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Latent profile and transition analyses of internet gaming disorder among college students: A one-year longitudinal study

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Abstract: Previous research has indicated heterogeneity in Internet Gaming Disorder (IGD) profiles in college students. However, longitudinal evidence regarding the stability and transition patterns of IGD subgroups among college students remains limited. This two-wave longitudinal study, with a one-year interval, included 343 Chinese undergraduate students (57.7% female; mean age = 18.28 years, SD = 1.14) who participated in both surveys. Latent profile analysis identified three distinct IGD subgroups—High, Moderate, and Low IGD—which were consistent across both time points. Regression analyses indicated that male gender, greater gaming time, loneliness, and depression were associated with higher IGD severity. Self-control consistently served as a protective factor. Latent transition analysis revealed moderate stability but substantial fluidity in IGD profiles, particularly among Moderate and High IGD groups, suggesting that IGD is a dynamic condition that changes over time. These findings are consistent with self-regulation theory and compensatory internet use theory and underscore the importance of integrated self-regulatory interventions to address IGD in university settings.

Keywords: Internet gaming disorder; college students; latent profile analysis; latent transition analysis; risk and protective factors

Introduction

Internet Gaming Disorder (IGD) has become an increasingly prevalent concern among college students (Ohayon & Roberts, 2021; Fraiwan & Almomani, 2025), often leading to negative academic, social, and psychological outcomes (Benjet et al., 2023; Orozco et al., 2024; Wang et al., 2025). To better understand these adverse consequences, empirical research has examined the underlying psychological, behavioral, and environmental risk factors contributing to IGD (Zhuang et al., 2023). However, accumulating evidence suggests that these factors do not operate uniformly across individuals, highlighting substantial heterogeneity in IGD-related characteristics. Person-centered approaches, such as latent profile analysis (LPA), are therefore particularly suitable for identifying distinct subgroups characterized by different configurations of risk and protective factors.

IGD risk and protective factors. According to an integrative review by Gao et al. (2022), IGD-related risk factors span multiple domains, including psychosocial characteristics (e.g., anxiety, depression, emotional distress, low self-esteem), behavioral manifestations (e.g., prolonged gaming, poor academic performance), and environmental contexts (e.g., family dysfunction, interpersonal difficulties). Emerging evidence indicates that maladaptive cognitive and motivational patterns function as proximal risk factors for IGD through several mechanisms. First, distorted cognitions—such as overvaluation of in-game rewards, escapist beliefs, and perceived online superiority—bias information processing and reinforce excessive gaming as a primary coping strategy (Yu et al., 2021). Second, maladaptive motivational orientations, including heightened reward sensitivity and reliance on gaming for need fulfillment (e.g., competence, autonomy), increase persistence in gaming despite negative consequences (Zhou et al., 2024). Third, these cognitive–motivational patterns impair self-regulatory monitoring, thereby reducing individuals' capacity to disengage from gaming cues and amplifying compulsive use tendencies (Tu et al., 2025).

In contrast, several protective factors mitigate vulnerability to IGD by enhancing adaptive psychological functioning. Self-control, as a core regulatory capacity, enables individuals to inhibit impulsive gaming behaviors and prioritize long-term goals over immediate gratification, thereby directly reducing problematic use (Ropovik et al., 2023). Similarly, higher levels of self-esteem and life satisfaction decrease reliance on gaming as a compensatory mechanism for unmet psychological needs, weakening the motivational pull of virtual environments (Ji et al., 2022). In addition, stronger cognitive abilities—particularly executive functions such as attentional control and cognitive flexibility—facilitate more effective monitoring and regulation of gaming behavior, reducing susceptibility to addictive patterns (Ropovik et al., 2023).

Although previous studies have identified that individual demographic factors (e.g., gender, gaming time) and psychological factors (e.g., self-control, loneliness,

depression) can predict different categories of IGD, few longitudinal investigations have examined the temporal stability of these predictive effects across different time points. This study extends existing research by examining not only heterogeneity in IGD profiles among college students—a population less frequently studied than adolescents—but also the dynamic interplay of risk and protective factors over time, thereby clarifying which factors contribute to persistence or recovery.

Subgroupings. Empirical evidence shows that IGD exhibits substantial heterogeneity, characterized by distinct subgroups of gamers differing in symptom severity, motivational patterns, and psychosocial functioning. Using latent class or profile analyses (LCA/LPA), multiple studies across cultural contexts have consistently identified differentiated profiles rather than a single homogeneous continuum. Specifically, Lemmens et al. (2015), analyzing data from 2444 Dutch adolescents, identified three subgroups—normal, risky, and disordered gamers—thus providing early evidence that problematic gaming behaviors cluster in qualitatively distinct forms. Building on this, Cerniglia et al. (2019) applied LPA among Italian adolescents and found that the number and nature of IGD-related profiles varied by developmental stage, with two profiles emerging in early adolescence (ages 14–15) and three in mid-to-late adolescence (ages 16–17), suggesting that IGD heterogeneity may evolve with age. Similarly, Tullett-Prado et al. (2021), using data from 1032 gamers, identified four distinct classes—normative, aversive, moderate-risk, and high-risk—which differed significantly in their patterns of social engagement, highlighting the social-behavioral dimensions underlying IGD subtypes.

Theoretical foundations. Drawing on Self-Regulation Theory and Compensatory Internet Use Theory (CIUT) (Baumeister & Vonasch, 2015; Kardefelt-Winther, 2014), self-control is conceptualized as a central mechanism that enables individuals to manage impulses and regulate gaming behavior, reducing vulnerability to IGD. In parallel, CIUT posits that individuals may engage in online gaming to compensate for unmet psychosocial needs or to cope with negative emotions. Loneliness and depression are key indicators of such needs, as students experiencing social isolation or elevated depressive symptoms may use gaming as a coping strategy. Together, these frameworks provide a clear rationale for including self-control, loneliness, and depression as psychological variables in the LPA and LTA. This allows the study to examine how individual differences in regulation and compensatory motives contribute to the formation of distinct IGD profiles and their longitudinal transitions, highlighting potential mechanisms of persistence, escalation, or improvement over time.

The China context. In large-scale Chinese samples, Zhang et al. (2023) conducted LPA on 5988 high school students and delineated four gamer groups, ranging from healthy to disordered gamers, demonstrating a clear gradient in gaming control and priority. Likewise, Hao et al. (2025), analyzing 5593 young adolescents, categorized gamers into high-, medium-, and low-risk profiles based on personality traits, emphasizing that individual dispositions contribute meaningfully to IGD differentiation. Extending beyond symptomatology, Kim et al. (2023) classified 674 Korean online gamers according to gaming motives, revealing four distinct motivational profiles—problematic gamer type, highly engaged gamer type, and two casual gamer types—thereby demonstrating that motivational and affective dimensions further account for IGD heterogeneity. Taken together, these findings consistently suggest that IGD should be regarded as comprising several qualitatively distinct subgroups rather than a single disorder differing only in severity. Although extensive research has analyzed the heterogeneity of IGD using cross-sectional designs, limited attention has been paid to the developmental trajectories of these subgroups (Kang et al., 2025).

Need for longitudinal studies. Longitudinal assessments of IGD changes are vital for identifying specific high-risk developmental patterns and for informing tailored interventions suited to individuals with diverse developmental profiles (Teng et al., 2020). Most prior research has adopted a cross-sectional approach, with relatively few employing longitudinal designs to explore the heterogeneity and developmental trajectories of IGD (Lemmens et al., 2015; Wang et al., 2025; Chang et al., 2023). Moreover, existing research has primarily focused on adolescents rather than tertiary students (Zhang et al., 2023; Cerniglia et al., 2019), and the IGD subtypes identified through person-centered analyses have often been inconsistent across studies.

The present study. This study investigated the latent subgroups of IGD among college students at different time points and the individual demographic and psychological variables predict transitions between IGD profiles. We hypothesized that

Hypothesis 1. IGD exhibit in multiple distinct profiles rather than a homogeneous continuum.

Hypothesis 2. Most individuals maintain stable subgroup membership over time.

Hypothesis 3. Lower self-control and higher loneliness and depression predicts transitions toward more severe IGD profiles.

By incorporating LTA within this theoretical framework, the study aims not only to identify distinct subgroups but also to reveal differential mechanisms of persistence versus remission, providing insight into which individuals are more likely to escalate, maintain, or improve over time. This is particularly relevant for Moderate IGD users, who may represent a qualitatively distinct subgroup requiring targeted interventions.

Methods

Participants and setting

In this study, a non-random sampling strategy sample of 343 Chinese college student online game were participants. (54.7% female; M_{age} = 18.28, *SD* = 1.04). Regarding residential background, 69.4% of the participants were from rural areas, while 31.6% were from urban areas. In terms of academic major, 73.6% of the students were enrolled in science, technology, engineering, and mathematics (STEM)–related programs, whereas 26.4% majored in humanities and social sciences. On average,

participants reported spending 11.27 h per week on online gaming ($SD = 9.52$).

Measures

Data were collected at two time points: September 2022 (T1) and September 2023 (T2) using the following measures.

Self-control scale

Self-control at T1 was measured using the seven-item Brief Self-Control Scale (Morean et al., 2014; Luo et al., 2021), which assesses self-discipline and impulse regulation. Participants rated items on a 5-point scale, and average scores were computed, with higher values reflecting greater self-control. The scale demonstrated good internal consistency in this sample ($\alpha = 0.84$).

Loneliness scale

Loneliness at T1 was measured using the 8-item Short-Form Loneliness Scale (Hays & DiMatteo, 1987), a unidimensional instrument that has demonstrated satisfactory psychometric properties among Chinese college students (Gao et al., 2024). Participants rated each item on a 4-point scale. Mean scores were calculated, with higher values indicating greater loneliness. The scale demonstrated good internal consistency (Cronbach's $\alpha = 0.86$).

Depression scale

Depressive symptoms at T1 were assessed using the 9-item Patient Health Questionnaire (PHQ-9; Kroenke & Spitzer, 2002). Participants rated each item on a 4-point scale. Total scores were computed, with larger scores reflecting elevated depressive symptoms. The scale demonstrated high internal consistency ($\alpha = 0.88$).

Internet gaming disorder scale

IGD measured using the Internet Gaming Disorder Scale developed by Pearcy et al. (2016). This single-factor measure consists of nine items, each rated on a five-point Likert scale, where larger scores reflect elevated symptom severity. The scale demonstrated excellent internal reliability at both assessment points (T1: Cronbach's $\alpha = 0.92$; T2: Cronbach's $\alpha = 0.91$).

Procedure

This research was obtained from the Institutional Review Board of Shanghai Normal University (protocol code SHNU-IRB-2022038, date of approval: 28 April 2022), and all procedures aligned with the ethical provisions of the Helsinki Declaration and its later modifications. Prior to participating in the anonymous online survey conducted between September 2022 and September 2023, all participants provided informed consent in compliance with all regulatory standards. Data collection was conducted online through individualized survey links to ensure that each participant's responses could be matched across the two time points while maintaining anonymity. Electronic informed consent was obtained from all participants before data collection. To enhance data quality, attention-check items were embedded in the questionnaire, and response times were monitored to identify invalid submissions.

Data analysis

All data processing and statistical testing were carried out using SPSS 27.0 and Mplus 8.3. Before revising the preliminary analysis to focus on the correlation matrix, we assessed the missing data mechanism using Little's (1988) test. The results supported the assumption that the data were missing completely at random (MCAR), $\chi^2_{(18)} = 18.46$, $p = 0.298$. To ensure robustness, all longitudinal latent transition models were estimated using full information maximum likelihood (FIML) in Mplus (Lai, 2021). Descriptive statistics and demographic comparisons were first conducted to explore differences in IGD across gender, age, residence, and other background variables using *t*-tests and one-way ANOVA. Prior to advanced modeling, longitudinal measurement invariance of the IGD scale across the two waves was tested to ensure construct equivalence over time.

Subsequently, a Latent Profile Analysis (LPA) was conducted at each time point to identify distinct subgroups of college student gamers based on their IGD symptom patterns (Tein et al., 2013). Model selection was guided by multiple fit indices, including the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), adjusted BIC, entropy, and the Lo–Mendell–Rubin likelihood ratio test (LMRT). To further explore the factors associated with IGD subgroups, multinomial logistic regression analyses were conducted to assess the predictive effects of self-control, loneliness, and depression on IGD profile membership at T1 and T2. Finally, a Latent Transition Analysis (LTA) was employed to assess the longitudinal stability and transitions between IGD profiles from T1 to T2, with profile means and variances constrained for comparability across time (Nylund-Gibson et al., 2023).

Results

Preliminary analysis

Comparative statistics of IGD scores by demographic variables

Table 1 summarizes the descriptive statistics and group comparisons for IGD at both time points. Male students reported significantly higher IGD levels than female students at T1 and T2, indicating a moderate-to-large gender effect. No significant differences were found between urban and rural students. Family income showed a small but significant effect at T2, whereas differences at T1 were not significant. Overall, gender emerged as the most consistent demographic predictor of IGD across both waves.

Descriptive statistics and correlational analyses

Correlation analyses among the study variables are presented in Table 2. Self-control at T1 was negatively correlated with loneliness, depression, IGD at T1, and IGD at T2. Loneliness and depression were positively correlated and both were positively associated with IGD at T1 and T2. IGD scores at T1 and T2 were strongly positively correlated.

Measurement invariance analysis for IDG scale

As displayed in Table 3, the IGD scale demonstrated an acceptable fit across the configural, metric, and scalar

Table 1. Descriptive and comparative statistics of IGD

Variable	Category	IGD T1 (M ± *SD*)	t/F	IGD T2 (M ± *SD*)	t/F
Gender	Male	2.32 ± 0.84	t = 5.84***	2.31 ± 0.82	t = 3.63***
	Female	1.79 ± 0.79		1.99 ± 0.76	
Residence	Urban	1.94 ± 0.85	t = –0.79	2.15 ± 0.82	t = 1.25
	Rural	2.02 ± 0.84		2.04 ± 0.76	
Family income	Low (<3000 RMB)	1.75 ± 0.72	F = 1.79	1.84 ± 0.83	F = 3.68*
	Medium (3000–5000 RMB)	2.04 ± 0.85		2.17 ± 0.80	
	High (5000–8000 RMB)	1.81 ± 0.84		1.97 ± 0.70	
	Very high (>8000 RMB)	1.95 ± 1.06		1.38 ± 0.53	

Note. *$p < 0.05$, ***$p < 0.001$.

Table 2. Descriptive statistics and correlation matrix

	M	*SD*	1	2	3	4	5
1.Self-control T1	3.18	0.61	1				
2. Loneliness T1	2.01	0.55	–0.30**	1			
3. Depression T1	1.45	0.53	–0.26**	0.41**	1		
4. IGD T1	1.98	0.84	–0.36**	0.22**	0.28**	1	
5. IGD T2	2.10	0.79	–0.32**	0.20**	0.27**	0.56**	1

Note. **$p < 0.01$.

Table 3. Longitudinal measurement invariance for IGD scale

	Model fits						Model comparison			
	χ^2	df	CFI	TLI	RMSEA	SRMR	Pairs	ΔCFI	ΔTLI	ΔRMSEA
IGD										
M1 (CI)	210.07	109	0.973	0.962	0.052	0.031	—	—	—	—
M2 (MI)	216.08	115	0.973	0.964	0.051	0.033	M2 vs. M1	0.000	0.002	–0.001
M3 (SI)	227.55	121	0.971	0.964	0.051	0.033	M3 vs. M2	–0.002	0.000	0.000

Note. M1–M3 represent Models 1–3, CI = Configural invariance, MI = Metric invariance, SI = Scalar invariance.

models over the two assessment points. When the factor loadings were constrained to test metric invariance, the model fit indices changed only marginally, remaining well within established criteria for longitudinal invariance. Similarly, imposing equality constraints on the item intercepts to examine scalar invariance led to minimal variations in fit statistics, indicating that the overall model fit was well maintained. Taken together, the consistently minor differences across models provide strong evidence that the IGD scale retained stable psychometric properties over time, thereby meeting the requirements for configural, metric, and scalar invariance necessary for further longitudinal analyses.

Latent profile analysis for IGD

Table 4 presents the fit indices for two- to four-profile LPA solutions of IGD at T1 and T2. At both time points, model comparisons were conducted using the AIC, BIC, sample-size adjusted BIC (aBIC), entropy values, and the results of the BLRT and the LMRT. At Time 1, all model fit indices favored the three-profile solution. The three-profile model exhibited lower AIC (6014.56), BIC (6160.39), and aBIC (6039.85) values compared with the two-profile model, while maintaining a high entropy value of 0.935, indicating good classification accuracy. The LMRT was significant ($p = 0.015$), indicating that the three-profile model fit the data significantly better than the two-profile model. Although the four-profile model yielded slightly lower fit indices, the LMRT remained significant ($p = 0.017$), and the smallest profile accounted for only 4.4% of participants, falling below the recommended 5% threshold for acceptable profile size (Tein et al., 2013). Therefore, the three-profile solution was considered the most appropriate representation of the data at T1. At Time 2, a similar pattern emerged. The three-profile solution showed lower AIC (5494.51), BIC (5640.34), and aBIC (5519.80) values than the two-profile model, with the highest entropy (0.961), indicating excellent classification quality. The LMRT result ($p = 0.027$) supported the three-profile solution over the two-profile model, while the four-profile model did not yield a significant improvement in model fit ($p = 0.095$). Furthermore, the smallest profile in the four-profile model comprised only 0.6% of the total sample, again suggesting model overextraction. The BLRT remained significant ($p < 0.001$) across all comparisons, further confirming the superiority of the three-profile solution. Taken together, the

Table 4. Profile analysis solutions of IGD at T1 and T2

Profiles number	AIC	BIC	aBIC	Entropy	BLRT (*p*)	LMRT (*p*)	Profile prevalence
Time 1							
2	7424.95	7532.41	7443.59	0.926	<0.001	<0.001	0.601/0.399
3	6014.56	6160.39	6039.85	0.935	<0.001	0.015	0.557/0.292/0.152
4	5288.96	5473.17	5320.91	0.936	<0.001	0.017	0.557/0.292/0.108/0.044
Time 2							
2	7041.95	7149.41	7060.58	0.957	<0.001	<0.001	0.588/0.412
3	5494.51	5640.34	5519.80	0.961	<0.001	0.027	0.411/0.391/0.198
4	4710.80	4895.01	4742.74	0.954	<0.001	0.095	0.411/0.391/0.192/0.006

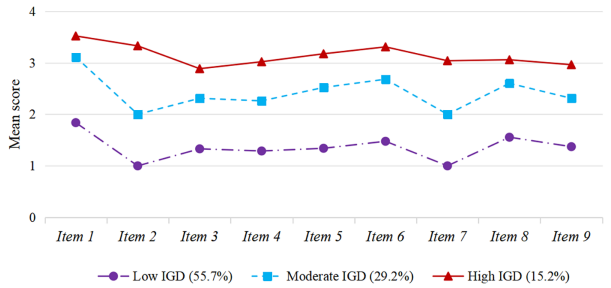

Figure 1. Latent profile plot of students' IGD at Time 1

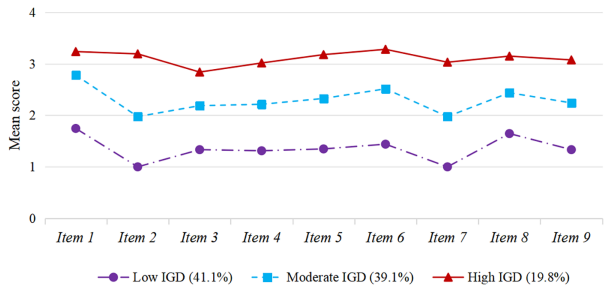

Figure 2. Latent profile plot of students' IGD at Time 2

model fit indices, classification quality, and interpretability all supported the three-profile solution as the best-fitting and most parsimonious representation of IGD at both T1 and T2. These findings support Hypothesis 1, indicating that IGD is characterized by multiple distinct latent profiles rather than a homogeneous continuum.

Figures 1 and 2 illustrate the three-profile structure identified at T1 and T2, respectively. The configuration patterns of IGD among college students showed considerable consistency over time, which supported the use of consistent labeling for the profiles. Profile 1, designated as the Low IGD group, included 55.7% of participants at T1 and 41.1% at T2, displaying the lowest average scores across all nine items. Profile 2, referred to as the Moderate IGD group, demonstrated moderately elevated scores on each indicator and constituted 29.2% of the sample at T1 and 39.1% at T2. Profile 3, identified as the High IGD group, recorded the highest mean values on every item compared to the other two profiles, making up 15.2% of respondents at T1 and 19.8% at T2. The similarity in profile structure and relative distribution across time points provides preliminary support for Hypothesis 2, suggesting a degree of stability in subgroup membership over time.

Table 5. Transition probabilities of IGD subgroups from T1 to T2

Profile group	Low IGD T2	Moderate IGD T2	High IGD T2
Low IGD T1	0.550	0.366	0.084
Moderate IGD T1	0.280	0.450	0.270
High IGD T1	0.154	0.365	0.481

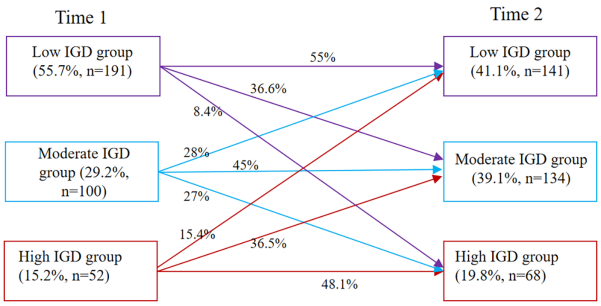

Figure 3. Longitudinal transitions of IGD profiles across two time points

Latent transition analysis for IGD profile

We conducted a LTA to examine the temporal stability and changes in profile membership across the two measurement occasions. As the three-profile solution provided the optimal fit in both LPAs, these profiles were retained, with their means and variances constrained to equality over time to ensure comparability. The LTA yielded satisfactory model fit (AIC = 11,446.80, BIC = 11,650.20, adjusted BIC = 11,482.07) and high classification precision (entropy = 0.936), indicating that the model effectively distinguished among the latent profiles across time. Table 5 and Figure 3 present the transition probabilities of IGD subgroup memberships from T1 to T2. As shown, while 55.0% of participants initially classified in the Low IGD group at T1 remained in the same category at T2, a substantial proportion (45.0%) shifted to higher-risk categories, indicating moderate fluidity even among Low IGD participants. Among individuals in the Moderate IGD group at T1, 28.0% improved to Low IGD, but 27.0% escalated to High IGD, highlighting considerable developmental volatility. For participants identified as High IGD at T1, nearly half (48.1%) remained in this category, whereas 51.9% improved to lower-risk groups, further underscoring the dynamic nature of IGD status

Table 6. Logistic regression analysis for IGD profiles

		High vs. Low IGD profile		Moderate vs. Low IGD profile	
		B	**OR**	***B***	**OR**
Gender	Time 1	−0.93**	0.39**	−0.81**	0.45**
	Time 2	−1.08***	0.34***	−0.50*	0.61*
Family income	Time 1	−0.01	1.01	−0.25	0.78
	Time 2	−0.19	0.82	−0.28	0.75
Residence	Time 1	0.08	1.08	0.35	1.42
	Time 2	0.08	1.08	−0.17	0.83
ATOG	Time 1	0.82***	2.27***	0.53***	1.67**
	Time 2	0.62***	1.85**	0.48***	1.62**
Self-control	Time 1	−1.28***	0.28***	−0.89***	0.41***
	Time 2	−1.45***	0.23***−	0.59**	0.56***
Loneliness	Time 1	0.98**	2.65*	0.58*	1.79*
	Time 2	1.17*	3.23*	0.38	1.46
Depression	Time 1	1.41***	4.11**	0.74**	2.09*
	Time 2	1.43***	4.19*	0.83**	2.30*

Note. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, Gender (male = 1, female = 2), Residence (1 = urban, 2 = rural), ATOG = Average time of online games per week, OR = Odds ratio, reference group = low IGD profile.

across time. Overall, these results suggest that IGD profiles exhibit moderate stability in some cases but also substantial fluidity, particularly for the Moderate and High IGD groups. This developmental volatility implies that individuals' gaming-related problems are not trait-like and may respond to timely interventions. Intervention strategies should therefore consider the dynamic nature of IGD, with a focus on periods of potential escalation or improvement rather than assuming fixed risk profiles. Taken together, these findings provide partial support for Hypothesis 2. Although a proportion of individuals remained in the same subgroup over time, the substantial transition probabilities across profiles indicate that subgroup membership is not fully stable but rather characterized by moderate stability alongside notable fluidity.

Analysis of IGD profile predictors for T1 and T2

Table 6 summarizes logistic regression findings on membership in the high- and moderate-level IGD profiles relative to the low IGD profile at T1 and T2. Odds ratios (OR) and regression coefficients (B) were estimated for gender, family income, residence, average time spent on online games (ATOG), and self-control. It should be noted that all predictors were measured at T1, and therefore these analyses reflect baseline associations rather than dynamic predictors of profile membership or transitions at T2. At both T1 and T2, gender emerged as a significant predictor of IGD profile membership, with females serving as the reference group. Specifically, at T1, females had significantly lower odds of belonging to the high IGD profile (B = –0.93, OR = 0.39, $p < 0.01$) and the moderate IGD profile (B = –0.81, OR = 0.45, $p < 0.01$) compared with males, indicating that males were more likely to be classified into these higher-risk profiles. A similar pattern was observed at T2. Females showed reduced odds of membership in the high IGD profile (B = –1.08, OR = 0.34, $p < 0.001$) as well as the moderate profile (B = –0.50, OR = 0.61, $p < 0.05$) relative to males. Overall, these findings consistently suggest a higher likelihood of males belonging to moderate and high IGD profiles across both time points. Family income and residence were not significant predictors at either time point, indicating that students' family economic background and living area (urban vs. rural) were not associated with IGD severity levels. In contrast, ATOG showed a strong and consistent positive association with IGD profile membership across both waves. At T1, students who spent more time gaming were 2.27 times more likely to be in the high IGD profile (B = 0.82, OR = 2.27, $p < 0.001$) and 1.67 times prone to be in the moderate profile (B = 0.53, OR = 1.67, $p < 0.01$). Comparable results were found at T2 (high: B = 0.62, OR = 1.85, $p < 0.01$; moderate: B = 0.48, OR = 1.62, $p < 0.001$).

Finally, self-control emerged as a robust negative predictor of IGD profile membership at both T1 and T2. Students with higher self-control were substantially less likely to belong to the high or moderate IGD profiles. At T1, high self-control was associated with a 72% lower likelihood of being in the high IGD group (B = –1.28, OR = 0.28, $p < 0.001$) and a 59% lower likelihood of being in the moderate group (B = –0.89, OR = 0.41, $p < 0.001$). These protective effects remained stable at T2 (high: B = –1.45, OR = 0.23, $p < 0.001$; moderate: B = –0.59, OR = 0.56, $p < 0.01$). Across both waves, loneliness and depressive symptoms significantly predicted IGD profile membership. Loneliness was associated with increased odds of belonging to the high IGD profile at Time 1 (OR = 2.65, $p < 0.05$) and Time 2 (OR = 3.23, $p < 0.05$), and with the moderate profile at Time 1 only (OR = 1.79, $p < 0.05$). In contrast, depressive symptoms consistently predicted higher odds of membership in both the high

and moderate IGD profiles across waves (ORs = 2.09–4.19, *ps* < 0.05), relative to the low IGD profile. Overall, these results indicate that gender, weekly gaming time, and self-control were the most salient baseline predictors: males and those who spend more time gaming were prone to exhibit higher IGD levels, whereas strong self-control consistently served as a protective factor. However, it should be emphasized that these findings reflect baseline-only associations and do not capture dynamic influences on profile transitions at T2. Therefore, these findings provide partial support for Hypothesis 3. While lower self-control and higher levels of loneliness and depression were associated with greater likelihood of belonging to more severe IGD profiles, the hypothesis regarding their role in predicting transitions toward more severe profiles cannot be directly confirmed without modeling transition probabilities with covariates.

Discussion

The present findings indicate that male students consistently reported higher IGD levels than females, which aligns with previous research suggesting that males are more prone to excessive gaming due to higher engagement in competitive and reward-driven gaming behaviors (Abutara et al., 2025). From the perspective of Self-Regulation Theory, this gender difference may reflect systematic variations in impulse control and reward sensitivity, with males exhibiting relatively lower inhibitory control in reward-rich digital environments (Baumeister & Vonasch, 2015). One possible explanation is that males exhibit heightened activation in reward-related brain regions, such as the striatum and orbitofrontal cortex, suggesting that increased reward sensitivity and craving responses may partly account for their stronger motivation to engage in gaming (Dong et al., 2018). The lack of significant differences between urban and rural students suggests that geographical background may have limited influence on IGD in this sample, which is consistent with recent empirical evidence indicating that individual-level psychological mechanisms may outweigh structural or contextual factors in explaining IGD risk among college students. The small effect of socioeconomic status at T2 could reflect minor variations in access to gaming resources or leisure time, but it appears less critical than gender in predicting IGD. Overall, gender differences seem to be the most robust demographic factor associated with IGD, highlighting the need for targeted prevention and intervention strategies for male students.

The LPA revealed a stable three-profile structure of IGD across both time points, comprising Low, Moderate, and High IGD groups. The majority of students belonged to the Low IGD group, while a smaller proportion exhibited high levels of gaming disorder, consistent with previous findings indicating that only a minority of college students develop problematic gaming behaviors (Chang et al., 2023; Lemmens et al., 2015). This latent heterogeneity aligns with person-centered perspectives emphasizing that IGD manifests in qualitatively distinct subgroups rather than along a single continuum of severity. The increase in the Moderate and High IGD groups at T2 suggests a slight shift toward more severe IGD over time, which may reflect developmental trends in self-regulation, academic stress, or increased exposure to online gaming (Jeong et al., 2019; Zhou et al., 2024). The consistency in profile patterns across waves supports the robustness and stability of these latent subtypes, providing a meaningful framework for identifying at-risk students. These results highlight the need for tailored interventions (Park et al., 2021), particularly for individuals in the High IGD group, while suggesting that preventive strategies should also target those in the Moderate group to prevent escalation.

The logistic regression results highlight several key factors associated with IGD severity. Consistent with previous research, males were substantially more likely than females to belong to both the high and moderate IGD profiles (Macur & Pontes, 2021), suggesting that gender-related differences in gaming motivation, reward sensitivity, or socialization may contribute to greater vulnerability among male students. Time spent on online games was also a robust risk factor, reflecting that higher engagement increases exposure to gaming stimuli and may reinforce addictive patterns (Kim et al., 2021). In contrast, self-control emerged as a strong protective factor, providing direct empirical support for Self-Regulation Theory, which posits that effective impulse regulation and goal-directed control are central to preventing maladaptive behaviors such as IGD (Baumeister & Vonasch, 2015). Moreover, students with greater capacity for impulse regulation and goal-directed behavior are less likely to develop problematic gaming behaviors (Zhou et al., 2024; Lei et al., 2025). The lack of significant effects for family income and residence suggests that IGD may be relatively independent of family economic background or urban-rural context in this sample. Finally, loneliness and depressive symptoms consistently predicted higher IGD profile membership, which can be interpreted through the lens of Compensatory Internet Use Theory (CIUT) (Kardefelt-Winther, 2014). According to CIUT, individuals may engage in excessive gaming as a compensatory strategy to cope with unmet psychosocial needs or negative emotional states, supporting prior empirical findings that gaming can serve an emotion-focused coping function for socially isolated or psychologically distressed students (Estupiñá et al., 2024; Wu et al., 2020). Overall, these findings underscore the importance of targeting high-risk groups—particularly male students and frequent gamers—while promoting self-control and emotional regulation skills to prevent or reduce IGD.

The latent transition analysis revealed both stability and moderate changes in IGD profiles over time. Most students in the Low IGD group remained stable, indicating that low-risk gamers tend to maintain adaptive gaming behavior. However, transitions from Moderate to High IGD and the relatively high persistence of the High IGD group suggest that individuals with elevated gaming behaviors are at risk of maintaining or worsening their condition over time (Kang et al., 2025). Conversely, a subset of students in the Moderate and High groups showed improvement, highlighting the potential for behavioral change. These findings suggest that while IGD exhibits a degree of temporal stability (Martončik et al., 2024; Hong et al., 2023), particularly among high-risk individuals, there remains sufficient fluidity to justify early identification and targeted

intervention. Preventive strategies should focus not only on high-risk gamers but also on those in the Moderate group to prevent escalation. From a theoretical standpoint, these transitions underscore the dynamic interplay between self-regulation capacity and compensatory coping motives in shaping the progression or remission of IGD over time, reinforcing the relevance of integrating Self-Regulation Theory and CIUT in understanding IGD development.

Implications for research and practice

The present findings have important theoretical and practical implications. First, the identification of stable Low, Moderate, and High IGD profiles, along with their temporal transitions, highlights the heterogeneous nature of gaming behaviors among college students and the potential for both escalation and improvement over time (Fong et al., 2023). Furthermore, Moderate IGD users are highlighted as a potentially distinct intervention target, given their higher likelihood of transitioning toward either Low or High IGD profiles. Second, demographic factors, particularly gender, and behavioral indicators such as weekly gaming time emerged as robust risk factors, whereas self-control consistently served as a protective factor, underscoring the importance of individual differences in vulnerability to IGD. Third, the consistent associations of loneliness and depressive symptoms with higher IGD profile membership emphasize the interplay between emotional well-being and problematic gaming. Practically, these results suggest that interventions should be tailored according to risk level: preventive programs targeting Moderate gamers may help prevent progression, while more intensive interventions are warranted for High-risk students (King et al., 2018). Enhancing self-control, promoting adaptive coping strategies, and addressing underlying emotional difficulties may be particularly effective in mitigating the development or persistence of IGD (Hu et al., 2025). Finally, the observed stability and fluidity of IGD profiles underscore the need for ongoing monitoring and longitudinal support to ensure timely identification and intervention.

Limitations and future directions

First, the sample consisted solely of Chinese college students, which may limit the generalizability of the findings to other age groups or cultural contexts. Second, the study included only two measurement occasions, and the follow-up period was limited to one year, restricting the ability to capture longer-term trajectories of IGD; future research should incorporate more waves and extended tracking periods. Third, the current sample lacked hierarchical or nested structures (e.g., class- or school-level attributes), precluding multilevel analyses that could account for contextual influences on gaming behaviors. Fourth, all variables were assessed via self-report questionnaires, which may be subject to response bias; specifically, social desirability bias and common method variance could have inflated the observed associations among self-control, depression, and IGD. Future studies should aim to mitigate these biases by incorporating multiple methods of assessment. For instance, behavioral logs, ecological momentary assessment (EMA) or passive digital tracking, and informant or clinician ratings could be integrated to provide more objective and reliable measures. Addressing these methodological limitations in future research would strengthen the validity of conclusions regarding the development, maintenance, and prevention of IGD.

Conclusion

This longitudinal study examined the heterogeneity, predictors, and temporal dynamics of IGD among Chinese college students across two measurement occasions. Latent Profile Analysis identified three distinct IGD subgroups—Low, Moderate, and High—whose profiles exhibited both stability and moderate transitions over time, highlighting the heterogeneous and dynamic nature of gaming behaviors. Logistic regression analyses revealed that male gender and greater weekly gaming time consistently increased the likelihood of belonging to higher IGD profiles, whereas self-control served as a robust protective factor. Additionally, loneliness and depressive symptoms were identified as risk factors for more severe IGD, emphasizing the interplay between emotional well-being and problematic gaming. The findings suggest the value of developing and applying targeted prevention and intervention approaches, particularly for high- and moderate-risk individuals, through enhancing self-regulation and addressing underlying emotional difficulties. Overall, the present study provides important empirical evidence for understanding IGD heterogeneity, its key predictors, and temporal patterns among emerging adults, with clear implications for prevention and intervention efforts.

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References

Abutara, A., Amaral, D., Vieira, J., Rocha, N., Houlis, M., et al. (2025). Gaming and emotional regulation: Coping mechanisms and strategies. In *Social and affective neuroscience of gaming: Insights from fundamentals to public mental health applications* (pp. 159–175), Cham, Switzerland: Springer Nature.

Baumeister, R. F., & Vonasch, A. J. (2015). Uses of self-regulation to facilitate and restrain addictive behavior. *Addictive Behaviors*, *44*, 3–8. https://doi.org/10.1016/j.addbeh.2014.09.011

Benjet, C., Orozco, R., Albor, Y. C., Contreras, E. V., Monroy-Velasco, I. R., et al. (2023). A longitudinal study on the impact of Internet gaming disorder on self-perceived health, academic performance, and social life of first-year college students. *The American Journal on Addictions*, *32*(4), 343–351. https://doi.org/10.1111/ajad.13386

Cerniglia, L., Griffiths, M. D., Cimino, S., De Palo, V., Monacis, L., et al. (2019). A latent profile approach for the study of internet gaming disorder, social media addiction, and psychopathology in a normative sample of adolescents. *Psychology Research and Behavior Management*, *12*, 651–659. https://doi.org/10.2147/PRBM.S211873

Chang, C. I., Fong Sit, H., Chao, T., Chen, C., Shen, J., et al. (2023). Exploring subtypes and correlates of internet gaming disorder severity among adolescents during COVID-19 in China: A latent class analysis. *Current Psychology*, *42*(23), 19915–19926. https://doi.org/10.1007/s12144-022-03133-8

Dong, G., Wang, L., Du, X., & Potenza, M. N. (2018). Gender-related differences in neural responses to gaming cues before and after gaming: Implications for gender-specific vulnerabilities to Internet gaming disorder. *Social Cognitive and Affective Neuroscience*, *13*(11), 1203–1214. https://doi.org/10.1093/scan/nsy084

Estupiñá, F. J., Bernaldo-de-Quirós, M., Vallejo-Achón, M., Fernández-Arias, I., & Labrador, F. (2024). Emotional regulation in gaming disorder: A systematic review. *The American Journal on Addictions*, *33*(6), 605–620. https://doi.org/10.1111/ajad.13621

Fong, T. C., Cheng, Q., Pai, C. Y., Kwan, I., Wong, C., et al. (2023). Uncovering sample heterogeneity in gaming and social withdrawal behaviors in adolescent and young adult gamers in Hong Kong. *Social Science & Medicine*, *321*, 115774. https://doi.org/10.1016/j.socscimed.2023.115774

Fraiwan, M., & Almomani, F. (2025). Internet gaming disorder: Prevalence and associated factors among university students. *Acta Psychologica*, *260*(1), 105690. https://doi.org/10.1016/j.actpsy.2025.105690

Gao, B., Shen, Q., Luo, G., Xu, Y., & Lu, J. (2024). Why does COVID-19 make me depressed? The longitudinal relationships between fear of COVID-19 and depressive symptoms: A moderated mediation model. *Current Psychology*, *43*(32), 1–10. https://doi.org/10.1007/s12144-024-05944-3

Gao, Y. X., Wang, J. Y., & Dong, G. H. (2022). The prevalence and possible risk factors of internet gaming disorder among adolescents and young adults: Systematic reviews and meta-analyses. *Journal of Psychiatric Research*, *154*(4), 35–43. https://doi.org/10.1016/j.jpsychires.2022.06.049

Hao, J., Liao, Z., Huang, Q., Chen, X., Lin, S., et al. (2025). Classifying problematic gaming using a latent profile approach based on personality traits in Chinese young adolescent. *BMC Psychiatry*, *25*(1), 104. https://doi.org/10.1186/s12888-025-06561-5

Hays, R. D., & DiMatteo, M. R. (1987). A short-form measure of loneliness. *Journal of Personality Assessment*, *51*(1), 69–81. https://doi.org/10.1207/s15327752jpa5101_6

Hong, Y. N., Hwang, H., Starcevic, V., Choi, T. Y., Kim, T. H., et al. (2023). Which is more stable and specific: DSM-5 internet gaming disorder or ICD-11 gaming disorder? A longitudinal study. *Psychiatry and Clinical Neurosciences*, *77*(4), 213–222. https://doi.org/10.1111/pcn.13522

Hu, Y., Chen, S., Qi, D., & Zhu, S. (2025). Problematic gaming and self-control among adolescents and emerging adults: A systematic review and meta-analysis. *Cyberpsychology, Behavior, and Social Networking*, *28*(5), 301–317. https://doi.org/10.1089/cyber.2024.0537

Jeong, E. J., Ferguson, C. J., & Lee, S. J. (2019). Pathological gaming in young adolescents: A longitudinal study focused on academic stress and self-control in South Korea. *Journal of Youth and Adolescence*, *48*(12), 2333–2342. https://doi.org/10.1007/s10964-019-01065-4

Ji, Y., Yin, M. X. C., Zhang, A. Y., & Wong, D. F. K. (2022). Risk and protective factors of Internet gaming disorder among Chinese people: A meta-analysis. *Australian & New Zealand Journal of Psychiatry*, *56*(4), 332–346. https://doi.org/10.1177/00048674211025703

Kang, M. F., Xu, L. X., Zhang, J. L., Song, K. R., Wang, Z. L., et al. (2025). Exploring the heterogeneity of internet gaming disorder: A stage-based framework characterized by evolving euphoria and compulsivity. *Addictive Behaviors*, *171*(6), 108457. https://doi.org/10.1016/j.addbeh.2025.108457

Kardefelt-Winther, D. (2014). A conceptual and methodological critique of internet addiction research: Towards a model of compensatory internet use. *Computers in Human Behavior*, *31*(1), 351–354. https://doi.org/10.1016/j.chb.2013.10.059

Kim, B. N., Kang, H. S., & Park, J. (2023). A latent profile approach for classifying internet gamers based on motives for online gaming. *Journal of Behavioral Addictions*, *12*(1), 148–158. https://doi.org/10.1556/2006.2022.00092

Kim, D., Lee, J., & Nam, J. K. (2021). Latent profile of internet and internet game usage among South Korean adolescents during the COVID-19 pandemic. *Frontiers in Psychiatry*, *12*, 714301. https://doi.org/10.3389/fpsyt.2021.714301

King, D. L., Delfabbro, P. H., Doh, Y. Y., Wu, A. M., Kuss, D. J., et al. (2018). Policy and prevention approaches for disordered and hazardous gaming and Internet use: An international perspective. *Prevention Science*, *19*(2), 233–249. https://doi.org/10.1007/s11121-017-0813-1

Kroenke, K., & Spitzer, R. L. (2002). The PHQ-9: A new depression diagnostic and severity measure. *Psychiatric Annals*, *32*(9), 509–515. https://doi.org/10.3928/0048-5713-20020901-06

Lai, K. (2021). Using information criteria under missing data: Full information maximum likelihood versus two-stage estimation. *Structural Equation Modeling: A Multidisciplinary Journal*, *28*(2), 278–291. https://doi.org/10.1080/10705511.2020.1780925

Lei, W., Huang, Y., Peng, Y., Chen, G., Gong, K., et al. (2025). Imbalanced goal-directed and habitual control in individuals with internet gaming disorder. *Journal of Behavioral Addictions*, *14*(2), 831–845. https://doi.org/10.1556/2006.2025.00037

Lemmens, J. S., Valkenburg, P. M., & Gentile, D. A. (2015). The internet gaming disorder scale. *Psychological Assessment*, *27*(2), 567–582. https://doi.org/10.1037/pas0000062

Little, R. J. A. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of The American Statistical Association*, *83*(404), 1198–1202. https://doi.org/10.1080/01621459.1988.10478722

Luo, T., Chen, L. M., Qin, L. X., & Xiao, S. Y. (2021). Reliability and validity of chinese version of brief self-control scale. *Chinese Journal of Clinical Psychology*, *29*(1), 83–86. [in chinese]. https://doi.org/10.16128/j.cnki.1005-3611.2021.01.017

Macur, M., & Pontes, H. M. (2021). Internet gaming disorder in adolescence: Investigating profiles and associated risk factors. *BMC Public Health*, *21*(1), 1547. https://doi.org/10.1186/s12889-021-11394-4

Martončik, M., Ropovik, I., & Adamkovič, M. (2024). Development of gaming disorder: Underlying risk factors and complex temporal dynamics. *Computers in Human Behavior*, *153*(4), 108112. https://doi.org/10.1016/j.chb.2023.108112

Morean, M. E., DeMartini, K. S., Leeman, R. F., Pearlson, G. D., Anticevic, A., et al. (2014). Psychometrically improved, abbreviated versions of three classic measures of impulsivity and self-control. *Psychological Assessment*, *26*(3), 1003–1020. https://doi.org/10.1037/pas0000003

Nylund-Gibson, K., Garber, A. C., Carter, D. B., Chan, M., Arch, D. A. N., et al. (2023). Ten frequently asked questions about latent transition analysis. *Psychological Methods*, *28*(2), 284–300. https://doi.org/10.1037/met0000486

Ohayon, M. M., & Roberts, L. (2021). Internet gaming disorder and comorbidities among campus-dwelling US university students. *Psychiatry Research*, *302*, 114043. https://doi.org/10.1016/j.psychres.2021.114043

Orozco, R., Borges, G., Caldas-de-Almeida, J. M., Gutiérrez-García, R. A., Albor, Y., et al. (2024). Internet gaming disorder and the incidence of suicide-related ideation and behaviors in college students. *Journal of Addiction Medicine*, *18*(6), 643–648. https://doi.org/10.1097/adm.0000000000001331

Park, J. J., Wilkinson-Meyers, L., King, D. L., & Rodda, S. N. (2021). Person-centred interventions for problem gaming: A stepped care approach. *BMC Public Health*, *21*(1), 872. https://doi.org/10.1186/s12889-021-10749-1

Pearcy, B. T. D., Roberts, L. D., & McEvoy, P. M. (2016). Psychometric testing of the personal internet gaming disorder evaluation-9: A new measure designed to assess internet gaming disorder. *Cyberpsychology, Behavior, and Social Networking*, *19*(5), 335–341. https://doi.org/10.1089/cyber.2015.0534

Ropovik, I., Martončik, M., Babinčák, P., Baník, G,, Vargová, L., & Adamkovič, M. (2023). Risk and protective factors for (internet) gaming disorder: A meta-analysis of pre-COVID studies. *Addictive Behaviors*, *139*(3), 107590. https://doi.org/10.1016/j.addbeh.2022.107590

Tein, J. Y., Coxe, S., & Cham, H. (2013). Statistical power to detect the correct number of classes in latent profile analysis. *Structural Equation Modeling: A Multidisciplinary Journal*, *20*(4), 640–657. https://doi.org/10.1080/10705511.2013.824781

Teng, Z., Pontes, H. M., Nie, Q., Xiang, G., Griffiths, M. D., et al. (2020). Internet gaming disorder and psychosocial well-being: A longitudinal study of older-aged adolescents and emerging adults. *Addictive Behaviors*, *110*(6), 106530. https://doi.org/10.1016/j.addbeh.2020.106530

Tu, S., Hu, K., Wu, H., Du, M., Wang, J., et al. (2025). Effects of cognitive reappraisal on gaming craving and inhibitory control in adolescents with internet gaming disorder. *Psychology of Addictive Behaviors*, *39*(6), 560–570. https://doi.org/10.1037/adb0001091

Tullett-Prado, D., Stavropoulos, V., Mueller, K., Sharples, J., & Footitt, T. A. (2021). Internet gaming disorder profiles and their associations with social engagement behaviours. *Journal of Psychiatric Research*, *138*(4), 393–403. https://doi.org/10.1016/j.jpsychires.2021.04.037

Wang, L. J., Mu, L. L., Li, X. Y., Song, P. P., Pan, Z. Z., et al. (2025). Mediating role of depression and gender in the relationship between daily video games exposure and internet gaming disorder (IGD) among college students. *BMC Psychology*, *13*(1), 965. https://doi.org/10.1186/s40359-025-03328-1

Wu, L. L., Potenza, M. N., Zhou, N., Kober, H., Shi, X. H., et al. (2020). A role for the right dorsolateral prefrontal cortex in enhancing regulation of both craving and negative emotions in internet gaming disorder: A randomized trial. *European Neuropsychopharmacology*, *36*(11), 29–37. https://doi.org/10.1016/j.euroneuro.2020.04.003

Yu, Y., Mo, P. K. H., Zhang, J., Li, J., & Lau, J. T. F. (2021). Impulsivity, self-control, interpersonal influences, and maladaptive cognitions as factors of internet gaming disorder among adolescents in China: Cross-sectional mediation study. *Journal of Medical Internet Research*, *23*(10), e26810. https://doi.org/10.2196/26810

Zhang, L., Liu, M., Yuan, M., Hou, M., Yang, C., et al. (2023). The latent profile analysis of Chinese adolescents' gaming disorder: Examination and validation. *BMC Psychiatry*, *23*(1), 833. https://doi.org/10.1186/s12888-023-05320-8

Zhou, R., Morita, N., Zhu, C., Ogai, Y., Saito, T., et al. (2024). The relationship between self-control and internet gaming disorder and problematic social networking site use: The mediation effects of internet use motives. *Frontiers in Psychiatry*, *15*, 1369973. https://doi.org/10.3389/fpsyt.2024.1369973

Zhuang, X., Zhang, Y., Tang, X., Ng, T. K., Lin, J., et al. (2023). Longitudinal modifiable risk and protective factors of internet gaming disorder: A systematic review and meta-analysis. *Journal of Behavioral Addictions*, *12*(2), 375–392. https://doi.org/10.1556/2006.2023.00017