

Prevalence and associated factors of Internet gaming disorder among community dwelling adults in Macao, China

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Background and aims: Internet gaming disorder (IGD) has been mainly studied among adolescents, and no research to date has examined its prevalence in general Chinese adult populations. This study estimated the prevalence of probable IGD in community-dwelling adults in Macao, China. Associations between IGD and psychological distress (i.e., depression and anxiety) as well as IGD and character strength (i.e., psychological resilience and purpose in life) were also tested. *Methods:* A random, representative sample of 1,000 Chinese residents (44% males; mean age = 40.0) was surveyed using a telephone poll design from October to November 2016. *Results:* The estimated prevalence of probable IGD was 2.0% of the overall sample and 4.3% among the recent gamers ($n = 473$), with no statistically significant sex and age effects observed ($p > .05$). The two most prevalent IGD symptoms were mood modification and continued engagement, despite negative consequences. Probable IGD respondents were more vulnerable to psychological distress (25.0% and 45.0% for moderate or above levels of depression and anxiety, respectively) than their non-IGD counterparts. They also reported a lower level of psychological resilience than non-IGD respondents. No significant buffering effect of the two character strength variables on the distress–IGD relationship was found. *Discussion and conclusions:* These results provide empirical evidence that IGD is a mental health threat not only to adolescents but also to adults. IGD was significantly associated with psychological distress, which should be addressed in conjunction with IGD symptoms in interventions. Inclusion of gamers of both sexes and different age groups in future prevention programs is also recommended.

Keywords: Internet gaming disorder, prevalence, distress, resilience, purpose in life, Chinese

INTRODUCTION

With the rapid increase in Internet use, gaming has become one of the most popular online activities, with active gamers in 2016 reached 417 million in China (i.e., 57% of the overall Internet population; [China Internet Network Information Center, 2017](#)). Despite the entertainment purpose of online gaming, engaging in excessive, problematic gaming can be devastating to an individual's well-being ([Kuss & Griffiths, 2012](#)); hence, in its fifth edition, the *Diagnostic and Statistical Manual for Mental Disorders* (DSM-5; [American Psychiatric Association \[APA\], 2013](#)) has labeled it as an Internet gaming disorder (IGD), which is a clinical condition for further study. Individuals with IGD experience symptoms similar to those who developed substance dependence; these symptoms include preoccupation with gaming, developing a tolerance, withdrawal symptoms, unsuccessful attempts to stop, escape from bad moods, and jeopardizing significant relationships or opportunities because of gaming. IGD has emerged as a serious public health threat worldwide due to its high prevalence, although its prevalence varies across countries and regions due to differences in sample characteristics and in the

screening tool used (ranged from 0.7% to 15.6%; [Feng, Ramo, Chan, & Bourgeois, 2017](#)).

The data on prevalence of IGD provide essential information regarding the need for health policies and the effectiveness of those policies. There is, however, no prevalence research on Chinese community adult population. The existing four Chinese IGD studies reporting prevalence were all conducted among middle-school students ([Ko, Yen, Yen, Lin, & Yang, 2007](#); [Li, Zhang, Lu, Zhang, & Wang, 2014](#); [Wang et al., 2014](#); [Xu et al., 2012](#)) and the information about IGD in adult populations is lacking. Despite the higher vulnerability of adolescents to IGD, it is important to examine the prevalence of IGD in the general adult population. It is because online gaming is fast becoming a common form of entertainment for all ages and there are adults in both the East and West report symptoms and negative consequences of problematic online gaming ([Kim et al., 2016](#);

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Sigerson, Li, Cheung, Luk, & Cheng, 2017; Wenzel, Bakken, Johansson, Götestam, & Øren, 2009). The first aim of this study is to investigate the prevalence of probable IGD among community-dwelling adults in Macao, China according to the DSM-5 criteria (APA, 2013).

Psychological distress such as depression and anxiety has been proposed to be a predispositional factor of Internet-related addictions, including IGD (Davis, 2001). People with higher psychopathology are more vulnerable to these addictions due to multiple plausible mechanisms such as fewer psychosocial resources and the desire to escape from emotional difficulties (Ko, Yen, Chen, Yeh, & Yen, 2009; Wu, Li, Lau, Mo, & Lau, 2016). Previous research showed that depression, anxiety, social phobia, cognitive functioning, and overall psychological or internalizing problems were positively associated with gaming addictions among students, online gamers, and pathological gamblers (Jiménez-Murcia et al., 2014; Müller et al., 2015; Stockdale & Coyne, 2018; Wei, Chen, Huang, & Bai, 2012). The second aim of this study is to test if the positive association between psychological distress (depression and anxiety symptoms) and IGD tendency can be replicated in a representative sample of community-dwelling adults to inform interventions.

In addition to the risk factors for IGD, such as psychological distress, an examination of protective factors is also warranted, because many individuals who are at risk for IGD due to the presence of particular risk factors do not develop IGD. According to positive psychology, character strength such as psychological resilience and purpose in life would not only help one to flourish, but also protect one against developing addictions (Krentzman, 2013). Psychological resilience is defined as an ego strength, which helps one to not only rebound from but also thrive in adverse situations (Lee et al., 2013); purpose in life is regarded as living with reasons and objectives (Ryff, 1995). These two character strength variables have been demonstrated to be negatively associated with both psychosocial problems (e.g., loneliness, stress, and anxiety) and addictive behaviors (Fumaz et al., 2015; Harlow, Newcomb, & Bentler, 1986; Hou et al., 2017; Wu, Lei, & Ku, 2013). Their protective effects against IGD have not yet been tested and reported in the existing literature. The third aim of this study is to fill in this research gap, and we tested the hypothesis that the psychological resilience and the purpose in life would be negatively correlated with IGD tendency. Previous studies also reported that psychological resilience buffered the effect of an individual risk factor (e.g., childhood abuse) on an addictive behavior (e.g., drug use and problematic social networking use; Hou et al., 2017; Wingo, Ressler, & Bradley, 2014). This study, therefore, also tested whether the potential buffering effect of the two variables of character strength would also attenuate the relationship between psychological distress and IGD.

To our best knowledge, this study is the first empirical attempt to estimate the prevalence of IGD among Chinese adults. Given that previous research attention was mainly on adolescents and studies of IGD in general adult populations were scarce in both the West and the East, we also aimed to test psychological risk (i.e., depression and anxiety) and protective (i.e., psychological resilience and purpose in life) factors of IGD among community-dwelling adults. In this study, the following hypotheses were tested:

Hypothesis 1: A positive association exists between psychological distress (i.e., depression and anxiety) and IGD.

Hypothesis 2: A negative association exists between character strength (i.e., psychological resilience and purpose in life) and IGD.

Hypothesis 3: Psychological resilience and purpose in life attenuate the positive association between psychological distress and IGD.

METHODS

Procedures and respondents

After obtaining ethical approval from the affiliated university of the corresponding author, the telephone survey was conducted in 2016 (October–November) in Macao, China. We randomly sampled telephone numbers from the 2015 Macao residential phonebook. At the household level, we selected Chinese residents, who were 18 years old or above following the “last birthday” rule. Each interview lasted approximately 12 min. The participation of the respondents was voluntary and no monetary reward was involved. No exclusion criteria were set and there were 1,000 respondents participated in and completed the survey on the phone. With reference to the formula of the American Association for Public Opinion Research (2011), the cooperation rate of this study was 61.8%.

The sample consisted of 440 males (44%, 95% CI [40.9, 47.1]) and 560 females (56%, 95% CI [52.9, 59.1]) with a mean age of 40.0 years ($SD = 15.3$; range = 18–97). The majority of the respondents had senior secondary (27%) and tertiary education (41%). About 67% of the respondents were full-time or part-time workers. Sex and age distribution of the present sample was similar to the population parameters reported in the 2016 Population By-census of Macao (Macao Statistics and Census Services, 2017), while taking into account that our sample included only those aged ≥ 18 years. In this sample, 47.3% had engaged in online gaming in the past 12 months and were classified as “recent gamers.”

Measures

IGD. The nine diagnostic criteria for IGD listed in the DSM-5 (APA, 2013) were used to assess IGD tendency and identify probable IGD in this study. These criteria have been used in previous research for the same purpose (Wu, Lai, Yu, & Tong, 2017; Yu & Cho, 2016). Only respondents who were recent gamers were asked to indicate whether each of these symptoms (e.g., preoccupation with Internet games) described their own condition in the past 12 months (0 = *no*, 1 = *yes*). Internal consistency (KR-20) of these items was 0.69 for the current sample. A greater level of IGD symptoms indicated a greater tendency to have IGD. Moreover, a cut-off of 4/5 was suggested in Ko et al.’s study (2014), which examined the diagnostic validity of the DSM-5 IGD items with a sample of Taiwanese young adults.

Psychological distress. Depression and anxiety symptoms were measured with the two 7-item subscales from the Chinese version of the 21-item Depression Anxiety Stress Scales (DASS-21; Moussa, Lovibond, & Laube, 2001); items were scored on a 4-point Likert scale, in which 0 = *did not apply to me at all* and 3 = *applied to me very much or most of the time*. Higher scores represented higher severity with respect to the corresponding psychological problem. The Cronbach's α were .82 and .79 for the depression and anxiety subscales, respectively, in this study.

Psychological resilience. The Connor–Davidson Resilience Scale (Connor & Davidson, 2003) has been validated in various Chinese populations. In this study, the 10-item Chinese version (Wang, Shi, Zhang, & Zhang, 2010) was used. A sample item was “You are not easily discouraged by failure,” with a 5-point scale from 0 = *not true at all* to 4 = *true nearly all the time*. A higher scale score indicates higher resilience. The Cronbach's α was .90 in this study.

Purpose in life. The 6-item Purpose in Life Scale (PIL; Crumbaugh & Maholick as cited in McKenna & West, 2007) was used to assess perceived life purpose and meaning. It has been used with Chinese adults (Wu et al., 2013). The respondents were asked to rate if they had found satisfying goals and purpose in life, on a 5-point Likert response scale (1 = *strongly disagree* to 4 = *strongly agree*). A higher score indicated a more positive perception of one's life purpose. The Cronbach's α was .82 in this study.

Background variables. We asked the respondents to report their age, sex, educational level, and employment status [i.e., full-time, part-time, student, and other types (e.g., homemaker and retired)]. Regarding online gaming behaviors, only recent gamers were asked to report weekly gaming frequency [1 = *seldom*, 2 = *occasionally*, 3 = *several times a week*, 4 = *almost everyday (less than 1 hr per day)*, and 5 = *everyday (2 hr or above per day)*], any online gaming expense in the past 12 months (yes/no), and favorite game type (multiplayer/single player).

Statistical analysis

We first examined all the respondents' gaming and demographic profiles in the overall sample and categorized the overall sample into different subsamples (i.e., recent gamer vs. non-gamer and probable IGD gamer vs. non-IGD gamer). Because some of the variables were ordinally scaled (e.g., education attainment) or skewed (e.g., age), they were analyzed by non-parametric statistical procedures, including the χ^2 tests, Mann–Whitney U tests, and Kruskal–Wallis tests.

We subsequently estimated the prevalence of IGD among gamers using DSM-5 criteria and further explored potential risk factors contributing to IGD with univariate χ^2 tests and Mann–Whitney U tests for demographic factors and t -tests and logistical regressions for psychological factors. Finally, we examined the potential moderating effects of psychological resilience and purpose in life on the relationship between psychological distress and IGD using PROCESS macro (Hayes, 2012) in SPSS 22.0.

Ethics

Telephone interviewers received data-collection training and performance assessment, which were conducted by the investigators of this study, before the telephone survey was implemented. The respondents were interviewed by these trained telephone interviewers on the phone after they were briefed on the study's purpose and their rights of participation. They also gave their informed consent to participate. The study was proposed and conducted by the research team involving clinical, social, and health psychologists as well as an epidemiologist, who are experienced in behavioral addiction research. The procedures, including data collection and analyses, were carried out in accordance with the Declaration of Helsinki. Ethical approval (ref. no.: MYRG2015-00213-FSS) was obtained from the affiliated university of the corresponding author.

RESULTS

Online gaming profiles of this sample

Overall sample ($N = 1,000$). Table 1 shows that recent gamers (who engaged in online games in the past 12 months) were more likely to be male, younger, and with higher educational attainment ($p < .05$) than non-gamers. Students were also more likely to be recent gamers than full-time employees (OR = 3.31), part-time employees (OR = 2.14), or other types (OR = 10.43). Part-time employees were more likely to be recent gamers than full-time employees (OR = 1.55) or other types (OR = 4.87).

Regarding psychological distress, 10.7% (95% CI [8.7, 12.7]) of the respondents reported moderate or above levels of depression (DASS-Depression ≥ 14), whereas 19.9% (95% CI [17.3, 22.5]) reported moderate or above anxiety levels (DASS-Anxiety ≥ 10). Depression and anxiety symptoms were negatively correlated with psychological resilience (Pearson's $r = -.31$ and $-.22$, respectively, $p < .001$) and purpose in life (Pearson's $r = -.32$ and $-.23$, respectively, $p < .001$). Recent gamers did not significantly differ from their counterparts on psychological distress or resilience ($p > .05$), but they reported significantly lower scores regarding purpose in life ($p = .004$).

Gamer sample ($n = 473$). Some statistically significant demographic differences were observed on gaming-related variables. Gamers who were male (Mann–Whitney $U = 22,919.0$, $z = -2.85$, $p = .004$), younger (Spearman's rank correlation $\rho = -.16$, $p = .001$), and more educated [Kruskal–Wallis $H(5) = 12.70$, $p = .03$] were more likely to report higher weekly gaming frequency. Gamers who were male and younger were also more likely to spend money on gaming [$\chi^2(1) = 28.27$, $p < .001$, OR = 3.56, and Mann–Whitney $U = 13,658.0$, $z = -3.46$, $p = .001$, respectively]. Employment status was significantly associated with gaming expense [$\chi^2(3) = 13.02$, $p = .005$], and part-time employees were more likely to spend money on gaming than full-time employees, students, and other types (OR = 2.33, 2.39, and 7.20, respectively).

Multiplayer games were more preferred by males [$\chi^2(1) = 32.87$, $p < .001$, OR = 3.38] and younger gamers

Table 1. Comparing stratified background profiles of overall sample and subsamples

	Overall sample subgroups			Gamer subgroups	
	Overall (N = 1,000)	Non-gamer (n = 525)	Recent gamer (n = 473)	Probable IGD (n = 20)	Non-IGD (n = 448)
Age		$U = 151,242.0, z = 13.17, p < .001$			$U = 3,063.5, z = -1.63, p = .10$
M (SD)	40.0 (15.3)	46.5 (15.1)	33.0 (12.2)	27.3 (8.9)	33.2 (12.2)
Sex		$\chi^2(1) = 44.87, p < .001$			$\chi^2(1) = 3.27, p = .07$
Male	44%	34.1%	55.2%	75.0%	54.5%
Educational attainment		$U = 89,470.0, z = -6.52, p < .001$			$U = 3,844.5, z = -0.63, p = .53$
Primary or below	13.9%	19.6%	7.6%	5.0%	7.8%
Junior secondary	14.9%	18.1%	11.4%	10.0%	11.6%
Senior secondary	26.7%	24.6%	29.2%	35.0%	28.6%
Tertiary	41.3%	33.6%	49.9%	45.0%	50.2%
Working status		$\chi^2(3) = 83.65, p < .001$			$\chi^2(3) = 4.06, p = .26$
Full-time	61.0%	57.5%	64.7%	55.0%	65.2%
Part-time	5.9%	4.4%	7.6%	10.0%	7.6%
Student	8.7%	3.8%	14.2%	10.0%	14.3%
Others	21.8%	31.4%	11.5%	25.0%	10.7%
Weekly gaming frequency				$U = 5,067.5, z = 1.54, p = .12$	
Mdn (SD)	–	–	3.00 (1.43)	4.00 (1.20)	3.00 (1.43)
Gaming expense				$\chi^2(1) = 14.74, p < .001$	
Yes %	–	–	23.9%	60.0%	22.3%
Game-type preference				$\chi^2(1) = 12.07, p = .001$	
Multiplayers %	–	–	33.0%	70.0%	31.3%
Depression		$t(996) = -0.25, p = .80$			$t(19.6) = -2.88, p = .01$
M (SD)	4.81 (6.51)	4.95 (6.83)	4.67 (6.15)	10.80 (9.89)	4.39 (5.81)
Mild	9.0%	8.8%	9.3%	15.0%	8.7%
Moderate	7.6%	8.0%	7.2%	10.0%	7.1%
Severe	3.1%	3.6%	2.5%	15.0%	2.0%
Anxiety		$t(995) = -1.16, p = .25$			$t(466) = -4.26, p < .001$
M (SD)	5.31 (6.52)	5.56 (6.97)	5.06 (6.01)	10.50 (7.04)	4.79 (5.82)
Mild	6.8%	5.0%	8.9%	25.0%	8.3%
Moderate	11.2%	12.0%	10.4%	30.0%	9.4%
Severe	8.7%	9.7%	7.6%	15.0%	7.4%
Resilience		$t(994) = -1.76, p = .80$			$t(465) = 2.95, p = .003$
M (SD)	2.59 (0.67)	2.62 (0.69)	2.55 (0.64)	2.16 (0.71)	2.58 (0.63)
Purpose in life		$t(996) = -2.87, p = .004$			$t(466) = 0.60, p = .55$
M (SD)	3.35 (0.64)	3.41 (0.64)	3.29 (0.64)	3.21 (0.85)	3.30 (0.63)

(Mann–Whitney $U = 10,782.5, z = -6.59, p < .001$). Part-time employees also tended to prefer multiplayer games than students [$\chi^2(3) = 16.34, p = .001, OR = 1.80$], who showed stronger preference to multiplayers games than full-time employees ($OR = 1.91$) and other types ($OR = 2.12$).

Estimating prevalence of Internet gaming disorder among recent gamers (n = 473)

The frequency of endorsement on each DSM-5 criterion for IGD is listed in Table 2. The most commonly endorsed items were mood modification (i.e., use Internet games to escape or relieve a negative mood; 26.2%) and continued excessive use (i.e., continue to play Internet games excessively despite knowledge of psychosocial problems; 24.1%).

Forty-six respondents, who were recent gamers, answered “uncertain” or refused to answer at least one item of the DSM-5 criteria, and the rate of these missing

responses ranged from 0.4% to 4.2%. After removing five unidentified cases with missing IGD items, the subsequent analyses retained three IGD cases that scored 5 or above on only the answered items and 39 non-IGD cases that scored 4 or below even when all the missing items were endorsed. As a result, 20 respondents were classified as probable IGD gamers among 468 recent gamers, which accounted for an IGD prevalence as 4.3% (95% CI [2.4, 6.1]). Considering the overall sample ($N = 1,000$), the IGD prevalence was 2.0% (95% CI [1.1, 2.9]).

Examining the potential risk factors of Internet gaming disorder

Background factors. As shown in Table 1, no statistically significant differences with respect to sex, age, educational attainment, employment status, and gaming frequency were found between probable IGD gamers and non-IGD gamers ($p = .07-.53$). Probable IGD gamers were found to be more likely to spend money on online games

Table 2. Endorsement rate of each item of the DSM-5 criteria

Item description	Recent gamers (<i>n</i> = 473)			Probable IGD gamers (<i>n</i> = 20)
	Yes	No	Uncertain/unanswered	Yes
1. Feel preoccupied with Internet games	51 (10.8%)	415 (87.7%)	7 (1.5%)	15 (75%)
2. Feel irritable, anxious, or sad when Internet gaming is taken away	25 (5.3%)	446 (94.3%)	2 (0.4%)	12 (60%)
3. Spend increasing amounts of time on gaming to achieve satisfaction	51 (10.8%)	416 (87.9%)	6 (1.3%)	16 (80%)
4. Have made unsuccessful attempts to control your participation in Internet games	46 (9.7%)	420 (88.8%)	7 (1.5%)	13 (65%)
5. Have lost interests in previous hobbies and entertainment as a result of, and with the exceptions of, Internet games	43 (9.1%)	426 (90.1%)	4 (0.8%)	15 (75%)
6. Continue to play Internet games excessively despite knowledge of psychosocial problems	114 (24.1)	339 (71.7%)	20 (4.2%)	13 (65%)
7. Have deceived others regarding the amount of Internet gaming	33 (7.0%)	431 (91.1%)	9 (1.9%)	12 (60%)
8. Use Internet games to escape or relieve a negative mood	124 (26.2%)	344 (72.7%)	5 (1.1%)	17 (85%)
9. Have jeopardized or lost a significant relationship, job, or educational or career opportunity because of participation in Internet games	16 (3.4%)	454 (96.0%)	3 (0.6%)	10 (50%)

(OR = 5.18) and prefer multiplayer games (OR = 5.32) than non-IGD gamers.

Psychological factors. A total of 25.0% and 45.0% of the probable IGD respondents had moderate or above levels of anxiety and depression, respectively. Pearson's correlation results showed that IGD tendency increased with depression and anxiety symptoms ($r = .34$ and $.32$, respectively, $p < .001$) and decreased with psychological resilience ($r = -.20$, $p < .001$) and purpose in life ($r = -.11$, $p = .02$). Similarly, probable IGD gamers were more likely to report higher levels of psychological distress and lower level of psychological resilience than their non-IGD counterparts ($p < .001$). However, no significant IGD-group difference was shown on purpose in life ($p = .55$; Table 1).

After adjusted for the demographic variables (i.e., sex, age, education, and employment status), the logistic regression models showed that depression ($p = .02$, adjusted OR = 1.1, 95% CI [1.0, 1.2]), anxiety ($p = .01$, adjusted OR = 1.1, 95% CI [1.0, 1.2]), and psychological resilience ($p = .02$, adjusted OR = .40, 95% CI [0.18, 0.88]), but not for purpose in life ($p = .96$), were significantly associated with probable IGD classification.

Moderating effects of psychological resilience and purpose in life

The potential moderating effects of psychological resilience and purpose in life on the associations between two psychological distress variables and probable IGD classification were probed by four independent logistic regression models. The interaction terms of Depression \times Resilience, Depression \times Purpose in life, Anxiety \times Resilience, and Anxiety \times Purpose in life were not statistically significant (OR ranged from 0.98 to 1.08, $ps > .05$).

DISCUSSION AND CONCLUSIONS

With the cut-off of 4/5 for the nine-item DSM-5 criteria, the estimated prevalence of probable IGD was 2.0% in our overall community-dwelling adult sample, and 4.3% among recent gamers in Macao, China. It was lower than the prevalence found among adult gamer samples, which were recruited online (e.g., 13.8%–16.7%; Kim et al., 2016; Wu et al., 2017), but comparable with those reported by some studies of adolescents (e.g., 1.2% and 5.9% among German and Korean adolescents, respectively; Rehbein, Kliem, Baier, Mößle, & Petry, 2015; Yu & Cho, 2016). This study provides evidence that, similar to adolescents, adult gamers are also susceptible to problematic gaming. Therefore, IGD prevention should be addressed by not only school-based programs but also interventions that take place in general community.

Our findings that a high proportion of probable IGD gamers suffered from moderate/severe levels of depression and anxiety (25.0% and 45.0%, respectively) provided further support for this recommendation. Our first hypothesis regarding the positive association between psychological distress and IGD was supported. In addition to the increased susceptibility to IGD due to psychological distress (Davis, 2001; Jo et al., 2017), it is also plausible that the development of IGD results in psychological distress among gamers, because excessive gaming is associated with adverse consequences, such as sleep problems, stress, and relationship deterioration (Kuss & Griffiths, 2012; Lemmens, Valkenburg, & Peter, 2011). The bidirectional relationship of depression and Internet addiction was shown in a longitudinal study among adolescents (Lau et al., under review), but empirical test on the reciprocal link between psychological distress and IGD in adults is warranted. To break the vicious cycle, IGD prevention programs are suggested to consider the risk effects of psychological

distress, while interventions for depression and anxiety should pay special attention to people with IGD.

The commonest symptoms endorsed by our Chinese gamer respondents were “gaming for an escape or a relief from negative moods” and “continued engagement despite psychosocial problems.” Indeed, escape from reality and mood modification is a major drive for those who engage in online gaming and represents the strongest motivational factor associated with IGD in previous studies (Király et al., 2015; Wu et al., 2017). In a multisample study, escape was also found to be the commonest IGD symptom reported by adult gamers (Kim et al., 2016). Despite their awareness of negative consequences, adult gamers tend to continue their problematic gaming pattern. Therefore, public education on the adverse consequences of excessive online gaming may not be the most effective prevention strategy. It is recommended that intervention may stress on positive trait enhancement. For example, phone applications promoting mood management and coping flexibility (Ameringen, Turna, Khalesi, Pullia, & Patterson, 2017; Christmann, Hoffmann, & Bleser, 2017) can be developed to lower the general public’s risk of IGD.

The hypothesized negative correlation between character strength (i.e., psychological resilience and purpose in life) and IGD tendency was found, but the magnitude was weak ($r = -.20$ and $-.11$, respectively) and no significant IGD-group difference was found on purpose in life. Moreover, the hypothesized buffering effect of character strength on the relationship between psychological distress and probable IGD was not supported in this study. Although the protective function of psychological resilience and purpose in life against social networking and gaming addictions in young adults have been reported (Hou et al., 2017; Wu et al., 2013), our findings provided only mildly supportive evidence that the positive psychology interventions are applicable to preventive measures for IGD among Chinese adults. It is plausible that the effects of resilience and purpose in life are more salient in young adults, who face new developmental tasks including searching for and accomplishing work and romance goals (Roisman, Masten, Coatsworth, & Tellegen, 2004) than other older adults. This speculation needs further examination with a larger age-stratified gamer sample in future studies.

No statistically significant demographic difference between probable IGD and non-IGD gamers was found in this study. Another recent study among adult gamers who spoke either Korean or European language also showed no demographic difference in terms of sex, age, education, marital status, and work status between probable IGD and non-IGD gamers who were recruited online (Kim et al., 2016). These findings suggest that some demographic risk factors reported in adolescent studies may not be very strong predictors of IGD in adults. Even male sex showed only a marginal significant effect ($p < .10$) in this study. This non-significant finding was plausibly related to the small group of probable IGD gamers ($n = 20$) in our sample and the power of the statistics was affected. On the other hand, such non-significant difference sheds lights on the potentially increasing vulnerability of female and older gamers to IGD in this Internet era. Although it was commonly observed that male and younger adults were more likely to play games and to have higher time and financial involvement, many female and older gamers were

also vulnerable to IGD. A recent study reported that the female video game addicts had more somatic problems and sleep disturbance (Stockdale & Coyne, 2018), and hence further studies are warranted to not only compare demographic risk factors of IGD between adolescents and adults but also identify sex-specific predictors and consequences of IGD in different age groups. Moreover, different consequences of IGD should also be considered in future intervention programs (e.g., personal health management).

Our telephone survey design with random sampling offered us the likelihood of collecting a representative heterogeneous community sample, including both online gamers and non-gamers, in Macao. Despite the practical insights brought by this study, some of its limitations should be noted. First, this approach allowed for only a short questionnaire to be administered, and only a limited number of variables were assessed. A number of potential protector factors were not included (e.g., social support) and they would be useful for designing effective intervention programs. Similar to those of other telephone surveys, the present findings are susceptible to self-report bias. We therefore began all interviews by assuring the respondents of anonymity and encouraging them to be frank in making their response to each item. They were also allowed to refuse to answer any question if they chose to. Due to its correlational study design, this study neither provided causal inference nor details on factors affecting the course of IGD development over time for adult sample.

To conclude, this study showed that some Chinese adult gamers were at high risk of IGD, and that IGD was positively associated with psychological distress. Interventions for both psychological distress and IGD should consider the potentially high comorbidity of these disorders. Moreover, demographic variables were not strong predictors of IGD and thus interventions should target to both sexes and different age groups in the Chinese communities. IGD tendency was negatively, but only slightly, associated with psychological resilience and purpose in life. Future studies may investigate whether demographic and psychological factors are specific to a particular age group or life stage due to different developmental needs.

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