



AKADÉMIAI KIADÓ

Journal of Behavioral Addictions


9 (2020) 3, 654–663

DOI:
10.1556/2006.2020.00043
© 2020 The Author(s)

FULL-LENGTH REPORT



The psychometric properties of the Revised Illness Perception Questionnaire (IPQ-R) regarding Internet gaming disorder in a general population of Chinese adults

JOSEPH T. F. LAU¹, LE DANG^{2,3,4}, RAY Y. H. CHEUNG⁵,
MENG XUAN ZHANG^{2,3}, JULIET HONGLEI CHEN² and
ANISE M. S. WU^{2,3*} 

¹ Centre for Health Behaviors Research, School of Public Health and Primary Care, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong, China

² Department of Psychology, Faculty of Social Sciences, University of Macau, Taipa, Macau, China

³ Centre for Cognitive and Brain Sciences, University of Macau, Taipa, Macau, China

⁴ Faculty of Teacher Education, Pingdingshan University, South Weilai Road, Xinhua District, Pingdingshan, Henan, China

⁵ Department of Applied Psychology, Faculty of Social Science, Lingnan University, Hong Kong, China

Received: February 9, 2020 • Revised manuscript received: April 14, 2020 • Accepted: June 13, 2020
Published online: September 8, 2020

ABSTRACT

Background and aims: Internet gaming disorder (IGD) has been recognized as a mental illness. Cognitive and emotional illness representations affect coping and health outcomes. Very little is known about such perceptions related to IGD, in both general and diseased populations. This study examined the psychometric properties of the Revised Illness Perception Questionnaire (IPQ-R) for IGD in a general population that included mostly non-cases while a small proportion of the sample was IGD cases. *Methods:* An anonymous cross-sectional telephone survey was conducted in a random sample of 1,501 Chinese community-dwelling adults (41.3% male; mean age = 40.42, SD = 16.85) in Macao, China. *Results:* The confirmatory factor analysis identified a modified 6-factor model (i.e., timeline cyclical, consequence, personal control, treatment control, illness coherence, and emotional representations) of 26 items that showed satisfactory model fit and internal consistency. Criterion-related validity was supported by the constructs' significant correlations with stigma (positive correlations: timeline cyclical, consequence, emotional representations; negative correlations: illness coherence). Ever-gamers, compared to never-gamers, reported higher mean scores in the subscales of personal control and illness coherence, and lower mean scores in time cyclical, consequence, and emotional representations. Among the sampled gamers, probable IGD cases were more likely than non-IGD cases to perceive IGD as cyclical and involved more negative emotions. *Conclusions:* This study shows that the revised 26-item version of IPQ-R is a valid instrument for assessing illness representation regarding IGD in a general population of Chinese adults. It can be used in future research that examines factors of incidence and prevention related to IGD.

KEYWORDS

illness representation, Illness Perception Questionnaire-Revised, online gaming, behavioral addiction, Internet gaming disorder

*Corresponding author.
E-mail: anisewu@umac.mo

INTRODUCTION

Globally, Internet gaming disorder (IGD) has become a major public health concern (American Psychiatric Association [APA], 2013; Zhao & Hao, 2019). In 2013, the fifth edition of Diagnostic and Statistical Manual of Mental Disorder (DSM-5; APA, 2013) proposed IGD as a new mental disorder in need of further research. The World Health Organization (WHO, 2018) added gaming disorder (both online and offline) as an addictive disorder in the 11th Revision of the International Classification of Diseases (ICD-11), in parallel with gambling disorder. Symptoms of IGD include preoccupation, tolerance, inability to stop playing, and continued use despite negative consequences for at least 12 months (APA, 2013; WHO, 2018). IGD is significantly associated with mental disorders including depression, anxiety, and other addictions (Chen, Tong, Wu, Lau, & Zhang, 2018; Wang, Cho, & Kim, 2018; Wichstrøm, Stenseng, Belsky, von Soest, & Hygen, 2019; Wu, Chen, Tong, Yu, & Lau, 2018a; 2018b; Yen et al., 2016), and health-related problems such as sleep problem and poor academic/work performance (Eickhoff et al., 2015; Hawi, Samaha, & Griffiths, 2018; Satghare et al., 2016). IGD prevalence based on the DSM-5 criteria varies across age and cultural groups, ranging from 1.2 to 10.8% worldwide (Feng, Ramo, Chan, & Bourgeois, 2017; Gentile et al., 2017; Müller et al., 2015; Wang, Cho, & Kim, 2018; Wartberg, Kriston, & Thomasius, 2017; Wichstrøm, Stenseng, Belsky, von Soest, & Hygen, 2019; Wu et al., 2018a; C.-Y. Wu, Lee, Liao, & Ko, 2019; Yu & Cho, 2016).

Concepts and measurement of illness representation

Lay public's perceptions of IGD as a mental illness (i.e., illness representation) may affect people's behavioral and emotional responses to the illness. Illness representation captures how people (patients and non-patients) perceive a disease or illness. It is a key component of the Leventhal's Common-Sense Model of illness (CSM; Leventhal, Leventhal, & Contrada, 1998), which postulates that people actively construct their mental representations toward potential health threats (i.e., an illness). Illness representation consists of cognitive representations and emotional representations. These two components interact with each other to affect individuals' coping to illnesses and health outcomes (Weinman & Petrie, 1997). For instance, Chen, Tsai, and Chou (2011) found that some cognitive representations (e.g., perceived controllability) improved treatment adherence among hypertension patients. A meta-analysis also showed that emotional representations were positively associated with avoidance coping in cancer patients (Richardson, Schüz, Sanderson, Scott, & Schüz, 2017). Both cognitive and emotional representations are dynamic and may be affected by one's responses to health threats (Browning, Wewers, Ferketich, Otterson, & Reynolds, 2009; Leventhal et al., 1998). Furthermore, illness representation can be modified through interventions (Broadbent, Ellis, Thomas, Gamble, & Petrie, 2009; Glattacker, Heyduck, & Meffert, 2012).

The revised version of Weinman et al.'s Illness Perception Questionnaire (IPQ-R; Moss-Morris et al., 2002) has commonly been used to assess illness representations of both physical and mental illnesses (Baines & Wittkowski, 2013; Dempster, Howell, & McCorry, 2015). Besides the disease-specific constructs of causes and identity (symptoms), IPQ-R comprises six constructs of cognitive representations and one construct of emotional representations that are generic to all illnesses: (1) timeline chronic (perceived chronicity of the illness); (2) timeline cyclical (perceived cyclical nature of the illness); (3) consequences (perceived outcomes or impacts of the illness); (4) personal control (self-efficacy in controlling or managing the illness); (5) treatment control (perceived effectiveness of treatments); (6) illness coherence (individuals' understanding of the illness); and (7) emotional representations (emotional responses toward the illness). Given the theoretical and clinical significance of illness representation, the developers of IPQ (Weinman, Petrie, Moss-Morris, & Horne, 1996) and IPQ-R (Moss-Morris et al., 2002) encouraged researchers to adapt the scale to cover various illnesses, populations, and cultural settings. IPQ-R has been widely applied in different countries and languages to understand both physical problems (e.g., hypertension and cancer) and mental illnesses (Cabassa, Lagomasino, Dwight-Johnson, Hansen, & Xie, 2008; Hou, Cleak, & Peveler, 2010; Munson, Floersch, & Townsend, 2009; Williams & Steer, 2011) such as schizophrenia (Fleming, Martin, Miles, & Atkinson, 2009; Lobban & Barrowclough, 2005; Lobban, Barrowclough, & Jones, 2004) and eating disorders (Holliday, Wall, Treasure, & Weinman, 2005; Stockford, Turner, & Cooper, 2007).

The literature has demonstrated that IPQ-R possesses moderate to good psychometric properties despite minor revisions during scale adaptation (Fan et al., 2017; Lam et al., 2015; Wu et al., 2018b). One exception was that a previous study's confirmatory and exploratory factor analyses did not support the postulated factor structure of illness representation for substance dependence, when IPQ-R was applied to a sample of people who inject drug in China (Mo et al., 2015). The authors attributed the unexpected finding to the possibility that problematic substance use, like gambling disorder, might be perceived as a personal misconduct instead of a clinical problem in China (Mo et al., 2015; Wu & Lau, 2015). Nevertheless, one study reported good psychometric properties of IPQ-R for substance dependence in a sample of Chinese non-substance users (healthcare professionals and master's students; Ayu, Dijkstra, Golbach, De Jong, & Schellekens, 2016). Thus, application of IPQ-R to study addictive problem needs further research. To our best knowledge, no study has investigated illness representation and validation of IPQ-R related to behavioral addictions (e.g., gambling disorder and IGD). The study attempted to fill out this gap.

Illness representation and public stigma

Perception toward a disease may shape stigma toward the disease. Previous research has established links between



the illness representations and stigma. For instance, Mak, Chong, and Wong (2014) found that various constructs of illness representation (e.g. controllability, timeline, consequences, and illness coherence) were significantly associated with public stigma toward mental disorders. The authors pointed out that, according to the attribution theory (Weiner, Perry, & Magnusson, 1988) and previous research (e.g., Weisman & López, 1997), low perceived controllability and stability of a mental disorder would lead to social rejection and public stigma toward such disorder, as people would be more sympathetic to the illness condition that is acute and have non-volitional causes (Corrigan, 2000). In general, such attributions match with the constructs of illness representation (e.g., controllability and timeline). In particular, those with low coherence of IGD might create misunderstandings that could lead to stigma; those who perceived high severity of IGD might associate IGD cases with personal failure (e.g., drop-outs); those who perceived low personal control and high chronicity might associate IGD cases with weak personality and self-control. In addition, Holliday et al. (2005) also applied CSM to evaluate public perceptions toward anorexia nervosa (e.g., caused by own behaviors like eating habits) and suggested that such perceptions may have contributed to stigma toward anorexia nervosa. Thus, stigma was used for testing criterion-related validity in this study. We hypothesized that stigma toward people with IGD would be negatively associated with illness coherence and positively associated with other constructs of illness representations regarding IGD.

The present study

This study investigated the psychometric properties of a Chinese IGD-specific version of IPQ-R in a representative population-based sample of the Chinese community-dwelling adults in Macao, China. We examined the factor structure, reliability, and criterion-related validity of this IGD-specific version of IPQ-R. We also tested the differences in IPQ-R factor scores by gamer status (yes or no) and IGD status (i.e., whether being probable IGD cases as defined by DSM-5 criteria) to understand whether these subgroups would perceive IGD differently. The availability of a validated tool would facilitate related understanding and research development on IGD.

METHOD

Participants and procedures

We conducted a telephone survey from 29 September to 9 November 2017 to identify prospective participants, based on the local residential phonebook in Macao, China. We randomly sampled telephone numbers from the phonebook. At the household level, we selected Chinese residents (aged ≥ 18 years), following the “last birthday” rule. The trained interviewers briefed the participants and obtained their verbal informed consent prior to commencement of

the survey. Without any monetary reward, 1,501 participants (41.3% male; mean = 40.42, SD = 16.85, Range = 18–93) voluntarily completed an anonymous questionnaire via phone. With reference to the formula of the American Association for Public Opinion Research (2011), the cooperation rate of this study was 63.9%. The age distribution of the sample was similar to the adult population parameter reported in the 2016 Population By-census of Macao but the female sex was slightly overrepresented in this study (Macao Statistics and Census Services, 2017). Over half of the participants had had secondary education or above (83.4%) and a full-time job (56.8%; and 12.4% were students).

Measures

Illness representation of IGD. The 38-item IPQ-R (Moss-Morris et al., 2002) was translated by two professional translators, following standard translation and back-translation procedures (Brislin, 1970). The items were modified to assess illness representation of IGD. For instance, “My illness has serious financial consequences” was modified to “IGD brings serious financial consequences to an IGD gamer”. The face validity of all the translated items was found satisfactory by two bilingual psychologists. The version was also tested on six participants, and was finalized based on the feedbacks obtained. Using the 5-point Likert scales (1 = *strongly disagree* to 5 = *strongly agree*), higher summated scores represented higher levels of the corresponding construct.

IGD symptoms. IGD symptoms were assessed by nine diagnostic criteria proposed in the DSM-5 (APA, 2013). Participants answered whether they have experienced symptoms in the last 12 months (1 = *Yes*, 0 = *No*). Higher total scores indicated severer IGD symptoms. Participants who scored ≥ 5 were classified as probable IGD (Ko et al., 2014). The internal reliability (KR-20) was 0.66. The tool has been used in other IGD studies (Wu et al., 2018a, 2018b; Zhang, Wang, Yu, & Wu, 2019).

Public Stigma. Four items were selected from the 12-item subscale public stigma of the Stigma and Acceptance Scale (Mak et al., 2014) and modified to assess participants’ negative attitudes toward people with IGD. Participants rated items (e.g., “people with IGD are a burden to society”) on 6-point scales from 1 = *strongly disagree*, to 6 = *strongly agree*. Higher scores represented stronger stigma against people with IGD. Cronbach’s alpha of this measure was 0.79 in the present study.

Socio-demographics variables. Participants were asked to state their gender, age, educational attainment (1 = *kindergarten or none* to 6 = *university or above*), and lifetime online gaming experience (Yes/No).



Statistical analysis

The structure and dimensionality of IPQ-R regarding IGD were tested by confirmatory factor analysis (CFA) with full information maximum likelihood (FIML) estimation using IBM SPSS Amos 25. FIML is a special maximum likelihood procedure that makes it possible to estimate a model using all available data even if there are missing values in the data set, and it outperformed some typical missing data methods such as listwise deletion (Enders & Bandalos, 2001). The seven-factor model using the 38-item IPQ-R for IGD was first tested and, if the model fit was not satisfactory, modified according to the factor loading of each item and modification indices provided by Amos. According to Kline's recommendations (2015), the goodness-of-model fit was assessed by χ^2 value, Comparative Fit Index (CFI) and Root Mean Square Error of Approximation (RMSEA). Standardized root mean squared residual (SRMR), was also computed, with its value <0.08 representing an acceptable fit. Descriptive statistics, internal consistency (≥ 0.70 representing a satisfactory reliability; Cortina, 1993), and correlation analysis were performed by IBM SPSS 25.0. Criterion-related validity was assessed by the correlations between IPQ-R and stigma. The equal variance or unequal variance version of independent-sample *t*-test was used to test significance of the between-group differences in IPQ-R scores by online gamer status and IGD status (probable IGD or not), according to significance of Levene's test on each IPQ-R factor for equal variance of the two populations.

Ethics

All respondents were briefed on the purpose of study and provided their informed consent to participate in this anonymous survey. The study procedures were carried out in accordance with the Declaration of Helsinki. Ethical approval was obtained from the affiliated university of the corresponding author (ref. no.: MYRG2016-00162-FSS).

RESULTS

Factor structure of IPQ-R for IGD

We first conducted CFA for the 38-item IPQ-R with the original seven-factor structure (i.e., timeline chronic, timeline cyclical, consequences, personal control, treatment control, illness coherence, and emotional representations). The model fit was not satisfactory, with χ^2 (644) = 7,457.843, $p < 0.001$, CFI = 0.668, SRMR = 0.095, RMSEA = 0.084, 90% confidence intervals (CI) [0.082, 0.086]. We also tested the one-factor model of this 38-item scale but the model did not converged and further test could not be conducted on this specified model. Such model mis-

specification indicated the very poor goodness of fit of the model with the current data.

Because all the loadings for the timeline chronic factor (ranging from -0.056 to 0.746) were not statistically significant due to the model's large standard errors ($p = 0.997$), we dropped that factor and proceeded to examine a 6-factor structure. The model fit was still far from satisfactory, with χ^2 (449) = 5,979.499, $p < 0.001$, CFI = 0.692, SRMR = 0.099, RMSEA = 0.091, 90%CI [0.089, 0.093]. We further removed six items that exhibited non-significant, low (<0.30), or reverse (e.g., a positive loading while all other items were negative) factor loadings (Table 1) (i.e., Item 8 from consequences subscale, Items 19 and 23 from treatment control subscale, Items 15 and 17 from personal control subscale, and Item 36 from emotional representations subscale). The revised six-factor model showed an acceptable model fit, χ^2 (284) = 2,288.325, $p < 0.001$, CFI = 0.869, SRMR = 0.067, RMSEA = 0.069, 90% CI [0.066, 0.071]. According to the modification indices, one error covariance was added (between Items 37 and 38) into the model, and the overall model fit was further improved, χ^2 (283) = 1,794.173, $p < 0.001$, CFI = 0.901, SRMR = 0.066, RMSEA = 0.060, 90%CI [0.057, 0.062]. This final model also had satisfactorily high factor loadings (>0.30) for all items. Table 2 further shows that all the factors of the model were significantly and mildly associated with each other ($r = -0.35$ to 0.34 , $p < 0.05$), except the relationship between treatment control and emotional representations which was of marginal significance ($r = -0.052$, $p = 0.053$).

Reliability and criterion-related validity of IPQ-R for IGD

The Cronbach's alphas for the six modified factors ranged from 0.670 to 0.910 (see Table 1), indicating acceptable internal consistency. Regarding criterion-related validity, timeline cyclical, emotional representations, and consequence showed statistically significant mild to moderate positive associations with public stigma ($r = 0.23$, 0.39 , and 0.51 respectively, $p < 0.01$), while illness coherence was negatively and significantly correlated with public stigma ($r = -0.29$, $p < 0.01$). In addition, a mild, positive, and significant association was found between treatment control and public stigma ($r = 0.09$, $p < 0.01$), but a non-significant association was found between personal control and stigma ($r = -0.04$, $p = 0.12$) (Table 2).

Levels of illness representation regarding IGD

Table 2 lists the subscales' mean scores. The results showed that the participants were quite neutral about the statements related to illness coherence, and tended to agree with the items of timeline cyclical, consequences, personal control, and treatment control. Interestingly, they did not tend to endorse the items of emotional representations. The results were consistent with the item endorsement rate presented in

Table 1. Confirmatory factor analysis results and reliabilities of IPQ-R for IGD

Item	Standardized factor loadings		Cronbach's α Revised scale	Endorsement % ^a Revised scale
	Original scale	Revised scale		
<i>Factor timeline chronic</i>				
1. IGD will last a short time (R)	0.000	–	–	–
2. IGD is likely to be permanent rather than temporary	0.626	–	–	–
3. IGD will last for a long time	0.266	–	–	–
4. IGD will pass quickly (R)	–0.056	–	–	–
5. IGD is expected to stay for the rest of one's life	0.746	–	–	–
18. IGD will improve in time (R)	0.071	–	–	–
<i>Factor consequence</i>				
6. IGD is a serious condition	0.566	0.584	0.773	62.0
7. IGD has major consequences on one's life	0.572	0.588	–	57.5
8. IGD does not have much effect on one's life (R)	–0.054	–	–	–
9. IGD strongly affects the way others see that IGD gamer	0.617	0.609	–	44.8
10. IGD has serious financial consequences	0.655	0.652	–	46.6
11. IGD causes difficulties for those who are close to that IGD gamer	0.736	0.723	–	45.5
<i>Factor personal control</i>				
12. There is a lot which one can do to control IGD symptoms	0.236	0.457	0.670	61.2
13. What one does can determine whether IGD gets better or worse	0.173	0.686	–	69.6
14. The course of IGD depends on that gamer	0.188	0.691	–	72.2
15. Nothing that addict does will affect his/her IGD (R)	0.601	–	–	–
16. A person with IGD has the power to influence it (i.e., IGD)	0.206	0.464	–	58.6
17. One's action will have no effect on the outcome of his/her IGD (R)	0.815	–	–	–
<i>Factor treatment control</i>				
19. There is very little that can be done to improve one's IGD (R)	0.737	–	0.889	–
20. Counseling treatment will be effective in improving IGD	–0.146	0.833	–	70.3
21. The negative effects of IGD can be prevented (avoided) by counseling treatment	–0.115	0.882	–	66.5
22. Counseling treatment can control my illness	–0.171	0.842	–	66.4
23. There is nothing which can help one's IGD condition (R)	–0.761	–	–	–
<i>Factor illness coherence</i>				
24. The symptoms of IGD are puzzling to you	0.374	0.373	0.722	31.3
25. IGD is a mystery to you	0.554	0.548	–	25.5
26. You don't understand IGD	0.789	0.788	–	37.5
27. IGD doesn't make any sense to you	0.809	0.811	–	36.1
28. You have a clear picture or understanding of IGD (R)	0.512	0.419	–	29.9
<i>Factor timeline cyclical</i>				
29. The symptoms of IGD change a great deal from day to day	0.826	0.825	0.776	49.5
30. IGD symptoms come and go in cycles	0.871	0.870	–	48.8
31. IGD is very unpredictable	0.466	0.467	–	46.0
32. One goes through cycle in which IGD gets better and worse	0.558	0.559	–	49.6
<i>Factor emotional representations</i>				
33. You get depressed when you think about IGD	0.853	0.881	0.910	20.0
34. When you think about IGD you get upset	0.879	0.918	–	22.8
35. IGD makes you feel angry	0.813	0.789	–	22.0
36. IGD does not worry you (R)	0.143	–	–	–
37. Problems regarding IGD makes you feel anxious	0.790	0.721	–	16.4
38. IGD makes you feel afraid	0.747	0.672	–	19.8

^aValid percentage for the responses of “Agree” and “Strongly agree” to each item.

Table 3, in which items 13 and 14, from the personal control subscale, and Item 20, from the treatment control subscale, were the most commonly endorsed (69.6%, 72.2%, and 70.3% respectively), whereas the five items from the emotional representations subscale were the least endorsed (ranged from 16.4% to 22.8%).

Differences in illness representation by gamer status and IGD status

About two fifth (41.0%; $n = 615$) of the participants had ever experienced online gaming (ever-gamers); 2.6% ($n = 39$) had had probable IGD. In Table 3, it is seen that ever-gamers,



Table 2. Descriptive statistics and inter-correlations of constructs of IPQ-R, stigma, IGD symptoms, and socio-demographics

	Item number	M	SD	Range	1	2	3	4	5	6
1. IPQ-Cyc	4	13.11	2.90	4–20	–					
2. IPQ-Con	5	16.69	3.66	5–25	0.34**	–				
3. IPQ-Pc	4	14.67	2.71	4–20	0.11**	0.07*	–			
4. IPQ-Tc	3	10.95	2.42	3–15	0.21**	0.14**	0.23**	–		
5. IPQ-Ic	5	15.60	3.68	5–25	–0.26**	–0.25**	0.08**	–0.07*	–	
6. IPQ-Er	5	11.86	4.71	5–25	0.30**	0.34**	–0.09**	0.05	–0.35**	–
7. Stigma	4	11.13	3.46	4–24	0.23**	0.51**	–0.04	0.09**	–0.29**	0.39**
8. IGD symptoms	9	0.57	1.29	0–9	0.07*	–0.01	0.06*	–0.02	0.13**	0.05*
9. Age	1	40.42	16.85	18–93	0.17**	0.23**	–0.12**	0.06*	–0.35**	0.26**
10. Education#	1	–	–	–	–0.17**	–0.11*	0.07**	0.02	0.30**	–0.23**
11. Gender#	1	–	–	–	0.09**	0.15**	0.00	0.04	–0.14**	0.14**

Note: * $p < 0.05$; ** $P < 0.01$; # mean, standard deviation and range are not provided for binomial/ordinal variables.

IPQ-Cyc = timeline cyclical; IPQ-Con = consequences; IPQ-Pc = personal control; IPQ-Tc = treatment control; IPQ-Ic = illness coherence; IPQ-Er = emotional representations; IGD = Internet gaming disorder.

Table 3. Mean (standard deviation) of IPQ-R factor scores by gamer status and IGD status

	Ever-gamers ($n = 615$)	Never-gamers ($n = 886$)	t	Probable IGD ($n = 39$)	Non-IGD ($n = 1,462$)	t
IPQ-Cyc	12.85 (2.92)	13.32 (2.87)	–2.92**	14.92 (2.96)	13.05 (2.88)	3.88**
IPQ-Con	16.05 (3.58)	17.18 (3.64)	–5.76**	17.81 (3.82)	16.66 (3.65)	1.89
IPQ-Pc	15.09 (2.66)	14.35 (2.72)	5.02**	14.00 (2.90)	14.69 (2.72)	–1.49
IPQ-Tc	10.85 (2.48)	11.03 (2.38)	–1.38	10.95 (2.74)	10.95 (2.42)	–0.13
IPQ-Ic	16.86 (3.43)	14.66 (3.57)	11.53**	15.61 (3.01)	15.60 (3.69)	0.03
IPQ-Er	10.96 (4.36)	12.53 (4.86)	–6.39**+	15.00 (4.94)	11.78 (4.68)	4.18**

Note: * $p < 0.05$; ** $P < 0.01$; + statistic for “equal variance not assumed” given the significant Leven’s test result.

IPQ-Cyc = timeline cyclical; IPQ-Con = consequences; IPQ-Pc = personal control; IPQ-Tc = treatment control; IPQ-Ic = illness coherence; IPQ-Er = emotional representations.

compared to never-gamers, reported significantly higher scores for personal control and illness coherence, but significantly lower scores for time cyclical, consequences, and emotional representations, than those without gaming experience ($p < 0.05$). Those with IGD reported significantly higher scores than non-IGD participants for timeline cyclical and emotional representations ($p < 0.05$).

DISCUSSION

With some modifications, the 26-item IPQ-R for IGD possessed satisfactory factorial validity, criteria-related validity, and reliability. This is the first study investigating illness representation and IPQ-R for IGD, and in fact, the first one in behavioral addiction research. Since the analysis was not pre-registered, the results should be considered exploratory.

We removed the factor of timeline chronic, as its items all showed non-significant factor loadings. Similar observations have been reported for some IPQ-R’s timeline chronic subscales such as that of esophageal cancer (Dempster & McCorry, 2012). This construct is supposed to assess the perceived chronicity nature of IGD. As IGD is a newly defined disease, even the scientific community may not have

reached consensus on its chronicity; the general public might hence have little idea about its curability, remission, and hence chronicity, as they have not been informed by the scientists. Daily observations of cure over long time periods, which are necessary for formation of the perception on chronicity, may also be lacking as the disease is a new one. Furthermore, as the value, motives, and time availability for online gaming may change over one’s life course, the general public may know little about whether remission from IGD would occur along different life stages. In the absence of clear symptoms and diagnostic tools, lay people may find it difficult to identify onset and remission regarding IGD. Thus, it is understandable that the general public may not possess a clear perception whether IGD is chronic or transitory. We contend that the perception would be formed when the science community have reached and disseminated their consensus.

Given that IGD is recognized and presented as a type of addiction, its natural course of development may be seen as diverse; relapse is not uncommon (Mihara & Higuchi, 2017). It is therefore not surprising that timeline cyclical, compared to timeline chronic, was found to be a more structurally stable and meaningful factor in IPQ-R for IGD. Moss-Morris et al. (2002) who developed the IPQ-R, also suggested timeline cyclical is a more useful dimension than

timeline chronic when the illness concerned cannot be adequately captured on a simple acute/chronic dimension.

Given some poor factor loadings, the original IPQ scale was modified by removal of six items (i.e., items 8, 15, 17, 19, 23, and 36) from the factors of consequences, personal control, treatment control, and emotional representations. Similar modifications have been commonly reported in other IPQ-R validation studies (Abubakari et al., 2012; Chen, Tsai, & Lee, 2008; Hagger & Orbell, 2005). All these six removed items involved reverse wording expressions. Researchers have pointed out that instead of preventing response biases, reversed item wordings may weaken validity, as such responses were more prone to errors due to inattention and confusion (Van Sonderen, Sanderman, & Coyne, 2013). Past research has encountered similar problems with items of reverse wording; some of such studies eventually removed the reversed items from the scales (Abubakari et al., 2012; Cabassa et al., 2008; Chen et al., 2008).

Other psychometric properties of the 26-item modified IPQ-R for IGD were found to be satisfactory. Compared to the original IPQ-R ($\alpha = 0.43\text{--}0.85$; Moss-Morris et al., 2002), the modified scale showed comparative or even higher internal consistency ($\alpha = 0.69\text{--}0.91$). The mild inter-factor correlations suggested that each factor was measuring a distinct underlying construct of illness representation. Criterion-related validity was supported by the positive correlations of stigma with the factors of timeline cyclical, consequence, treatment control, and emotional representations, and its negative correlation with illness coherence. Corroborating previous studies regarding mental disorders (Mak et al., 2014; Munson et al., 2009), subscales scores of the cyclical nature, negative consequences, and negative emotions was positively associated with stigma. The negative correlation between illness coherence and stigma also suggests that promoting understanding and knowledge about IGD in the general population may reduce negative public's views against people with IGD, and may foster a more encouraging environment for help-seeking.

The findings suggest that in general, the participants believed that IGD is subjected to relatively good personal control and treatment control. The findings are encouraging as low perceived treatment control is a potential barrier of help-seeking behaviors, and were associated with avoidance and negative coping (Richardson et al., 2017). However, future research need to examine the extent of perceived treatment control among those with IGD. Presently, there is a dearth of evidence-based treatment for IGD. We thus also need to understand deeper what treatment participants refer to. Furthermore, the results showed that ever-gamers were more likely than never-gamers to perceive better understanding on IGD, higher perceived control over IGD, less severe outcomes of IGD, and less negative emotions due to IGD. Gamers thus seem to feel less threatened by IGD than never-gamers. The stronger threat perceived by never-gamers might be partial reasons for their staying away from Internet gaming. Again, future research is needed to test this contention.

The participants, as a whole, did not perceive much severe emotional distress due to IGD. It is understandable as the participants were asked about their present emotional representations toward IGD, while most of them may not have trouble with Internet gaming. Those with IGD showed more negative emotional representations than those without IGD. It is plausible that, compared to the non-IGD cases, those IGD cases were more likely to experience symptoms and show related emotional responses. A reminder is that the level of emotional representation was quite low, possibly because many participants have not recognized that IGD being a disease, and have not observed immediate serious consequences that evoke emotions (unlike drug addiction). IGD cases were also more likely than non-IGD cases to score higher in the level of the time cyclical factor; some of the IGD cases might have made attempts to regulate gaming time, experienced fluctuations in level of symptoms, and/or experienced remission and relapses. Similarly, IGD cases tended to show better comprehensiveness than non-IGD cases; it is plausible that their IGD-related experience might have driven them to seek information about IGD. Such comparisons between IGD and non-IGD cases are potentially important. The number of sampled IGD cases in this study was however small; further research is warranted to understand levels and impact of these two factors among those with and without IGD.

The study has several limitations. First, our sample was drawn from the general population and not confined to only those with IGD. As mentioned in the last paragraph, the levels of illness representations did differ between IGD cases and non-IGD cases. The sample size of the IGD group was however, very small and interpretation need to be cautious. The number of sampled IGD cases was too small for separate testing of the psychometric properties in this important group. Further validation is therefore greatly warranted for testing whether the factor structure of this version of IPQ-R for IGD among IGD cases would differ from the one reported here. The revised tool validated in this study can be applied to general populations that have not been screened for IGD, but should not be applied to IGD cases until further validation confirms the findings of the present study among IGD cases. Second, the findings may not be generalizable to Western and/or adolescent populations. Cross-validations in such samples are also warranted. Third, this cross-sectional study does not allow for causal inferences. Fourth, the study did not examine test-retest reliability. Fifth, the study was conducted prior to the formal inclusion of gaming disorder into ICD-11; the influence of such announcement to the public's illness representation of the disorder as well as stability of the perceptions are unknown. It is also a limitation that the selection of stigma for testing criterion validity was not theory-based. Future research may use other variables for such testing, such as intention to regulate gaming time or worry about developing IGD for validations in general populations and coping and health outcomes for validations among IGD cases (according to CSM). Lastly, measurement invariance test was not conducted for the comparisons between IGD versus non-IGD

cases, as the small sample size of IGD cases would not allow for such testing. We also did not use the test before comparing ever-gamers and never-gamers, since our validation refers to the entire general population. We recommend future studies to include such tests to confirm whether the identified factor structure would be applicable to particular subgroups of significance.

Despite these limitations, the modified version of IPQ-R has acceptable reliability and validity, and is suitable for measuring illness representation of IGD in general populations of Chinese adults. Based on the CSM (Leventhal et al., 1998), illness representation influences coping strategies and behaviors related to the illness. Using the validated tool, future research may examine how illness representation regarding IGD would influence incidence, remission, and treatment-seeking behaviors. It is warranted to develop interventions to modify illness representation regarding IGD for prevention and remission of IGD, and promote related help-seeking behaviors.

Funding sources: The research was supported by the research grant of the University of Macau (Ref #: MYRG2016-00162-FSS and MYRG2019-00014-FSS). The funding source had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

Authors' contribution: TFL was involved in research conception, questionnaire design, as well as writing and finalizing the manuscript. LD was involved in literature review and manuscript writing. RYHC was responsible for data analysis and result interpretation. MXZ was involved in literature review, data preparation, and manuscript preparation. JHC was involved in data collection and preparation. AMSW was the principal investigator of the project and responsible for research conception, design, and coordination, data interpretation, and manuscript preparation. All authors contributed to and approved the final manuscript.

Conflict of interest: All authors declare no conflict of interest.

REFERENCES

- Abubakari, A. R., Jones, M. C., Lauder, W., Kirk, A., Devendra, D., & Anderson, J. (2012). Psychometric properties of the revised illness perception questionnaire: Factor structure and reliability among African-origin populations with type 2 diabetes. *International Journal of Nursing Studies*, 49(6), 672–681. <https://doi.org/10.1016/j.ijnurstu.2011.11.008>.
- American Association for Public Opinion Research. (2011). *Standard definitions: Final dispositions of case codes and outcome rates for surveys* (7th ed.). Retrieved <https://www.aapor.org/Content/NavigationMenu/AboutAAPOR/StandardsampEthics/StandardDefinitions/StandardDefinitions2011.pdf>.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Ayu, A. P., Dijkstra, B., Golbach, M., De Jong, C., & Schellekens, A. (2016). Good psychometric properties of the addiction version of the revised illness perception questionnaire for health care professionals. *PLOS ONE*, 11(11), e0164262. <https://doi.org/10.1371/journal.pone.0164262>.
- Baines, T., & Wittkowski, A. (2013). A systematic review of the literature exploring illness perceptions in mental health utilising the Self-Regulation Model. *Journal of Clinical Psychology in Medical Settings*, 20(3), 263–274. <https://doi.org/10.1007/s10880-012-9337-9>.
- Brislin, R. W. (1970). Back-translation for cross-cultural research. *Journal of Cross-Cultural Psychology*, 1(3), 185–216. <https://doi.org/10.1177/135910457000100301>.
- Broadbent, E., Ellis, C., Thomas, J., Gamble, G., & Petrie, K. (2009). Further development of an illness perception intervention for myocardial infarction patients: A randomized controlled trial. *Journal of Psychosomatic Research*, 67(1), 17–23. <https://doi.org/10.1016/j.jpsychores.2008.12.001>.
- Browning, K. K., Wewers, M. E., Ferketich, A. K., Otterson, G. A., & Reynolds, N. R. (2009). The Self-regulation Model of Illness applied to smoking behavior in lung cancer. *Cancer Nursing*, 32(4), E15–E25. <https://doi.org/10.1097/NCC.0b013e3181a0238f>.
- Cabassa, L. J., Lagomasino, I. T., Dwight-Johnson, M., Hansen, M. C., & Xie, B. (2008). Measuring Latinos' perceptions of depression: A confirmatory factor analysis of the illness perception questionnaire. *Cultural Diversity and Ethnic Minority Psychology*, 14(4), 377–384. <https://doi.org/10.1037/a0012820>.
- Chen, J. H., Tong, K. K., Wu, A., Lau, J. T., & Zhang, M. X. (2018). The comorbidity of gambling disorder among Macao adult residents and the moderating role of resilience and life purpose. *International Journal of Environmental Research and Public Health*, 15(12), 2774. <https://doi.org/10.3390/ijerph15122774>.
- Chen, S.-L., Tsai, J.-C., & Chou, K.-R. (2011). Illness perceptions and adherence to therapeutic regimens among patients with hypertension: A structural modeling approach. *International Journal of Nursing Studies*, 48(2), 235–245. <https://doi.org/10.1016/j.ijnurstu.2010.07.005>.
- Chen, S. L., Tsai, J. C., & Lee, W. L. (2008). Psychometric validation of the Chinese version of the Illness Perception Questionnaire-Revised for patients with hypertension. *Journal of Advanced Nursing*, 64(5), 524–534. <https://doi.org/10.1111/j.1365-2648.2008.04808.x>.
- Corrigan, P. W. (2000). Mental health stigma as social attribution: Implications for research methods and attitude change. *Clinical Psychology: Science and Practice*, 7, 48–67. <https://doi.org/10.1093/clipsy.7.1.48>.
- Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, 78(1), 98–104. <https://doi.org/10.1037/0021-9010.78.1.98>.
- Dempster, M., Howell, D., & McCorry, N. K. (2015). Illness perceptions and coping in physical health conditions: A meta-analysis. *Journal of Psychosomatic Research*, 79(6), 506–513. <https://doi.org/10.1016/j.jpsychores.2015.10.006>.



- Dempster, M., & McCorry, N. K. (2012). The factor structure of the revised Illness Perception Questionnaire in a population of oesophageal cancer survivors. *Psycho-Oncology*, 21(5), 524–530. <https://doi.org/10.1002/pon.1927>.
- Eickhoff, E., Yung, K., Davis, D. L., Bishop, F., Klam, W. P., & Doan, A. P. (2015). Excessive video game use, sleep deprivation, and poor work performance among U.S. Marines treated in a military mental health clinic: A case series. *Military Medicine*, 180(7), e839–e843. <https://doi.org/10.7205/milmed-d-14-00597>.
- Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling*, 8(3), 430–457. https://doi.org/10.1207/S15328007SEM0803_5.
- Fan, Y., Huang, Z., Zhang, D., Chang, J., Jia, Y., He, S., et al. (2017). Psychometric validation of the Chinese version of the Illness Perception Questionnaire-Revised for women with stress urinary incontinence. *Journal of Obstetrics and Gynaecology Research*, 43(8), 1305–1316. <https://doi.org/10.1111/jog.13351>.
- Feng, W., Ramo, D. E., Chan, S. R., & Bourgeois, J. A. (2017). Internet gaming disorder: Trends in prevalence 1998–2016. *Addictive Behaviors*, 75, 17–24. <https://doi.org/10.1016/j.addbeh.2017.06.010>.
- Fleming, M. P., Martin, C. R., Miles, J., & Atkinson, J. (2009). The utility of the Illness Perception Questionnaire in the evaluation of mental health practitioners' perspectives on patients with schizophrenia. *Journal of Evaluation in Clinical Practice*, 15(5), 826–831. <https://doi.org/10.1111/j.1365-2753.2008.01103.x>.
- Gentile, D. A., Bailey, K., Bavelier, D., Brockmyer, J. F., Cash, H., Coyne, S. M., et al. (2017). Internet gaming disorder in children and adolescents. *Pediatrics*, 140(Suppl. 2), S81–S85. <https://doi.org/10.1542/peds.2016-1758h>.
- Glattacker, M., Heyduck, K., & Meffert, C. (2012). Illness beliefs, treatment beliefs and information needs as starting points for patient information—evaluation of an intervention for patients with chronic back pain. *Patient Education and Counseling*, 86(3), 378–389. <https://doi.org/10.1016/j.pec.2011.05.028>.
- Hagger, M. S., & Orbell, S. (2005). A confirmatory factor analysis of the revised illness perception questionnaire (IPQ-R) in a cervical screening context. *Psychology and Health*, 20(2), 161–173. <https://doi.org/10.1080/0887044042000334724>.
- Hawi, N. S., Samaha, M., & Griffiths, M. D. (2018). Internet gaming disorder in Lebanon: Relationships with age, sleep habits, and academic achievement. *Journal of Behavioral Addictions*, 7(1), 70–78. <https://doi.org/10.1556/2006.7.2018.16>.
- Holliday, J., Wall, E., Treasure, J., & Weinman, J. (2005). Perceptions of illness in individuals with anorexia nervosa: A comparison with lay men and women. *International Journal of Eating Disorders*, 37(1), 50–56. <https://doi.org/10.1002/eat.20056>.
- Hou, R., Cleak, V., & Peveler, R. (2010). Do treatment and illness beliefs influence adherence to medication in patients with bipolar affective disorder? A preliminary cross-sectional study. *European psychiatry : The Journal of the Association of European Psychiatrists*, 25(4), 216–219. <https://doi.org/10.1016/j.eurpsy.2009.09.003>.
- Kline, R. B. (2015). *Principles and practice of structural equation modeling* (4th ed.). Guilford Press.
- Ko, C. H., Yen, J. Y., Chen, S. H., Wang, P. W., Chen, C. S., & Yen, C. F. (2014). Evaluation of the diagnostic criteria of Internet gaming disorder in the DSM-5 among young adults in Taiwan. *Journal of Psychiatric Research*, 53, 103–110. <https://doi.org/10.1016/j.jpsychires.2014.02.008>.
- Lam, W. W. T., Liao, Q., Wong, J. H. F., Lai, C. L., Yuen, M. F., Tsang, J. W. H., et al. (2015). Measuring and validating a general cancer predisposition perception scale: An adaptation of the Revised-IPQ-Genetic predisposition scale. *PLoS One*, 10(11), e0142620. <https://doi.org/10.1371/journal.pone.0142620>.
- Leventhal, H., Leventhal, E. A., & Contrada, R. J. (1998). Self-regulation, health, and behavior: A perceptual-cognitive approach. *Psychology and Health*, 13(4), 717–733. <https://doi.org/10.1080/08870449808407425>.
- Lobban, F., & Barrowclough, C. (2005). Common sense representations of schizophrenia in patients and their relatives. *Clinical Psychology & Psychotherapy*, 12(2), 134–141. <https://doi.org/10.1002/cpp.443>.
- Lobban, F., Barrowclough, C., & Jones, S. (2004). The impact of beliefs about mental health problems and coping on outcome in schizophrenia. *Psychological Medicine*, 34(7), 1165–1176. <https://doi.org/10.1017/s003329170400203x>.
- Macao Statistics and Census Services. (2017). *Detailed results of 2016 population by-census*. Macao: Macao Statistics and Census Services. Retrieved from https://www.dsec.gov.mo/getAttachment/bfa0112a-eaf3-49a9-9168-b5add46e9d65/C_ICEN_PUB_2016_Y.aspx.
- Mak, W. W. S., Chong, E. S. K., & Wong, C. C. Y. (2014). Beyond attributions: Understanding public stigma of mental illness with the common sense model. *American Journal of Orthopsychiatry*, 84(2), 173–181. <https://doi.org/10.1037/h0099373>.
- Mihara, S., & Higuchi, S. (2017). Cross-sectional and longitudinal epidemiological studies of internet gaming disorder: A systematic review of the literature. *Psychiatry and Clinical Neurosciences*, 71(7), 425–444. <https://doi.org/10.1111/pcn.12532>.
- Mo, P. K. H., Lau, J. T. F., Cheng, K. M., Mak, W. W. S., Gu, J., Wu, A. M. S., et al. (2015). Investigating the factor structure of the Illness Perception Questionnaire-Revised for substance dependence among injecting drug users in China. *Drug and Alcohol Dependence*, 148, 195–202. <https://doi.org/10.1016/j.drugalcdep.2015.01.008>.
- Moss-Morris, R., Weinman, J., Petrie, K., Horne, R., Cameron, L., & Buick, D. (2002). The revised illness perception questionnaire (IPQ-R). *Psychology and Health*, 17(1), 1–16. <https://doi.org/10.1080/08870440290001494>.
- Müller, K. W., Janikian, M., Dreier, M., Wölfling, K., Beutel, M. E., Tzavara, C., et al. (2015). Regular gaming behavior and internet gaming disorder in European adolescents: Results from a cross-national representative survey of prevalence, predictors, and psychopathological correlates. *European Child & Adolescent Psychiatry*, 24(5), 565–574. <https://doi.org/10.1007/s00787-014-0611-2>.
- Munson, M. R., Floersch, J. E., & Townsend, L. (2009). Attitudes toward mental health services and illness perceptions among adolescents with mood disorders. *Child and Adolescent Social Work Journal*, 26(5), 447–466. <https://doi.org/10.1007/s10560-009-0174-0>.



- Richardson, E. M., Schüz, N., Sanderson, K., Scott, J. L., & Schüz, B. (2017). Illness representations, coping, and illness outcomes in people with cancer: A systematic review and meta-analysis. *Psycho-Oncology*, 26(6), 724–737. <https://doi.org/10.1002/pon.4213>.
- Satghare, P., Abdin, E., Vaingankar, J., Chua, B. Y., Pang, S., Picco, L., et al. (2016). Prevalence of sleep problems among those with internet gaming disorder in Singapore. *ASEAN Journal of Psychiatry*, 17(2), 188–198.
- Stockford, K., Turner, H., & Cooper, M. (2007). Illness perception and its relationship to readiness to change in the eating disorders: A preliminary investigation. *The British Journal of Clinical Psychology*, 46(2), 139–154. <https://doi.org/10.1348/014466506X115786>.
- Van Sonderen, E., Sanderman, R., & Coyne, J. C. (2013). Ineffectiveness of reverse wording of questionnaire items: Let's learn from cows in the rain. *PLOS ONE*, 8(7), e68967. <https://doi.org/10.1371/journal.pone.0068967>.
- Wang, H. R., Cho, H., & Kim, D. J. (2018). Prevalence and correlates of comorbid depression in a nonclinical online sample with DSM-5 internet gaming disorder. *Journal of Affective Disorders*, 226, 1–5. <https://doi.org/10.1016/j.jad.2017.08.005>.
- Wartberg, L., Kriston, L., & Thomasius, R. (2017). The prevalence and psychosocial correlates of internet gaming disorder. *Deutsches Arzteblatt International*, 114(25), 419–424. <https://doi.org/10.3238/arztebl.2017.0419>.
- Weiner, B., Perry, R. P., & Magnusson, J. (1988). An attributional analysis of reactions to stigmas. *Journal of Personality and Social Psychology*, 55, 738–748. <https://doi.org/10.1037/0022-3514.55.5.738>.
- Weinman, J., & Petrie, K. J. (1997). Illness perceptions: A new paradigm for psychosomatics? *Journal of Psychosomatic Research*, 42(2), 113–116. [https://doi.org/10.1016/s0022-3999\(96\)00294-2](https://doi.org/10.1016/s0022-3999(96)00294-2).
- Weinman, J., Petrie, K. J., Moss-Morris, R., & Horne, R. (1996). The illness perception questionnaire: A new method for assessing the cognitive representation of illness. *Psychology and Health*, 11(3), 431–445. <https://doi.org/10.1080/08870449608400270>.
- Weisman, A. G., & López, S. R. (1997). An attributional analysis of emotional reactions to schizophrenia in Mexican and Anglo American cultures 1. *Journal of Applied Social Psychology*, 27(3), 223–244.
- Wichstrøm, L., Stenseng, F., Belsky, J., von Soest, T., & Hygen, B. W. (2019). Symptoms of Internet gaming disorder in youth: Predictors and comorbidity. *Journal of Abnormal Child Psychology*, 47(1), 71–83. <https://doi.org/10.1007/s10802-018-0422-x>.
- Williams, K., & Steer, H. (2011). Illness perceptions: Are beliefs about mental health problems associated with self-perceptions of engagement in people with psychosis? *Behavioural and Cognitive Psychotherapy*, 39(2), 151–163. <https://doi.org/10.1017/S1352465810000627>.
- World Health Organization. (2018). *Gaming disorder*. Retrieved from <https://icd.who.int/dev11/l-m/en#/http://id.who.int/icd/entity/1448597234>.
- Wu, A. M. S., Chen, J. H., Tong, K.-K., Yu, S., & Lau, J. T. F. (2018a). Prevalence and associated factors of Internet gaming disorder among community dwelling adults in Macao, China. *Journal of Behavioral Addictions*, 7(1), 62–69. <https://doi.org/10.1556/2006.7.2018.12>.
- Wu, A. M. S., & Lau, J. T. F. (2015). Gambling in China: Socio-historical evolution and current challenges. *Addiction*, 110(2), 210–216. <https://doi.org/10.1111/add.12710>.
- Wu, C.-Y., Lee, M.-B., Liao, S.-C., & Ko, C.-H. (2019). A nationwide survey of the prevalence and psychosocial correlates of internet addictive disorders in Taiwan. *Journal of the Formosan Medical Association*, 118(1), 514–523. <https://doi.org/10.1016/j.jfma.2018.10.022>.
- Wu, X., Lau, J. T. F., Mak, W. W. S., Gu, J., Mo, P. K. H., & Wang, X. (2018b). How newly diagnosed HIV-positive men who have sex with men look at HIV/AIDS-validation of the Chinese version of the revised illness perception questionnaire. *BMC Infectious Diseases*, 18(1), 2. <https://doi.org/10.1186/s12879-017-2902-y>.
- Yen, J.-Y., Liu, T.-L., Wang, P.-W., Chen, C.-S., Yen, C.-F., & Ko, C.-H. (2016). Association between Internet gaming disorder and adult attention deficit and hyperactivity disorder and their correlates: Impulsivity and hostility. *Addictive Behaviors*, 64, 303–318. <https://doi.org/10.1016/j.addbeh.2016.04.024>.
- Yu, H., & Cho, J. (2016). Prevalence of internet gaming disorder among Korean adolescents and associations with non-psychotic psychological symptoms, and physical aggression. *American Journal of Health Behavior*, 40(6), 705–716. <https://doi.org/10.5993/AJHB.40.6.3>.
- Zhang, M. X., Wang, X., Yu, S. M., & Wu, A. M. S. (2019). Purpose in life, social support, and internet gaming disorder among Chinese university students: A 1-year follow-up study. *Addictive Behaviors*, 99, 106070. <https://doi.org/10.1016/j.addbeh.2019.106070>.
- Zhao, M., & Hao, W. (2019). Challenges of gaming disorder: Suggestions from a public health perspective. *General Psychiatry*, 32(3), e100086. <https://doi.org/10.1136/gpsych-2019-100086>.

