diagnosis oriented; rather it intended to explore probable disordered gaming and its corresponding effects on the mental health outcomes through latent profiling. To understand overall gaming tendency and its impact on mental health functioning, it is also necessary to focus on the motivations behind such probable addictive behaviors. Moreover, the correlation as well as comorbidity between IGD and mental health outcomes need to be explored in future studies.

Limitations and Future Research Implication

This present study is not without limitations. First, the IGD-20 Test has limited existing literature on Chinese population. How efficiently this tool assesses IGD among children and adolescents is relatively unknown. An adequate number of literatures could encompass more cogency for the present study. Second, the study data were collected using a self-report cross-sectional survey, which might be subject to memory bias and desirability of social norms of the respondents. This also conforms to the drawback of determining causality among the study variables. However, the study interpreted IGD, and mental health outcomes based on latent personality profiles. Since the personality traits are relatively static, it is important to interpret internet gaming and other mental health condition based on personality profiles [80]. Further longitudinal LPA is recommended in future research to discern the developmental trajectories of children and adolescents in terms of the severity of mental health outcomes or normalization due to the presence of IGD. Moreover, longitudinal data will also reveal whether the present latent profiles are stable or change over time. By randomized sampling, the results could help to generalize to the overall national population, however, the present study lacks such sampling technique. Moreover, problematic gaming has shown a significant impact on sleep quality and disturbance [74] which is related to mental health and functional impairment, but this present study has not explored this phenomenon.

Conclusions

This present study endeavors to contribute literature on gaming behavior and its mental health outcomes through latent profiling. The study unveils the positive correlations of probable problematic gaming disorder with different mental health problems, such as: depression and anxiety, as well as aggressive and hostile behaviors (conduct problems, hyperactivity, emotional problems, and peer problems). Probable disordered gamers subsequently were found to have reduced life satisfaction and prosocial behavior compared to those will less IGD scores. The findings of this study can be useful for mental health and behavioral professionals to design reasonable intervention programs considering personality and individual differences for children and adolescents in our ever-evolving social world online.

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Appendix A

TABLE A1

Descriptive statistics and normality assessment for study variables (n = 1005)

Variable	*M*	*SD*	Skewness	Kurtosis
Salience-tolerance	9.984	4.004	1.258	1.535
Mood modification	6.5990	2.77858	0.556	−0.262
Withdrawal	4.6517	2.06182	1.648	2.975
Conflict	9.3363	3.13608	0.766	0.830
Relapse	4.9065	2.25452	1.272	1.310
IGD-20 Test	36.0955	12.18879	0.995	1.096
Depression	8.4478	8.93528	1.710	4.061
Anxiety	25.5582	7.51995	2.750	2.173
Life satisfaction	28.4627	6.76762	−1.349	1.549
Emotional problems	2.7642	2.41367	0.808	0.044
Conduct problems	2.6567	2.20073	0.944	0.707
Hyperactivity	3.1144	2.33709	0.561	−0.127
Peer problems	3.2507	2.26809	0.567	−0.374
Prosocial behaviors	7.1731	2.41259	−0.689	−0.157

Note: *M* = Mean, *SD* = Standard Deviation.

TABLE A2

***Post hoc* test results among latent profiles in depression, anxiety, life satisfaction, emotional problem, conduct problem, hyperactivity, peer problem, prosocial behaviors**

Variable	(I)	(J)	Mean difference (I-J)	*Sig.*	95% Confidence interval		
					Lower bound	Upper bound	Effect size
Depression	Normal gamers	Moderate gamers	**−2.52**	**<0.001**	−3.75	−1.29	0.29
		Probable disordered gamers	**−5.27**	**<0.001**	−7.17	−3.36	0.51
	Moderate gamers	Probable disordered gamers	**−2.74**	**0.009**	−4.79	−0.69	0.25
Anxiety	Normal gamers	Moderate gamers	**−1.51**	**0.004**	−2.55	−0.47	0.20
		Probable disordered gamers	**−4.97**	**<0.001**	−6.57	−3.37	0.58
	Moderate gamers	Probable disordered gamers	**−3.46**	**<0.001**	−5.19	−1.74	0.37
Life satisfaction	Normal gamers	Moderate gamers	**1.41**	**0.003**	0.46	2.36	0.20
		Probable disordered gamers	**2.18**	**0.003**	0.72	3.64	0.32
	Moderate gamers	Probable disordered gamers	0.77	0.336	−0.80	2.34	0.11
Emotional problems	Normal gamers	Moderate gamers	−0.27	0.118	−0.61	0.07	0.11
		Probable disordered gamers	**−0.98**	**<0.001**	−1.50	−0.46	0.40
	Moderate gamers	Probable disordered gamers	**−0.71**	**0.013**	−1.27	−0.15	0.28
Conduct problems	Normal gamers	Moderate gamers	**−0.31**	**0.028**	−0.65	−0.04	0.16

(Continued)

Table A2 (continued)

Variable	(I)	(J)	Mean difference (I-J)	*Sig.*	95% Confidence interval		
					Lower bound	Upper bound	Effect size
		Probable disordered gamers	**−0.91**	**<0.001**	−1.38	−0.43	0.41
	Moderate gamers	Probable disordered gamers	**−0.56**	**0.031**	−1.07	−0.05	0.26
Hyperactivity	Normal gamers	Moderate gamers	**−0.59**	**<0.001**	−0.92	−0.27	0.25
		Probable disordered gamers	**−0.94**	**<0.001**	−1.44	−0.44	0.41
	Moderate gamers	Probable disordered gamers	−0.35	0.210	−0.89	0.20	0.15
Peer problems	Normal gamers	Moderate gamers	**−0.47**	**0.003**	−0.79	−0.16	0.21
		Probable disordered gamers	**−0.69**	**0.006**	−1.18	−0.21	0.30
	Moderate gamers	Probable disordered gamers	−0.22	0.417	−0.75	0.31	0.09
Prosocial behaviors	Normal gamers	Moderate gamers	**0.38**	**0.028**	0.04	0.72	0.16
		Probable disordered gamers	0.45	0.092	−0.07	0.97	0.18
	Moderate gamers	Probable disordered gamers	0.07	0.804	−0.49	0.63	0.28

Note: *Sig.* = Significance.