Prevalence and Correlates of Internet Gaming Disorder: A Comparison Between English-Speaking and Chinese-Speaking Adult Gamers

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ABSTRACT

Objectives: Studies have suggested that the prevalence of Internet Gaming Disorder (IGD) is higher among Asian populations. This study compared the prevalence and severity of IGD between English-speaking gamers and Chinese-speaking gamers. Correlates of IGD were investigated in the global sample. **Methods**: A total of 101 English-speaking gamers and 130 Chinese-speaking gamers were recruited via a social marketing campaign and participated in an online questionnaire. **Results**: The prevalence of IGD was 0.0% and 0.8%, respectively, among English-speaking gamers and Chinese-speaking gamers. Chinese-speaking gamers were more likely to deceive family members, therapists, or others because of the amount of gaming activity, and were more likely to have jeopardized or lost an important relationship, job, or an educational or career opportunity because of gaming activity. English-speaking gamers were more likely to own a dedicated gaming device, started video gameplay at a younger age, spent more hours weekly on gameplay, and were more likely to play games to escape or relieve a negative mood. Among the global sample, correlates of a higher level of IGD were: being males, being current students, spending more hours weekly on gameplay, having experienced anxiety in the past year, having a higher level of violence, and having less real-life social support. **Conclusions**: These results suggested that the prevalence of IGD is low and comparable between English-speaking and Chinese-speaking gamers. The two populations differed in certain diagnosis criteria of IGD and behavioral factors relating to gameplay. Psychosocial factors of IGD were observed among the global sample adjusting for the cultural background.

Keywords: Internet Gaming Disorder; addiction; behavioral health; cultural difference

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Introduction

In recent years there has been increasing research in the area of Internet Gaming Disorder [IGD], as a global issue of great concern [1-5]. There are concerns regarding Internet use addiction and its potential social, economic, and health consequences [6]. Any may readily observe how Internet use, in general, has permeated into almost every aspect of human life, including but not limited to working, shopping, and social networking. Yet, among all the online behaviors, excessive Internet gaming has gained great attention given its similarity to addiction and comorbidity to other mental health conditions [7].

The most recent Diagnostic and Statistical Manual of Mental Disorder [DSM-5] identified IGD as a condition that called for further research and evidence [8]. According to DSM-5, the nine core diagnostic criteria of IGD were: [1] preoccupation with Internet games; [2] psychological withdrawal symptoms such as anxiety when reducing or giving up gaming activities; [3] tolerance that one needs to spend an increasing amount of time playing games to feel satisfaction or pleasure; [4] failure in controlling or stopping gaming activities; [5] lack of interest in previous hobbies; [6] continued gaming activities regardless of gaming-caused real-world issues; [7] deception to family members and therapists about the amount of gaming activity; [8] use of Internet games to escape a negative state of mind; and [9] impairments in education employment, or interpersonal relationship as a result of gaming activities.

These nine diagnostic criteria paralleled that of substance-related and addictive disorders such as pathological gambling [9]. Compared to the long recognition of substance-related addiction, the concept of behavioral addiction emerged only in recent decades. Though the physical signs of substance-related addiction were generally absent in behavioral addiction, they had comparable etiology and symptoms such as salience, tolerance, and withdrawal [10]. From the neurobiological perspective, pathological Internet gaming activated brain regions that were engaged in reward and addiction, induced the reward pathway, altered the dopaminergic projections, and caused structural change of the brain [11]. Similar to substance user, people with Internet addiction showed a lower level of dopamine receptor and such a reduction increased with the severity of addiction [12; 13]. Literatures have documented that people with gaming addiction were at a higher risk of using substance regularly or excessively such as tobacco, alcohol, and cannabis [14; 15]. Problematic game user also consumed more caffeine possibly for the purpose of stimulation [16]. Further, people with earlier onset of substance abuse also showed a greater level of problematic use of video game [14]. Nevertheless, in a longitudinal study with male college students, it was found that Internet game addiction predicted fewer drug and alcohol violations whereas jeopardized academic achievement [17]. Therefore, the co-occurrence between IGD and substance abuse warranted further investigation.

One of the most important indicators of addiction was the deterioration of functionality [10]. Literatures have documented the negative association between IGD and social support [18; 19]. Problematic gamers generally had less social support in the real world and found it easier to make friends online [16]. Such impairment in social functioning was one of the core diagnosis criteria for IGD [8]. Another negative impact of problematic gameplay on social life was aggression [20]. Previous literatures have suggested a positive association between aggressive tendency and IGD [19]. Mehroof and Griffiths [21] found a positive relationship between online gaming addiction and level of aggression, which involved physical, verbal, and emotional and cognitive components of aggression. According to Brunborg et al. [22], a 10% increase in video game addiction was associated with a 5.9% increase in aggressive conduct during a 2-year follow up. One mechanism for the increased violence among disordered video

gamers was desensitization. For example, Carnagey et al. [23], experiment revealed that exposure to violent video game led to physiological desensitization to real life violence.

The comorbidity of IGD and other mental conditions, particularly major depression and anxiety, has been widely discovered [15; 22; 24-26]. A compromised psychological well being could be a result of IGD-related negative consequences discussed above, including impaired interpersonal relationship, loss of employment or education opportunities, elevated aggression, and substance abuse. For example, it has been well established that social support was protective of psychological well being via preventing as well as assisting the coping with stressful events [27]. Further, social support itself was an important coping resource and assistance [28]. Excessive online gameplay posed a substantial risk to individual real-life social support [25]. Thus, IGD could induce other mental conditions through the mechanism of impaired social support. On the other hand, IGD could be secondary to mental conditions. It has been proposed that disordered gameplay, alike other addiction such as gambling and substance use, was maladaptive self-regulatory strategy in face to mental health symptoms [29; 30]. Online game created an environment for the gamers to focus on and temporarily escape from the conflicts and negative emotions. Games that enabled the creation of Avatar also provided gamer an opportunity to create an "idea self" to compensate for the unsatisfied feeling that many people with depression were experiencing in real life [29]. Gamers who used gaming as a coping strategy were more subject to becoming addicted to gaming [30]. Kim et al. [20] evaluated the motivations for online gaming and found that gamers at a higher risk of IGD were more motivated to play online game for a range of purposes, especially for escaping from conflicts or as a coping strategy. Further, addicted video game user employed more avoidance-oriented coping strategies rather than actively solving the problems, which in turn was associated with a higher level of mental health conditions such as anxiety and depression [31]. Therefore, the relationship between IGD and other mental health conditions appeared to be a vicious cycle – people with compromised mental health status firstly turned to excessive gameplay to relieve their mental health symptoms, which later generated and accumulated more conflicts in daily life, and thus perpetuated the mental health conditions [29; 32].

Previous studies have suggested a higher Internet addiction prevalence among Asian populations [11; 33]. King et al. [34] highlighted a higher prevalence of problematic video game play in East Asian populations, compared to populations in Western Europe, North America, and Australia. Further, Wittek et al. [35] found that being born in Africa, Asia, South America or Central America were 4.9 times more like to be addicted gamers compared to respondents born in Norway. Current prevalence estimates of IGD varied across studies. A line of studies with a national representative sample have suggested the IGD prevalence ranging from 1.3% to 4.6% in Europe [36], while a study on Chinese population showed the prevalence of IGD was of 3.1% [37]. On the other hand, one study among Chinese gamers found a much higher prevalence of 15.6% [38]. In Gentile et al. [39], longitudinal study in Singapore, the prevalence of pathological video gameplay was approximate 9%. Such lack of consistence in prevalence estimates could be a result of different methodology, instrument, and criteria used cross different studies [7]. Therefore, cross-population prevalence estimation using the same instrument and criteria is in need. In order to reach a global consensus on IGD and determine its inclusion in DSM, researchers have advocated for cross-cultural study to investigate and evaluate the validity and reliability of the IGD diagnostic criteria [40].

The present study was conducted to compare the excessive gaming activities among Chinese-speaking gamers to that among English-speaking gamers by answering the following

research questions: 1] whether the two linguistic populations differed from each other regarding demographic and other game-related characteristics; 2] whether there was any difference regarding the severity and prevalence of IGD between the two populations; 3] what were the factors relating to IGD in the total sample?

Materials and Methods

Design

This is an analytic cross-sectional study and participants were recruited to participate in a self-administered online survey. The study survey was firstly designed in English. To recruit a Chinese-speaking sample, the research team translated the study survey into simplified Chinese language. The survey was translated into Chinese and then independently back-translated into English. The back-translated English survey was compared to the original English survey and any discrepancies between the two versions were resolved. Recruiting messages and flyers of the study were also translated into Chinese for Chinese-speaking sample recruitment.

Participants were recruited via a social media campaign. The recruiting message was distributed through postings on various gaming forums and social media platforms including Facebook, YouTube, and emails. Flyers of the study were posted on local information boards. Correspondingly, recruitment of Chinese-speaking participants occurred on the social media platforms that were widely adopted among Chinese, such as Weibo and Wechat. In order to widely disseminate the study information and obtain a desirable sample size, participants were encouraged to share the study information with other gamers they knew. The period of the social marketing campaign was the same for the English-speaking and Chinese-speaking sample recruitment. Participants who completed the survey would have a chance to win one of three $100 Amazon gift cards. The Institutional Review Board [IRB] for the

Protection of Human Subject at a University approved this study on February 21, 2019.

Participants

A total sample comprising 101 English-speaking gamers and 131 Chinese-speaking gamers participated in the study. Screening questions at the beginning of the survey ensured that all the participants were 18 years old or older gamers who played video games at least once a week at a minimum, considered themselves involved in Internet gaming, and had been gaming for the past six months. Initially, 258 participants [117 were English-speaking and 141 were Chinese-speaking] met the criteria, provided Informed Consent, and began the survey. A total of 231 participants [101 were English-speaking and 131 were Chinese-speaking] completed the survey to the point of providing data for the primary outcome variable and were therefore included in the data analysis. Comparisons between the groups of study completers versus non-completers showed that there were no significant differences between the two groups for essential demographic characteristics such as age, income, or education.

Instrument

Participants' experience of IGD was assessed by the Internet Gaming Disorder Scale – Short-Form [IGDS9-SF]. The scale was developed by Pontes and Griffiths [2015] and contained nine items reflecting the nine criteria of IGD proposed in DSM-5 [2013]. Participants were asked to respond to each item in a five-point Likert scale. Participants' level of IGD was a sum of the nine items, with a possible range from 9 to 45. According to Pontes and Griffiths [2015], participants who scored between 36 to 45, or answered the highest level for five or more items, would be classified as disordered gamers. Pontes and Griffiths [2015] also suggested that the scale was a valid instrument in assessing the severity of one's gaming addiction. In this study, participants' level of IGD was the sum of the nine items, and a higher total score indicated a higher level of IGD.

This study obtained the following demographic characteristics of the participants: age, gender, relationship status, and being a student or not. As advised by Pontes and Griffiths [2015], this study also obtained information on participants' age of beginning gameplay, weekly gameplay duration, ownership of a game console or other dedicated gaming device, and ownership of a mobile phone device with Internet access.

Participants' frequent use of cigarettes, e-cigarettes, and alcohol was measured by three separate items. Participants were asked whether they use cigarettes/e-cigarettes/alcohol more than 3 times a week and provided a binary Yes/No response to each item. During the data analysis procedure, participants who used either cigarettes or e-cigarettes were classified as cigarettes users.

A single item measured participants' experience of depression. After reading a provided definition of depression, participants were asked to provide a binary Yes/No response on whether they had experienced any depression in the past year. Similarly, participants were asked to provide a binary response to whether they had experienced any anxiety in the past year after reading a definition of anxiety.

Participants' level of perceived social support was measured by five items. Each item represented a scenario in daily life that one might need help from others, such as asking for advice, receiving encouragement, or getting a shelter, money, or food in an emergency. For example, participants were presented with the scenario "I could get food from them if I was hungry and had no food because of some emergency in my life" and responded in a five-point Likert type scale ranging from "I have no one like this in my life" to "I have 6 or more people like this in my life". Participants' level of perceived social support was the mean of the five items. This five-item scale has been adopted by a previous study [Lian & Wallace, 2017] and showed excellent internal consistency.

Regarding their level of gaming-related violence, participants completed a measure with a single item: "Have you ever been violent—hitting, striking, or pushing someone [parent, sibling, peer, or co-worker, etc.], or destroyed anything [breaking objects, smashing things], because of your gaming activity?". The response was in a five-point Likert scale and a higher rating indicated a higher level of gaming-related violence.

Data Analysis

Firstly, descriptive statistics were reported for both English-speaking and Chinese-speaking sample. Secondly, a comparison of the two samples was conducted. Specifically, independent t-test was used for continuous variables. The non-parametric Wilcoxon-Mann-Whitney test was used as an alternative when the assumption of normality of the dependent variable was not met. For categorical variables, Pearson Chi-square test was used. For categorical variables containing a cell less than five, Fisher's exact test was used as an alternative. Individual bivariate regression models were established to examine the correlation between the level of IGD and each independent variable in the total sample. Then, a multiple linear regression model was built. Statistical significance level was assumed at 0.05. All statistical analysis was conducted using SAS 9.4.

Results

The study's convenience sample comprised 95 females [41.13%] and 136 males [58.87%]. The total sample had a mean age of 27.26 years old. Approximate half of the sample [47.19%] currently had a partner, and more than half of the sample [61.47%] were current students. Compared to English-speaking participants, Chinese-speaking participants were younger and comprised more current students. The majority of English-speaking participants [84.15%] reported starting gameplay before 12 years old, compared to 49.23% of the Chinese-speaking participants. Regarding the weekly playing time, 11 out of the 101 English-speaking participants [10.89%] and 5 out of the 130 Chinese-speaking participants [3.85%] reported

playing Internet games more than 30 hours per week. The majority of the English-speaking sample [91.09%] owned a game console or other dedicated gaming device, compared to 43.08% of the Chinese-speaking sample. All the participants except two Chinese-speaking participants owned a mobile phone device with Internet Access [Table 1].

Table 1. Comparison of socio-demographic and gaming-related behavioral characteristics

	Total sample [N=231]	English-speaking sample [n=101]	Chinese-speaking sample [n=130]	p-value
Age				**0.0001***
Mean [SD]	27.26 $\pm$ 0.53	29.34$\pm$8.40	25.65 $\pm$7.51	
Gender				0.22
Female	95 [41.13]	37 [36.63]	58 [44.62]	
Male	136 [58.87]	64 [63.37]	72 [55.38]	
Partnership				0.16
Yes	109 [47.19]	53 [52.48]	56 [43.08]	
No	122 [52.81]	48 [47.52]	74 [56.92]	
Student Status				**0.0001***
Yes	142 [61.47]	48 [47.52]	94 [72.31]	
No	89 [38.53]	53 [52.48]	36 [27.69]	
First Gameplay Age				**0.0001***
Before age 6	48 [20.78]	40 [39.60]	8 [6.15]	
Between age 7 and 12	101 [43.72]	45 [44.55]	56 [43.08]	
Between age 13 and 17	53 [22.94]	11 [10.89]	42 [32.31]	
After age 18	29 [12.55]	5 [4.95]	24 [18.46]	
Weekly gameplay hour				**0.0001***
Less than 7 hours	95 [41.13]	24 [23.76]	71 [54.62]	
Between 8 and 14 hours	68 [29.44]	33 [32.67]	35 [26.92]	
Between 15 and 20 hours	35 [15.15]	22 [21.78]	13 [10.00]	
Between 21 and 30 hours	17 [7.36]	11 [10.89]	6 [4.62]	
Between 31 and 40 hours	6 [2.60]	5 [4.95]	1 [0.77]	
More than 40 hours	10 [4.33]	6 [5.94]	4 [3.08]	
Own a Game Console or Other Dedicated Gaming Device				**0.0001***
Yes	148 [64.07]	92 [91.09]	56 [43.08]	
No	83 [35.93]	9 [8.91]	74 [56.92]	
Own a Mobile Phone Device with Internet Access				0.21
Yes	229 [99.13]	101 [100.00]	128 [98.46]	
No	2 [0.87]	0 [0.00]	2 [1.54]	

*$p < .05$; **$p < .01$; ***$p < .001$

The majority of the total sample did not use cigarettes [85.28%] or alcohol [92.21%] more than three times per week. More than a third of the total sample [39.39%] had experienced depression in the past year, and 40.26% of the total sample had experienced anxiety in the past year. Comparatively, Chinese-speaking participants had a higher prevalence of frequent cigarette use. The prevalence of frequent alcohol use also tended to be higher among the Chinese-speaking participants [9.23% compared to 5.94%] but not at a statistically significant level. English-speaking participants were more likely to experience depression or anxiety in the part year. For example, more than half of the English-speaking participants [61.39%] reported having experienced anxiety in the past year, compared to 23.85% of the Chinese-speaking participants. The total sample on average had a low level of gaming-related

violence. The level of social support was a mean of 3.53, which was equivalent to having two to three people to help with different emergent situations [Table 2].

Table 2. Comparison of mental health outcomes, cigarette, and alcohol use, and other selected characteristics

	Total sample [N=231]	English-speaking sample [n=101]	Chinese-speaking sample [n=130]	p-value
Cigarettes use more than three times per week				0.0009***
Yes	34 [14.72]	6 [5.94]	28 [21.54]	
No	197 [85.28]	95 [94.06]	102 [78.46]	
Alcohol use more than three times per week				0.35
Yes	18 [7.79]	6 [5.94]	12 [9.23]	
No	213 [92.21]	95 [94.06]	118 [90.77]	
Past year depression				0.0001***
Yes	91 [39.39]	59 [58.42]	32 [24.62]	
No	140 [60.61]	42 [41.58]	98 [75.38]	
Past year anxiety				0.0001***
Yes	93 [40.26]	62 [61.39]	31 [23.85]	
No	138 [59.74]	39 [38.61]	99 [76.15]	
Level of Violence [Min=1, Max=5]				0.43
Mean [SD]	1.58$\pm$0.06	1.54$\pm$0.95	1.61$\pm$0.93	
Level of Social Support [Min =1, Max=5]				0.50
Mean [SD]	3.53 $\pm$0.07	3.47$\pm$1.10	3.58$\pm$0.98	

*$p < .05$; **$p < .01$; ***$p < .001$

The total sample had a mean score of 21.54 in the Internet Gaming Disorder Scale. Among the nine DSM-5 criteria, criteria "Escape" was scored highest, followed by criteria "Preoccupation" and "Give up other activities". English-speaking and Chinese-speaking participants showed no difference in the total score but in the scores of three criteria. Particularly, Chinese-speaking participants were more likely to have deceived family members, therapists or others because of the amount of gaming activity, and were more likely to have jeopardized or lost an important relationship, job or an educational or career opportunity because of gaming activity. On the other hand, English-speaking participants were more likely to play game to temporarily escape or relieve a negative mood [Table 3].

Endorsing the diagnosis criteria that respondents who answered the highest level for at least 5 of the 9 DSM-5 criteria were identified as having IGD, the prevalence of IGD was 0% [n=0] among English-speaking participants [n=101] and 0.8% [n=1] among Chinese-speaking participants [n=130]. Further, when applying the diagnosis criteria that participants who scored a minimum of 36 might as well be classified as disordered gamers [Pontes & Griffiths, 2014], three disordered gamers were identified among the English-speaking sample and one disordered gamer was identified in the Chinese-speaking sample.

Among the total sample, unadjusted models showed that participants with a higher level of IGD were more likely to be males, have experienced anxiety in the past year, and have expressed more gaming-related violence [p<0.05]. These three variables remained positive correlates of IGD in the adjusted model. The adjusted model additionally showed that participants who were current students or spent more time each week playing games had a

higher level of IGD [p<0.05]. On the other hand, social support appeared to be a significant protector of IGD, that the higher the level of social support, then the lower the level of IGD [p<0.05, Table 4].

Table 3. Comparison of Internet Gaming Disorder Scale [IGDS]

	Total sample [N=231]	English-speaking sample [n=101]	Chinese-speaking sample [n=130]	p-value
Preoccupation- Do You Feel Preoccupied with your Gaming Behavior	2.86 + 0.07	2.83 + 1.08	2.88 + 1.05	0.78
Withdrawal - Do You Feel More Irritability, Anxiety or Even Sadness when you Try to Either Reduce or Stop Your Gaming Activity	2.23 + 0.06	2.23+ 0.98	2.22+0.92	0.96
Tolerance - Do You Feel the Need to Spend Increasing Amounts of Time Engaged in Gaming in Order to Feel Satisfaction or Pleasure	2.22 +0.06	2.37+1.07	2.10+0.85	0.10
Loss of control - Do You Systematically Fail When Trying to Control or Cease Your Gaming Activity	2.22 + 0.07	2.14+1.09	2.28+0.97	0.16
Give up other activities - Has You Lost Interests in Previous Hobbies and Other Entertainment Activities as a Result of your Engagement with the Game	2.55 +0.08	2.58 +1.26	2.52+1.14	0.72
Persistence - Have You Continued Your Gaming Activity Despite Knowing It was Causing Problems Between You and Other People	2.26 +0.07	2.26 +1.15	2.26 +1.08	0.85
Deception - Have You Deceived Any of Your Family Members, Therapists or Others because of the Amount of Your Gaming Activity	2.10+0.08	1.69 + 0.89	2.41 + 1.22	**0.0001*****
Escape - Do You Play in Order to Temporarily Escape or Relieve a Negative Mood	3.30 +0.08	3.51 + 1.23	3.14+1.19	**0.007***
Impairment - Have You Jeopardized or Lost an Important Relationship, Job or an Educational or Career Opportunity because of Your Gaming Activity	1.81 +0.07	1.69 + 1.02	1.91 +1.02	**0.04***
Total Score of IGDS	21.54 ± 0.42	21.31 ±6.55	21.72 ±6.25	0.26

*p < .05; **p < .01; ***p < .001*

Table 4. Regression Analysis Predicting Internet Gaming Disorder [N=231]

Internet Gaming Disorder							
	Unadjusted Coefficients	95% CI	p value	Adjusted Coefficients	95% CI	p-value	
Demographics							
Gender							
Female		ref			ref		
Male	2.42	[0.77, 4.07]	**0.004****	2.35	[0.73, 3.96]	**0.005****	
Age	-0.03	[-0.13, 0.07]	0.592	0.13	[-0.003, 0.26]	0.056	
Current Student							
No		ref			ref		
Yes	1.41	[-0.28, 3.10]	0.102	2.68	[0.57, 4.79]	**0.013***	
Current Relationship							

No		ref			ref	
Yes	-1.23	[-2.88, 0.42]	0.143	-0.82	[-2.47, 0.83]	0.326
Language						
English		ref			ref	
Chinese	0.42	[-1.25, 2.08]	0.624	1.85	[-0.11, 3.82]	0.064
Cigarettes Use						
No		ref			ref	
Yes	0.99	[-1.35, 3.32]	0.406	0.58	[-1.72, 2.88]	0.620
Alcohol Use						
No		ref			ref	
Yes	0.98	[-2.11, 4.07]	0.532	-0.72	[-3.58, 2.15]	0.623
Past-year Depression						
No		ref			ref	
Yes	1.41	[0-.27, 3.09]	0.101	-0.06	[-1.97, 1.85]	0.951
Past-year Anxiety						
No		ref			ref	
Yes	2.14	[0.47, 3.80]	**0.012***	2.49	[0.55, 4.43]	**0.012***
First Age of Gameplay	-0.29	[-1.18, 0.60]	0.520	-0.29	[-1.26, 0.68]	0.552
Weekly Gameplay Time	0.49	[-.12, 1.11]	0.117	0.65	[0.05, 1.25]	**0.033***
Level of Violence	2.86	[2.06, 3.67]	**0.000*****	2.63	[1.83, 3.42]	**0.000*****
Level of Social Support	-0.75	[-1.55, 0.04]	0.064	-0.78	[-1.50, -0.05]	**0.036***

*p < .05; **p < .01; ***p < .001*

Discussion

This cross-sectional study with 101 English-speaking and 130 Chinese-speaking adult gamers found a low level of IGD that none of the English-speaking participants and only one of the Chinese-speaking participants met five out of the nine IGD diagnostic criteria listed in DSM-5. The IGD prevalence for the total sample was 0.43%. Applying the 36 out of 45 cut-off point criteria, the English-speaking sample contained three and the Chinese-speaking sample contained one addicted gamer, which slightly increased the IGD prevalence to 1.7% in the total sample. The IGD prevalence found in this study was lower compared to that of the Pontes et al. [41] study, which employed the same IGDS9-SF scale and cutoff value and found an IGD prevalence of 3.1% among a nationally representative sample of Slovenian adolescent gamers. Similarly, Chiu et al. [37] surveyed Chinese student gamers aged from 10 to 18 years old and found the IGD prevalence to be 3.1%. The instrument employed by Chiu et al. [37] for IGD diagnosis was also based on the nine IGD diagnostic criteria listed in DSM-5 and students responded on a three-point Likert scale. Therefore, the relatively low IGD prevalence found in the present study could indicate that IGD was less prevalent among adult gamers. Adolescents were found to be at a higher risk of problematic Internet gaming [42]. In the Wittek et al. [35] study with a national representative sample of video gamers in Norway [aged between 16 to 74], it was found that 1.41% of active gamers were addicted gamers and the likelihood of being addicted gamers declined over the age span.

While English-speaking sample spent more hours on weekly gameplay, English-speaking and Chinese-speaking gamers did not differ regarding their severity of IGD. The comparable IGD prevalence and IGD severity between the two samples disagreed with the previous suggestion that problematic Internet use and video game playing were more prevalent among Asian populations [11; 33; 34]. However, while the two study populations did not differ in the mean level of IGD, they showed significant difference in three criteria: Deception, Escape, and Impairment.

Chinese-speaking gamers were more likely to have deceived any of their family members, therapists or others because of the amount of their gaming activity than English-speaking

gamers [2.41 vs. 1.69, p<0.001]. Chinese-speaking gamers were also more likely to have jeopardized or lost an important relationship, job or an educational or career opportunity because of gaming activity. Both of these two criteria involved interpersonal interaction and the different scoring between the two samples could reflect the cultural discrepancy between collectivism and individualism. Generally, major English-speaking countries such as the United States, the United Kingdom, Australia, etc., had a high level of individualism, while Chinese-speaking countries were considered collectivistic [43]. Compared to individualistic cultures where individual autonomy and independence were emphasized and encouraged, Chinese collectivistic culture prioritized the welfare and goals of the group [e.g. family] rather than that of the individual [44]. In practice, Chinese people embraced the idea that one ought to "work hard so that one won't be a disappointment to one's family" as well as "bring praise through achievement to one's family" [45].

Engaging in excessive gameplay, nevertheless, may represent a deviation from family and social expectations. In China, Internet addiction has led to high social awareness in recent decades. In 2006, a hospital in Beijing established the first "Internet addiction diagnosis and treatment camp" in China. The camp treated more than three thousand persons in the following years and informed the establishment of "Clinical Diagnostic Criteria for Internet Addiction" in 2008. In contemporary times, a variety of treatment camps for Internet addiction have spread across China and were adopted for use by many Chinese parents seeking assistance for their children [46]. The fact that Internet addiction has been recognized as a behavioral health condition might also explain why Chinese-speaking gamers experienced more impairments in interpersonal relationships. In Chinese culture, mental illness generally implies individual insufficiency, and having a family member with mental illness could damage the reputation of the entire family [47]. Individuals with

mental illness were also likely to be socially ostracized [48]. Thus, the finding of this study on Chinese gamers' hesitation to disclose their gaming activities and experiences of jeopardized social relationships could reflect the pathologization and stigmatization of excessive Internet gaming in contemporary times in China.

The English-speaking sample reported a higher prevalence of past-year depression and anxiety. As per recent literature, the prevalence of major depression and anxiety disorder in China is comparable to the global prevalence [49]. The difference found in this present study could indicate a true difference between the two samples. It could also be a result of the reluctance to disclose mental disorders, the tendency to describe mental disorders as physical conditions, and the low recognition rate of mental health conditions among Chinese [50; 51].

Moreover, the two samples differed in demographic and behavioral characteristics related to gameplay and the potential development of IGD. Specifically, the Chinese-speaking sample was younger and contained more students, which potentially placed them at a higher risk of problematic Internet use and gameplay. This follows from how those who were university students likely had greater flexibility in time and money, wide access to Internet, independence in living, and the stress of adjusting to the new social role of students [34]. Further, university students were found to be less capable concerning engagement in self-regulation [52]. On the other hand, the English-speaking sample started gameplay at an earlier age and the vast majority of them [91.09%] owned a game console or other dedicated gaming device. These findings are comparable to those in the Pontes and Griffiths [53] study with 1060 English-speaking gamers. In their sample, 45.8% had their first experience of gameplay before the age of 6 and 44.3% of them started between 7 and 12 years of age. Further, 86.4% of them owned a mobile device with internet access and 70.1% owned a game console [53].

One explanation of the difference between the two samples in the study regarding first gameplay age and ownership of device could be the different economic levels of those living in different regions. Gamers in more economically developed areas had more access to Internet and electronics devices at an earlier age [52]. Mak et al. [54] surveyed adolescents from six Asian countries and found that 41% of Chinese adolescents owned a smartphone, compared to 84% of South Korean adolescents. However, it should be noted that with the fast economic development in China, such a gap would continue to diminish. Indeed, nowadays, China has a large Internet gaming community. As of Dec 2020, China had 989 million Internet users and 518 million of them [52.4%] were online game users [55].

The adjusted regression model of this study showed that male gender and current student status were two demographic risk factors for IGD. This finding was in line with the established recognition that males [35] and university students [34; 52] were at higher risk of problematic Internet use and gameplay. The adjusted model demonstrated that the longer the weekly gameplay, the higher the level of IGD. Indeed, a positive correlation between gameplay time and IGD was important in the criterion-related validity of the IGD measurement scale [53; 56]. People with IGD were preoccupied with play, and generally played more than 30 hours per week on gameplay [8]. Further, a longitudinal study found that pathological gamers experienced an increasing length of gameplay during the follow up, which indicated the "growing" of the addiction [57].

Regression models in this study revealed the association between IGD and game-related violence with a considerable effect size. This finding was consistent with the literature showing that disordered gameplay was associated with a higher level of violence [21; 22] and, specifically, violence appeared to be a negative consequence of gaming addiction. A longitudinal study indicated that pathological gaming at baseline predicted an increase in physical aggression in 6 months, possibly due to the interpersonal conflicts caused by excessive gameplay, withdrawal symptoms of addiction, and long-term exposure to virtual violence [57]. Violent game players could become more desensitized to real life violence. The Engelhardt et al. [58] experiment highlighted that persons with low previous exposure to violent video games, after playing a violent video game for 25 minutes, showed desensitization to violent pictures, and, in turn, an increased level of aggression.

Real life social support was found to be a significant protector of IGD in this study. This finding validated the IGD diagnosis criteria of "Impairment". Video gameplay was not inherently problematic or addictive, but could become problematic and impair one's well being if the activity started to cause dysfunctions in one's personal and professional life [39]. The relationship between real life social support and IGD is such that one may wonder what came first, or whether there is a vicious cycle. On one hand, people with limited social support may be more likely to start engaging in excessive gameplay. The initial preoccupation with online gaming could be a result of social anxiety and poor quality interpersonal relationships [59]. Prolonged gameplay could be an avoidance-strategy for coping with conflicts in daily life [60]. On the other hand, disordered Internet gaming activities could lead to impairments in social life and loss of important relationships [25; 61]. In the Gentile et al. [39] two-year longitudinal study, it was found that youth with lower social competence were more likely to become pathological gamers. Moreover, youth who became pathological gamers started to have more parent-child relational problems and showed an increased level of social phobia. An impaired social network was found to be harmful to one's mental health. Correspondingly, the present study found that active gamers with a higher level of IGD were more likely to have experienced anxiety in the past year. This finding aligned with the literature that also found the co-

occurrence of IGD and compromised mental health [24-26]. Specifically, Loton et al. [31] found that anxiety had the largest association with video game addiction compared to depression and level of stress. Wu et al. [26] found that 45% of probable IGD gamers had moderate or severe levels of anxiety and 25% with moderate or severe levels of depression.

However, it must be acknowledged that gamers might establish meaningful online social support through gaming activities that they otherwise could not derive in the real world [62]. In fact, socialization was one of the primary incentives for beginning to engage in online gaming [60]. Particularly, Massively Multiplayer Online Games [MMORPG] provided an important platform for online social interaction, and it was suggested that online social support was protective of one's well being [18]. On the other hand, while excessive gaming has been generally viewed as a maladaptive coping strategy for mental health symptoms [29], Loton et al. [31] suggested that gamers using gaming as a diversion coping strategy were at a lower risk of stress, anxiety, and depression.

Several limitations of this study should be acknowledged when interpreting the study findings. Firstly, the methodological nature of a cross-sectional study design restricted the ability to draw any causal inferences. Secondly, participants in this study were recruited through a social media campaign while also using a snowballing technique. Thus, the resultant sample of convenience in this present study inhibited the generalization of the study findings to the entirety of English-speaking and Chinese-speaking gamer populations. Thirdly, while anonymity and confidentiality were ensured, participants might underreport certain socially undesirable behaviors such as violence.

Conclusions

In response to the call for cross-cultural study of the IGD diagnostic criteria [40], the present study evaluated and compared the prevalence of IGD between English-speaking and Chinese-speaking active video gamers. Using a widely adopted instrument and diagnosis criteria, the present study found that IGD prevalence was low in both English-speaking and Chinese-speaking active gamers. Moreover, the two samples had a comparable level of severity of IGD, while Chinese-speaking participants were more likely to encounter interpersonal issues because of excessive gameplay, i.e. scored higher on the "Deception" and "Impairment" criteria. On the other hand, English-speaking participants tended to start video gameplay earlier, spent more hours weekly on gameplay, were more likely to own a game console or other dedicated gaming device, and were more inclined to engage in game play to escape or relieve a negative mood.

The present study may be seen as providing risk profiles and descriptions of those most vulnerable to IGD. Specifically, males and students were at a higher risk of IGD. Participants with a higher level of IGD spent more time on gameplay weekly, had a higher level of game-related violence, and were more likely to experience anxiety symptoms. On the other hand, having more real-life social support was protective of developing IGD.

IGD is currently listed in DSM-5 as a condition that calls for further investigation. Indeed, the risk of over-pathologizing behavioral addictions has been stated [61]. Gameplay is not inherently addictive and engagement does not predict addiction [57]. Based on the DSM diagnosis criteria, the present study found a low prevalence of IGD among active adult gamers from two different cultural backgrounds—i.e. English speaking or Chinese. However, the negative socio-behavioral outcomes associated with IGD highlighted the need to develop psychosocial interventions, especially for those who have experienced compromised social functioning, comorbidity, or violent behaviors relating to gameplay. Interventions should be selected while keeping in mind the role of cultural factors in IGD. For example, gamers from different cultural backgrounds may have different levels of willingness to disclose their

gaming activities and other mental health symptoms. Further studies should consider assessing the prevalence of IGD and factors associated with IGD among other cultural groups, in order to potentially reveal yet more cultural differences in IGD.

Conflicts of Interests

The authors declare that there is no conflict of interest.

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