COVID-19-related social isolation, self-control and Internet gaming disorder among Chinese university students: cross-sectional survey

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Abstract

Background: Internet gaming disorder (IGD) among university students has become a great concern of university counsellors worldwide during the COVID-19 pandemic. COVID-19 related social isolation was positively correlated with IGD. However, the impact pathway of self-control on IGD remain unclear.

Objective: We aimed to explore the associations among social isolation, self-control and IGD in Chinese university students and examine whether self-control mediates the positive effects of social isolation on IGD.

Methods: A total of 479 students were recruited from six university located in three different regions of Shandong Province, China. The isolation subscale of the Self-Compassion Scale, the Self-Control Scale and the Internet Gaming Disorder Scale were used to assess social isolation, self-control and internet gaming disorder among university students.

Results: Social isolation was positively correlated with IGD ($p < 0.05$) and that self-control was negatively correlated with social isolation and IGD(each $p < 0.05$). Self-control played a mediating role in the association between social isolation and IGD (coeffect = -0.185, 95% CI = -0.295 - -0.087). Compared with male students, the effects of social isolation on IGD among female students were lower.

Conclusions: This study highlight the need to decrease students' IGD during the pandemic, especially that of male students. Effective interventions that alleviate social isolation and enhance self-control should be developed.

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Abstract

Background: Internet gaming disorder (IGD) among university students has become a great concern of university counsellors worldwide during the COVID-19 pandemic. The influencing factors for IGD during the COVID-19 pandemic may be different.

Objective: This study aims to explore the associations among social isolation, self-control and IGD in Chinese university students and examine whether self-control mediates the positive effects of social isolation on IGD.

Methods: A cross-sectional study were employed to collect data among university students in Shandong Province from April to September 2022. The isolation subscale of the Self-Compassion Scale, the Self-Control Scale and the Internet Gaming Disorder Scale were used to assess social isolation, self-control and internet gaming disorder among university students. Model four and five for PROCESS were used to analyze the mediating role of self-control and moderating role of gender on the association between social isolation and IGD.

Results: A total of 479 students were recruited from six university located in three different regions of Shandong Province, China. Students experienced low levels of IGD and moderate levels of social isolation and self-control, with the mean scores of 8.94 (SD 9.06), 12.04 (SD 3.53) and 57.15 (SD 8.44), respectively. Social isolation was positively correlated with IGD ($p < 0.05$) and that self-control was negatively correlated with social isolation and IGD (each $p < 0.05$). Self-control played a mediating role in the association between social isolation and IGD (coeffect = -0.185, 95% CI = -0.295 - -0.087). Compared with male students, the effects of social isolation on IGD among female students were lower.

Conclusions: Self-control was a significant mediator in the association between social isolation and IGD. Moreover, gender played a moderating role in the association between social isolation and IGD. The study highlight the need to decrease students' IGD during the pandemic, especially that of male students. Effective interventions that alleviate social isolation and enhance self-control should

be developed.

Keywords: COVID-19 pandemic, Internet gaming disorder, Self-control, Social isolation, University students

Introduction

The COVID-19 pandemic was declared a global health emergency by the World Health Organization in March, 2020, which significantly impacted educational training institutions worldwide [1]. Previous studies have shown that because of education interruptions, remote learning, less physical activity, financial concerns, social isolation, lack of belongingness and the rapid rise in the number of COVID-19 infections, university students are one of the most vulnerable groups to experience anxiety, depression, frustration, loneliness, substance misuse and addiction [2-4]. To alleviate the negative impacts of COVID-19 on mental and physical health, university students choose Internet

gaming as a main source of entertainment [5]. According to the Research Report on the Internet Usage of Minors in China in 2023 released by China Internet Network Information Center, 522 million of Chinese citizens often play Internet games, and university students are one of the main groups who often play [6,7].

Internet gaming disorder (IGD), classified as an addictive disorder by the DSM-5 and the ICD-11, is defined as a pattern of continuous or repeated gaming behavior, manifested through five of nine diagnosis criteria in the DSM-5 (withdrawal, loss of control, loss of interest, preoccupation or obsession, tolerance, deceiving, continued overuse, functional impairment and escape of negative feelings) or diagnosis in the ICD-11 (impaired control of the game, increasing priority of the game, continuous or upgraded gaming despite of negative outcomes) [8,9]. Son et al [10] found that 36.4% of university students played Internet games three to four times per week, 19.5% played internet games every day and 48.1% played a game for over two hours. Vahidi et al [11] found that 48.5% of university students currently played Internet games, and among them, 4.3% were diagnosed with IGD. Siste et al [12] found that the prevalence rate of IGD was 2.03% among university students, and students with IGD played games 19 hours per week. Previous evidence shows that IGD leads to maladjustment in students' daily life, such as headaches, attention-deficit hyperactivity disorder, alexithymia, increased aggression, poor psychological well-being and a decline in study achievement [13-15]. IGD also inclines students to flee their home and engage in substance abuse, autolesionism and even suicidality when it becomes severe [16,17]. Therefore, exploring the influencing factors for IGD in university students during the COVID-19 pandemic is crucial for university counsellors and students themselves to take effective interventions to treat and relieve symptoms of IGD and prevent IGD in future pandemics.

Several qualitative and quantitative studies have indicated that social isolation plays a key role in the emergence of IGD, especially during the COVID-19 pandemic [18,19]. Social isolation is an objective measure reflecting an individual's absence or limitation of social contact or interactions

with friends, family, neighbors and colleagues [20]. Social isolation causes profound changes in social relationships that are linked with loneliness, anxiety, depression and exhaustion. It is possible that individuals who feel social isolation are more likely to surf online to address their loneliness [21,22]. Moreno et al [23] reported that, because of poor quality and infrequent social interactions, the prevalence of IGD among young adults was 4.43% during the COVID-19 pandemic. Gaming addiction is referred to as a consequence of dealing with COVID-19-related psychological distress and social isolation [24]. According to previous studies, social isolation has damaging effects on the IGD of university students influenced by personal characteristics [25,26]. However, the critical factors and impact pathway between social isolation and IGD remain unclear and need further investigation.

Self-control refers to individuals' ability to regulate their thoughts, feelings, and actions when permanently valued purposes collide with momentarily more satisfying goals [27]. As a facet of personality traits, self-control can involve engaging in desired behaviors and deserting undesired ones despite challenges to doing so. Studies suggest that good self-control benefits students' task performance, positive emotions, psychological well-being and health-promoting behaviors [28,29]. Studies have documented that self-control has a negative correlation with IGD, and poor self-control may increase the likelihood of students developing IGD during the COVID-19 pandemic [30]. Because of unsupportive living environments, controlling relationships and social withdrawal during the pandemic, students' self-control was undermined, which resulted in increased IGD.

Questions regarding the correlation between social isolation and self-control, and the impact of self-control on the relationship between social isolation and IGD remain largely unanswered. The limited research on this topic has reported that social isolation during the COVID-19 pandemic significantly increased the probability of Internet gaming, while students with high self-control are less likely to fall into Internet gaming dependence [31]. Moreover, some studies have found that self-control as a coping method is greatly associated with a variety of social isolation-related negative

experiences such as anxiety, frustration and loneliness [32,33]. According to Self-Determination Theory, social isolation can reduce students' self-motivation and decision-making abilities, while maladaptive motivations (e.g., introjected regulation, amotivation and strong extrinsic motivations) are positively associated with low self-control [34,35]. Low self-control was verified as an important predictor for serious IGD [36]. Therefore, social isolation may negatively correlate with self-control, and self-control may play a mediating role in the relationship between social isolation and IGD. Students who experienced severe social isolation were poor in self-control and consequently addicted to Internet gaming.

Based on these findings, this study aimed to explore the associations among social isolation, self-control and IGD and examine the mediating effect of self-control on the relationship between social isolation and IGD in university students during the COVID-19 pandemic and related lockdown procedures in mainland China.

Methods

Participants

A cross-sectional study design was employed. University students who were Chinese and familiar with communication software (e.g., WeChat and QQ) were invited to participate in the study. The survey were conducted between April and September 2022. Convenience sampling was used to recruit university student participants from Jinan, Zibo and Binzhou in Shandong Province. Jinan, the provincial capital of Shandong province, has 23 universities. Zibo and Binzhou have 2 and 1 universities, respectively. The number of university students were from 18, 000 to 70,000.

A total of 504 students completed the online survey. After excluding 25 questionnaires with incomplete data, 479 questionnaires were valid, an response rate of 95.04%. This survey received approval from the Institutional Review Board of the School of Nursing and Rehabilitation, Shandong University (NO. 2021-R-043). All procedures of this study followed the guidelines and requirements of the Institutional Review Board. This study was an anonymous online survey, and students who

submitted the questionnaires were considered as consenting to participate in the study. Students received ¥ 5 RMB ($ 0.69 USD) as compensations for their time and effort. The data were collected and stored in one computer owned by the research team, and only the researcher who joined the study knew the password for the data file.

Measurements

The isolation subscale of the Self-Compassion Scale [37] is a 4-item measure of social isolation. Each item contains a negative adjective description (e.g., alone, inadequate, down and struggling) to express feelings of isolating. A 5-point Likert scale from 1 (never) to 5 (always) was used to describe participants' experience of social isolation. The Chinese version of the Self-Compassion Scale has been shown to have good validity and reliability among university students [38]. In this study, the alpha reliability rate for the isolation subscale of the Self-Compassion Scale was 0.780.

The Self-Control Scale, developed by Tangney et al [39], is a 36-item scale and consists of five dimensions: self-discipline (11 items), impulse control (10 items), healthy habits (7 items), work or study performance (4 items) and dependability (4 items). A 5-point Likert scale (1 = completely out of line, 5 = fully compliant) is used to score the items. The Chinese version, translated and revised by Tan and Guo [40], is a 19-item scale with five dimensions: impulse control (six items), healthy habits (three items), resisting temptation (four items), work ethic(three items) and abstaining from entertainment (three items). The Chinese version also had good validity and reliability among university students, with the confirmatory factor analysis were statistically significant ($\chi^2/df = 1.533$, RMSEA= .050, GFI = 0.91, IFI = 0.93, NNFI = 0.91, CFI = 0.93) and the alpha reliability rate for the scale and its dimension were between 0.606 and 0.862. In the study, the alpha reliability rates for the Self-Control Scale and its dimensions were 0.868, 0.811, 0.640, 0.648, 0.575, and 0.512, respectively.

The Internet Gaming Disorder Scale [41] is a 9-item short scale that is scored via a 5-point Likert scale with 0 representing never and 5 representing always. The Internet Gaming Disorder

Scale has been translated into Chinese, Arabic and Turkish with good validity and reliability. The Chinese version of the Internet Gaming Disorder Scale has been widely used among young adults [42,43]. In the present study, the alpha reliability rate for the scale was 0.888.

Procedure

The study was conducted from April to September 2022. During this six-month period, there was one outbreak of the COVID-19 pandemic in Shandong Province, mainland China, which led to universities lockdown. Students were required to maintain social distance, refrain from going outdoors and study at home or in their dormitory. Therefore, several online and offline methods (e.g., recruitment advertisements, messages and calls) were used to recruit student participants.

The Wen-Juan-Xing platform [44] was used for data collection. We created an online survey through Wen-Juan-Xing for business to ensure its security and functionality. The survey included two components: an explanation and the questionnaires, which had five pages. The online survey link and its related QR code were sent to university counselors from six universities, who distributed the link and QR code to their students. Student participants were required to complete the sociodemographic questionnaire, Isolation subscale of the Self-Compassion Scale, Self-Control Scale and Internet Gaming Disorder Scale, in that order. Each IP address just can submit one questionnaire. Only when the technical completeness check for questionnaires were passed, the online questionnaire can be successfully submitted.

Statistical analysis

Harman's single-factor analysis [45] was used to explore the common method variance in the study. Descriptive analysis (mean, standard deviation (SD), frequency, percentage and 95% confidence intervals) was conducted to report the measured variables. Bivariate analysis was used to examine the differences in IGD by sociodemographic characteristics. Pearson correlation coefficients were used to test the correlations among social isolation, self-control and IGD. Model four for PROCESS was employed to test the mediating role of self-control on the association between social isolation

and IGD. Model five for PROCESS was employed to explore the moderating role of gender on the association between social isolation and IGD. Bootstrap samples were set as 5000, and a 95% confidence interval was used for mediation analysis.

Results

Common method variance analysis

To avoid self-report measure-related common method variance, anonymity and separating dimensions of the questionnaires were used in the data collection process [45]. Furthermore, Harman's single-factor analysis showed that only 25.1% of the variance can be explained by the first factor, which was less than 40%. Thus, no common method variance was found in the study.

Descriptive sociodemographic characteristics and associations between sociodemographic characteristics and IGD of student participants

Table 1 presents the descriptive sociodemographic characteristics of the student participants. The average age for students was 19.97 (SD 1.81) years old; 349 out of 479 (72.9%) were female, 304 out of 479 (63.5%) were not an only child, 49.3% (236/479) were freshman, and 48.2% (231/479) were majoring in medicine. The t-test and ANOVA showed that gender and major were significant influencing factors for students' IGD (each $p < .05$).

Table 1 Descriptive sociodemographic characteristics of student participants and the distribution of IGD (n = 479)

Characteristics	N (%)	IGD (M (SD))	*t/F*	*p*
Gender				
Male	130 (27.1%)	14.15 (9.13)	7.824	< .001

Female	349 (72.9%)	6.99 (8.24)		
Only child				
Yes	175 (36.5%)	9.95 (9.33)	1.847	.066
No	304 (63.5%)	8.35 (8.86)		
Grade				
Freshman year	236 (49.3%)	9.31 (8.93)	1.334	.26
Sophomore year	78 (16.3%)	8.67 (9.79)		
Junior year	80 (16.7%)	9.83 (8.35)		
Senior year	85 (17.7%)	7.31 (9.30)		
Major				
Liberal art	98 (20.5%)	8.32 (9.29)	5.863	.001
Science and engineering	118 (24.6%)	11.91 (9.50)		
Medicine	231 (48.2%)	7.81 (8.54)		
Others	32 (6.7%)	8.03 (8.31)		

[a]IGD, Internet gaming disorder

Descriptive social isolation, self-control and IGD and the correlations among the measured variables of student participants

Table 2 shows the descriptive social isolation, self-control and IGD and the correlations among these variables of students. The total score for social isolation was 12.04 (SD 3.53), which indicated that students experienced moderate levels of social isolation during the COVID-19 pandemic. The total score for self-control was 57.15 (SD 8.44), which indicated that students had moderate levels of self-control. The total score for IGD was 8.94 (SD 9.06), which indicated that students had low levels of internet gaming disorder.

The Pearson correlation analysis showed that social isolation was positively correlated with IGD ($p < .001$), while social isolation and IGD were negatively correlated with self-control (each $p \leq .001$).

Table 2 Descriptive statistics of the measured variables and the correlations among the variables (n = 479)

Variables	Mean (SD)	1	2	3
1. Social isolation	12.04 (3.53)	-		
2. Self-control	57.15 (8.44)	-0.355 ($p < .001$)	-	
3. IGD	8.94 (9.06)	0.217 ($p < .001$)	-0.260 ($p < .001$)	-

[a]IGD, Internet gaming disorder.

Mediation analysis

Model four of PROCESS was employed to analyze the mediating role of self-control on the association between social isolation and IGD. Gender and major were included in the model as covariate variables. Table 3 shows the results of mediation analysis.

Table 3 Mediation model of self-control on the association between social isolation and IGD (n = 479)

Outcome variables	Predictive variables	B	SE	t	p	F	p	R^2
IGD	Social isolation	0.526	0.205	4.896	< .001	32.137	< .001	0.163
	Gender	-6.995	-0.344	-8.209	< .001			
	Major	-0.524	-0.051	-1.225	.22			
Self-control	Social isolation	-0.844	0.103	-8.233	< .001	23.231	< .001	0.128
	Gender	-0.087	0.813	-0.106	.92			
	Major	-0.447	0.408	-1.095	.27			
IGD	Social isolation	0.341	0.112	3.033	.003	30.582	< .001	0.205
	Self-control	-0.219	0.047	-4.659	< .001			
	Gender	-6.976	0.834	-8.364	< .001			
	Major	-0.426	0.419	-1.016	.31			

[a]IGD, Internet gaming disorder

Social isolation had a positive direct effect on IGD (B = 0.526, t = 3.033, $p < .001$). When self-control, as a mediator, was included in the model, the positive direct effect of social isolation on IGD was also significant (B = 0.341, t = 3.033, $p = .003$); moreover, social isolation had a negative direct effect on self-control (B = -0.844, t = -8.233, $p < .001$), and self-control had a negative direct effect on IGD (B = -0.219, t = -4.659, $p < .001$). The results showed that self-control was a significant mediator in the relationship between social isolation and IGD.

Table 4 presents the effects of social isolation on IGD mediated by self-control.

TABLE4 Effects of social isolation on IGD mediated by self-control (n = 479)

Effect	Coeffect	Boot SE	95% Boot CI	Effect-total effect

				ratio
Direct effect of X on Y	0.341	0.112	0.120 to 0.562	64.83%
Indirect effect: X M1 Y	-0.185	-0.052	-0.295 to -0.087	35.17%

The results showed that social isolation was not only directly associated with IGD, but also indirectly associated with IGD through the path of self-control. The direct effect was two times stronger than the indirect effect, with effect-total effect ratios of 64.83% and 35.17%, respectively.

[a]X = social isolation
[b]Y = IGD, Internet gaming disorder
[c]M = self-control
[d]Boot SE = Boot standard error
[e]Boot CI= Boot confidence intervals.

Moderation analysis

Model five of PROCESS was conducted to examine whether gender mitigates the association between social isolation and IGD. Table 5 presents the moderation analysis results. The interaction variable (social isolation × gender) was negatively correlated with IGD (B = -0.496, t = -2.003, *p* = .046), indicating that gender was a moderator in the association between social isolation and IGD.

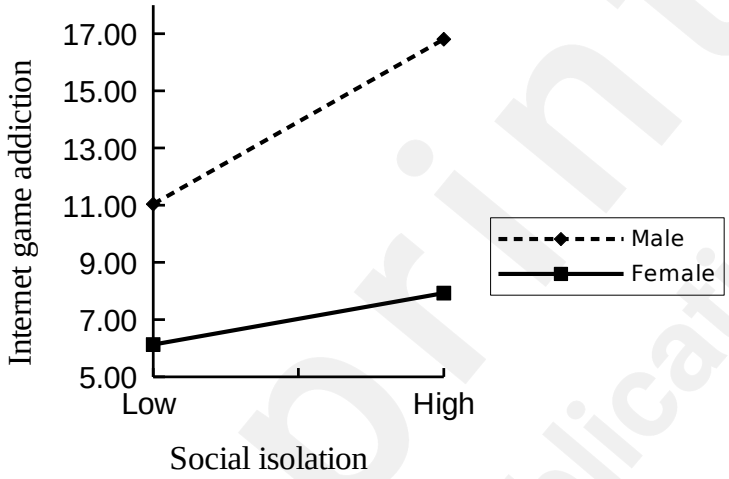
Table 5 moderating effects of gender in the association between social isolation and IGD (n = 479)

Outcome variables	Predictive variables	B	SE	t	p	F	R^2
IGD	Self-control	-0.219	0.047	-4.673	< .001	25.423 (*p* < .001)	0.212
	Major	-0.447	0.418	-1.068	.28		
	Social isolation	0.359	0.112	3.198	.001		
	Gender	-6.915	0.832	-8.312	< .001		
	Social isolation × gender	-0.496	0.248	-2.003	.046		

[a]IGD, Internet Gaming Disorder.

For further analysis of the moderation of gender, simple slope analysis was conducted. The

moderation of gender in the association between social isolation and IGD was depicted in Multimedia Appendix 1. The results showed that for male students, social isolation was positively correlated with IGD (simple slope = 0.906, t = 3.891, $p < .001$); for female students, social isolation was also positively correlated with IGD (simple slope = 0.410, t = 3.407, $p = .001$), while its effect size was lower than that of male students. These results indicated that gender moderated the association between social isolation and IGD.



Multimedia Appendix 1 Moderation analysis of gender in the association between social isolation and internet game addiction

Discussion

Social isolation has been a crucial negative feeling experienced by university students during the COVID-19 pandemic, and students may be at higher risk of social isolation, which results in IGD. The present study included a personal characteristic (self-control) and investigated the associations among social isolation, self-control and IGD and examined the mediating effect of self-control on the association between social isolation and IGD. Some interesting findings were disclosed that are discussed in the following sections.

In this study, social isolation was positively associated with IGD, which was in line with previous literature. Yang et al [46] suggested that because of protracted periods of social isolation during the pandemic, crisis-induced distress and technology-based activities were greatly increasing, which may lead to or intensify IGD among individuals. Social isolation is believed to disrupt students' adaptive

routines and learning habits and increase their loneliness, boredom, anxiety, frustration and depression [47]. Due to isolation-related disruption and negative emotions, students tend to socialize on the Internet platform to alleviate their stress and meet their psychological needs. Hence, students are more likely to overuse Internet games and, ultimately, have IGD.

Through the study, social isolation was demonstrated to have a negative correlation with self-control. This important finding was the first evidence revealing the relationship between social isolation and self-control. Previous studies have shown that social isolation indicates individuals' objective deficiency in interactions and support from others and the wider community, and the high prevalence of social isolation during the pandemic affects university students' economic and social resources, coping ability and mental health status [48]. Social isolation has been identified as a significant risk factor for emotion dysregulation and negative emotions [49,50]. Students with high levels of negative emotions tend to lose self-control in the face of difficulties and setbacks. Li et al [51] found that high negative emotions consume individuals' cognitive resources and impair their cognitive activities, thus deceasing their self-control capacity.

In this study, a negative correlation between self-control and IGD was found. This result corroborates Xiang et al [52] and Cudo et al [53], who suggested that self-control serves as a protective factor for mitigating IGD among students. Previous studies have reported that self-control represents the reasoned procedure and ability to manage impulses deliberatively [54], and students with high self-control may find it easy to withstand the temptation of Internet games and to cease playing [55]. Moreover, some studies have indicated that high self-control could reduce one's aggression and sensation seeking, and aggressive behaviors have been related to problematic Internet gaming and IGD [56].

The most interesting finding of this study was that self-control was a significant mediating factor in the association between social isolation and IGD. This important finding provides new evidence for understanding the generation process of IGD among university students during a global

pandemic and developing effective interventions for alleviating IGD. Because of lockdown requirements during the pandemic, university students experienced high levels of social isolation, which harmfully impacted students' self-control [57]. Lower self-control increases the possibility of Internet game playing, which eventually leads to IGD [30]. Therefore, university students become an extremely susceptible group for developing IGD. Targeted interventions to alleviate IGD should include training to promote the ability of self-control, increase alternative resources for human interaction and remove sources of gaming temptations to reduce intentions and behaviors of playing Internet games.

In the study, another interesting finding was that gender played a moderating role in the association between social isolation and IGD. Compared with male students, female students who experienced social isolation tended to have less IGD. This finding indicated that male students are more vulnerable to confront challenges of social isolation and are more likely to play Internet games to cope with isolation-related stress. Therefore, more attention should be given to male students when implementing interventions to reduce IGD.

Several limitations of this study should be considered before employing its findings. First, a cross-sectional study design was used that may hardly examine causal relationships among the measured variables. A longitudinal or cohort study should be used to explore the causal effects of social isolation and self-control on IGD. Second, limited socio-demographic characteristics and personal traits (self-control) were investigated. Other personal traits (e.g., self-efficacy, self-esteem, resilience and psychological capital) and family characteristics (e.g., economic status, parents' job and the relationship between parents and children) should be considered in future studies. Third, convenience sampling was used to recruit student participants, which may raise some respondent bias. Random sampling is suggested be used to reduce these biases. Fourth, the study used the isolation subscale of the self-compassion scale to measure social isolation. Future studies are suggested to employ more complex and reliable instruments such as the Lubben Social Network

Scale-6 [58] and the Orth-Gomer Measure of Social Networks Support [59].

Conclusion

This study has several notable contributions to the literature on IGD in university students in mainland China. This study provides new evidence of the associations among social isolation, self-control and IGD in university students during the COVID-19 pandemic in mainland China. In particular, the negative association between social isolation and self-control was first verified. Moreover, this study enriches the current knowledge by proving the significant mediating effect of self-control on the relationship between social isolation and IGD. Additionally, this study also establishes evidence of the impact of gender on the relationship between social isolation and IGD. The findings of the present study emphasize the challenges of social isolation and IGD among university students during the widespread COVID-19 pandemic and recommend that effective interventions and prevention measures be implemented with the least delay possible.

Declarations

Ethics approval All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (Shandong University, China) and with the Helsinki Declaration of 1975, as revised in 2000(5).

Conflict of interest disclosure

No conflict was declared by the authors.

Multimedia Appendix 1

Moderation analysis of gender in the association between social isolation and internet game addiction

References

1. Haddad JM, Macenski C, Mosier-Mills A, Hibara A, Kester K, Schneider M, Conrad RC, Liu CH. The impact of social media on college mental health during the COVID-19 pandemic: a multinational review of the existing literature. Curr Psychiatry Rep. 2021;23(11):70.[FREE Full

text][doi:10.1007/s11920-021-01288-y][Medline:34613542]

2. Rainford LA, Zanardo M, Buissink C, Decoster R, Hennessy W, Knapp K, Kraus B, ……McNulty JP. The impact of COVID-19 upon student radiographers and clinical training. Radiography (Lond), 2021;27(2):464-474. [FREE Full text][doi:10.1016/j.radi.2020.10.015] [Medline:33223416]

3. Anderson AR, Knee E, Anderson KR, Ramos WD. Campus recreational participation and COVID-19: impact on college student health and well-being. J Am Coll Health. 2022;11:1-8. [doi:10.1080/07448481.2022.2093116][Medline:35816740]

4. Browning MHEM, Larson LR, Sharaievska I, Rigolon A, McAnirlin O, Mullenbach L, Cloutier S, ……Alvarez HO. Psychological impacts from COVID-19 among university students: risk factors across seven states in the United States. PLoS One. 2021;16(1):e0245327.[FREE Full text] [doi:10.1371/journal.pone.0245327][Medline:33411812]

5. Wang Y, Liu M, Nogueira OCBL. Prevalence and risk factors of internet gaming disorder under the COVID-19 pandemic among university students in Macao. SAGE Open Nurs.2023;9:23779608231158158. [FREE Full text] [doi: 10.1177/23779608231158158][Medline: 36865753]

6. Report on the Internet Usage of Minors in China. (2023). https://www.doc88.com/p-13047264158693.html (accessed in 5 June, 2023)

7. Wang Y, Liu BJ, Zhang L, Zhang P. Anxiety, depression, and stress are associated with Internet gaming disorder during COVID-19: fear of missing out as a mediator. Front Psychiatry. 2022;13:827519. [FREE Full text] [doi:10.3389/fpsyt.2022.827519][Medline:35222126]

8. American Psychiatric Association. Diagnostic and statistical manual of mental disorders(DSM-5) American Psychiatric Publishing: Arlington, VA, USA, 2023.

9. World Health Organization. The ICD-11 classification of mental and behavioral disorders: diagnostic criteria for research. World Health Organization, Geneva, Switzerland, 2018.

10. Son SM, Oh JS, Jeon BJ. Correlational study between online friendship network and Internet game disorder among university students. Brain Behav. 2021;11(11):e2392. [FREE Full text] [doi:10.1002/brb3.2392][Medline:34661980]

11. Vahidi M, Zamanzadeh V, Musavi S, Roshangar F, Janani R. Gaming disorder among students of Tabriz university of medical sciences: the frequency and related factors. Med J Islam Repub Iran. 2021;35:98. [FREE Full text][doi:10.47176/mjiri.35.98][Medline:34956944]

12. Siste K, Hanafi E, Sen LT, Wahjoepramono POP, Kurniawan A, Yudistiro R. Potential correlates of Internet gaming disorder among Indonesian medical students: cross-sectional study. J Med Internet Res. 2021;23(4):e25468. [FREE Full text][doi:10.2196/25468][Medline:33871379]

13. Taner HA, Sari BA, Kulacoglu KC, Mayalik A, Mecit H, Ozekicioglu K, Zorbaz ZO. Internet gaming disorder's correspondence with attention deficit hyperactivity disorder and game/in-game purchases among university students. Entertainment Computing, 2022;42:100486.[doi:10.1016/j.entcom.2022.100486]

14. T'ng ST, Ho KH, Sim DE, Yu CH, Wong PY. The mediating effect of Internet gaming disorder's symptoms on loneliness and aggression among undergraduate students and working adults in Malaysia. Psych J. 2020;9(1):96-107. [doi:10.1002/pchj.320][Medline:31797557]

15. Evren C, Evren B, Dalbudak E, Topcu M, Kutlu N, Elhai JD. Relationship between Internet gaming disorder symptoms with attention deficit hyperactivity disorder and alexithymia symptoms among university students. Addicta-The Turkish J Addict. 2020;7(1):1-9. [doi:10.5152/addicta.2020.19076]

16. Burkauskas J, Griskova-Bulanova I, Doric A, Balhara YPS, Sidharth A, Ransing R, …… Stevanovic D. Association of Internet gaming disorder symptoms with anxiety and depressive symptoms and substance use: an international cross-sectional study. *Mid East Curr Psychiatry-Mecpsych*. 2022;29(1):14. [doi:10.1186/s43045-022-00180-6]

17. Cho H, Hwang Y. The effect of gaming disorder on suicidality: focusing on the mediating effect

of social support and self-esteem. *Korean J Food & Health Converg*. 2022;8(2):27-35.

18. King DL, Kaptsis D, Delfabbro PH, Gradisar M. Craving for Internet games? Withdrawal symptoms from an 84-h abstinence from massively multiplayer online gaming. Computers Hum Behav. 2016;62:488-494.

19. Tavormina MGM, Tavormina R. Video games and COVID-19: how do lockdown and addiction interact? Psychiatr Danub.2021;33(Suppl 9):152-157. [Medline:34559795]

20. De Jong Gierveld J, Van Tilburg TG, Dykstra PA. Loneliness and social isolation. Perlma DA, Vangelisti (Eds.), The Cambridge Handbook of Personal Relationships, Cambridge University Press, Cambridge, 2006;485-500.

21. Elhai JD, Gallinari EF, Rozgonjuk D, Yang HB. Depression, anxiety and fear of missing out as correlateds of social, non-social and problematic smartphone use. Addict Behav.2020;105:7. [doi:10.1016/j.addbeh.2020.106335][Medline:32062337]

22. Liu C, Liu Z, Yuan G. Cyberbullying victimization and problematic Internet use among Chinese adolescents: longitudinal mediation through mindfulness and depression. J Health Psychol. 2020;26:2822-31. [doi:10.1177/1359105320934158][Medline:32567374]

23. Moreno M, Riddle K, Jenkins MC, Singh AP, Zhao QQ, Eichhoff J. Measuring problematic Internet use, Internet gaming disorder, and social media addiction in young adults: cross-sectional survey study. JMIR Public Health Surveill. 2022;8(1):e27719. [FREE Full text] [doi:10.2196/27719][Medline:34081596]

24. Han TS, Cho HJ, Sung D, Park MH. A systematic review of the impact of COVID-19 on the game addiction of children and adolescents. Front Psychiatry. 2022;13:976601. [FREE Full text] [doi:10.3389/fpsyt.2022.976601][Medline:36061296]

25. Ali AM, Al-Amer R, Atout M, Ali ST, Mansour AMH, Khatatbeh H, Alkhamees AA, Hendawy AO. The nine-item Internet gaming disorder scale (IGDS9-SF): its psychometric properties among Sri Lankan students and measurement invariance across Sri Lanka, Turkey, Australia, and the

USA. Healthcare(Basel). 2022;10(3):490. [FREE Full text] [doi:10.3390/healthcare10030490] [Medline:35326968]

26. Shirasaka T, Tateno M, Tayama M, Tsuneta M, Kimura H, Saito T. Survey of the relationship between Internet addiction and social withdrawl (HIKIKOMORI) in Japan. Nihon Arukoru Yakubutsu Lgakkai Zasshi, 2016;51(5):275-282. [Medline:30462389]

27. Duckworth AL, Taxer JL, Eskreis-Winkler L, Galla BM, Gross JJ. Self-control and academic achievement. Annu Rev Psychol.2019;70:373-399. [doi: 10.1146/annurev-psych-010418-103230] [Medline:30609915]

28. Ozturk EA, Sezer TA, Tezel A. Self-control and problem-solving skills of undergraduate nursing program students, and an analysis of influential factors. Perspect Psychiatr Care.2022;58(2):464-470. [doi: 10.1111/ppc.12864][Medline:34018196]

29. Li S, Nie Y. Spirituality and cyberaggression: mediating and moderating effect of self-control and school climate. Int J Environ Res and Public Health. 2023;20(4):2973. [FREE Full text] [doi:10.3390/ijerph20042973] [Medline:36833669]

30. Yu Y, Fong VWI, Ng JHY, Wang Z, Tian X, Lau JTF. The associations between loneliness, hopelessness, and self-control and Internet gaming disorder among university students who were men who have sex with men: cross-sectional mediation study. J Med Internet Res. 2023;25:e43532.[FREE Full text][doi:10.2196/43532] [Medline:36649059]

31. Liu YL, Liu J, Wang W. The effect of future time perspective on Internet dependence among college students in pandemic time: a moderated mediation analysis. Psychol Res Behav Manag. 2023;16:509-520. [FREE Full text][doi: 10.2147/PRBM.S396622] [Medline:36860351]

32. Hamama R, Ronen T, Feigin R. Self-control, anxiety, and loneliness in siblings of children with cancer. Soc Work Health Care. 2000;31(1):63-83.[doi: 10.1300/J010v31n01_05] [Medline:10989875]

33. Barron-Martinez JB, Salvador-Cruz J. Social abilities in young Mexicans with down syndrome

during the COVID-19 pandemic. *Int J Dev Disabil.* 2022;69(6):888-895. [FREE Full text] [doi:10.1080/20473869.2022.2038527][Medline:37885837]

34. Ryan RM, Deci EI. Self-determination theory: basic psychological needs in motivation, development, and wellness. New York, NY: Guilford Press. 2017.

35. Converse BA, Juarez L, Hennecke M. Self-control and the reasons behind our goals. J Pers Soc Psychol. 2019;116(5):860-883. [doi:10.1037/pspp0000188][Medline:30070566]

36. Mills DJ, Allen JJ. Self-determination theory, internet gaming disorder, and the mediating role of self-control. Computers Human Behav. 2020;105:106209. [doi: 10.1016/j.chb.2019.106209]

37. Neff KD. The development and validation of a scale to measure self-compassion. Self Identity. 2003;2(3):223-250. [doi: 10.1080/15298860390209035]

38. Chen J, Yan L, Zhou L. Reliability and validity of Chinese version of self-compassion scale. Chinese J Clini Psychol. 2011;19(6):734-736.

39. Tangney JP, Baumeister RF, Boone AL. High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. J Pers. 2004;72(2):271-324. [doi: 10.1111/j.0022-3506.2004.00263.x][Medline:15016066]

40. Tan S, Guo Y. Revision of self-control scale for Chinese college students. Chinese J Clinil Psychol.2008;16(5):468-470.

41. Lemmens JS, Valkenburg PM, Gentile DA. The Internet gaming disorder scale. *Psycholl Assess.*2015;27(2):567-582.

42. Lei W, Liu K, Zeng Z, Liang X, Huang C, Gong K, He W,…… Chen J. The psychometric properties of the Chinese version Internet gaming disorder scale. Addict Behav. 2020;106:106392. [doi: 10.1016/j.addbeh.2020.106392][Medline:32193072]

43. Wu AMS, Lai MHC, Zhang M, Yogo M, Yu SM, Mao S, Chen JH. Effects of psychological distress and coping resources on Internet gaming disorder: comparison between Chinese and Japanese university students. Int J Enviro Res Public Health. 2022;19(5):2951. [FREE Full text]

[doi:10.3390/ijerph19052951] [Medline:35270644]

44. Wen-Juan-Xing platform. (https://www.wjx.cn). Changsha Ranxing Information Technology Co., Ltd. Assessed from April to September 2022.

45. Chang SJ, van Witteloostujin A, Eden L. From the editors: common method variance in international business research. J Inter Business Stud. 2010;41(2):178-184. [doi: 10.1057/jibs.2009.88]

46. Yang X, Yip BHK, Lee EKP, Zhang DX, Wong SYS. The relationship between technology use and problem technology use and potential psychosocial mechanisms: population-based telephone survey in community adults during COVID-19. Front Psychol. 2021;12:696271. [FREE Full text] [doi: 10.3389/fpsyg.2021.696271] [Medline:34434146]

47. King DL, Achab S, Higuchi S, Bowden-Jones H, Muller KW, Billieux J, …… Delfabbro PH. Gaming disorder and the COVID-19 pandemic: treatment demand and service delivery challenges. J Behav Addict. 2022;11(2):243-248. [FREE Full text][doi: 10.1556/2006.2022.00011] [Medline:35413005]

48. Leigh-Hunt N, Bagguley D, Bash K, Turner V, Turnbull S, Valtorta N, Caan W. An overview of systematic reviews on the public health consequences of social isolation and loneliness. Public Health.2017;152:157-171.[doi:10.1016/j.puhe.2017.07.035] [Medline:28915435]

49. Liu BS, Wu XY, Shi LK, Li H, Wu D, Lai X, Li YY, …… Li DN. Correlations of social isolation and anxiety and depression symptoms among patients with breast cancer of Heilongjiang province in China: the mediating role of social support. Nurs Open.2021;8(4):1981-1989. [FREE Full text] [doi: 10.1002/nop2.876] [Medline:33939294]

50. Wolters NE, Mobach L, Wuthrich VM, Vonk P, van der Heijde CM, Wiers RW, Rapee RM, Klein AM. Emotional and social loneliness and their unique links with social isolation, depression and anxiety. J Affect Disord.2023;329:207-217. [doi: 10.1016/j.jad.2023.02.096] [Medline:36842647]

51. Li X, Li W, Liu M, Xiao W, Zhou H. How does shyness affect Chinese college students'

tendency to mobile phone addiction? Testing the mediating roles of social anxiety and self-control. Front Public Health. 2022;10:902425. [FREE Full text][doi: 10.3389/fpubh.2022.902425] [Medline:35910898]

52. Xiang GX, Gan X, Jin X, Zhang YH, Zhu CS. Developmental assets, self-control and Internet gaming disorder in adolescence: testing a moderated mediation model in a longitudinal study. Front Public Health. 2022;10:808264. [FREE Full text][doi: 10.3389/fpubh.2022.808264] [Medline:35186844]

53. Cudo A, Wojtasinski M, Tuznik P, Fudali-Czyz A, Griffiths MD. The relationship between depressive symptoms, loneliness, self-control, and gaming disorder among Polish male and female gamers: the indirect effects of gaming motives. Int J of Environ Res Public Health, 2022;19(16):10438. [FREE Full text][doi: 10.3390/ijerph191610438] [Medline:36012072]

54. Finkenauer C, Engels RCME, Baumeister RF. Parenting behavior and adolescent behavioural and emotional problems: the role of self-control. Int J Behavior Devel. 2016;29(1):58-69. [doi: 10.1080/01650250444000333]

55. Yu Y, Mo PKH, Zhang J, Li J, Lau JTF. Impulsivity, self-control, interpersonal influences, and maladaptive cognitions as factors of Internet gaming disorder among adolescents in China: cross-sectional mediation study. J Med Internet Res. 2021;23(10):e26810. [FREE Full text][doi: 10.2196/26810] [Medline:34704960]

56. Jeong H, Yim HW, Lee SY, Lee HK, Potenza MN, Jo SJ, Son HJ, Kim G. Low self-control and aggression exert serial mediation between inattention/hyperactivity problems and severity of Internet gaming disorder features longitudinally among adolescents. J Behav Addict. 2020;9(2):401-409. [FREE Full text][doi: 10.1556/2006.2020.00039] [Medline:32634112]

57. Loades ME, Chatburn E, Higson-Sweeney N, Reynolds S, Shafran R, Brigden A, Linney C, …… Crawley E. Rapid systematic review: the impact of social isolation and loneliness on the mental health of children and adolescents in the context of COVID-19. J Am Acad Child Adolesc

Psychiatry. 2020;59(11):1218-1239. [FREE Full text][doi: 10.1016/j.jaac.2020.05.009] [Medline:32504808]

58. Lubben J, Blozik E, Gillmann G, Iliffe S, von Renteln Kruse W, Beck JC, Stuck AE. Performance of an abbreviated version of Lubben social network scale among three European community-dwelling older adult populations. Gerontologist. 2006;46:503-513. [doi: 10.1093/geront/46.4.503] [Medline:16921004]

59. Unden AL, Orth-Gomer K. Development of a social support instrument for use in population surveys. Soc Sci Med. 1989;29(12):1387-1392. [doi: 10.1016/0277-9536(89)90240-2] [Medline:2629121]

Supplementary Files

Multimedia Appendixes

Moderation analysis of gender in the association between social isolation and internet game addiction.
URL: http://asset.jmir.pub/assets/778f27de90815304ce86656b2bab296f.docx

STROBE Statement—Checklist of items that should be included in reports of cross-sectional studies.
URL: http://asset.jmir.pub/assets/ec258019be8e9c2b75979ef993c043e3.docx