Addictive Behaviors 74 (2017) 20–26

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Psychometric properties of the Chinese Internet Gaming Disorder Scale

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ARTICLE INFO

Keywords:
Internet gaming disorder
Problematic gaming
Behavioral addiction
Scale validation
DSM
Measurement invariance

ABSTRACT

To develop a consensus on the definition and measurement of Internet gaming disorder (IGD), several recent studies have used the DSM-5's proposed criteria for IGD as the basis in scale construction. This study contributes to this emerging consensus by developing and validating a new Chinese Internet Gaming Disorder Scale (C-IGDS) based on the DSM-5 criteria. A representative sample of Hong Kong community adults (n = 502, 50% men, mean age = 37.1, age range = 18–60) was recruited for a telephone survey with random digit dialing. Various statistical techniques were used to assess the psychometric properties of the C-IGDS. The C-IGDS had good reliability (Cronbach's α = 0.91) and structural validity (CFA model fit: RMSEA = 0.027, CFI = 0.991, TLI = 0.988) in our sample. Moderate to moderately strong correlations with depressive symptoms (r = 0.617, $p < 0.001$), social anxiety symptoms (r = 0.366, $p < 0.001$), and gaming hours (r = 0.412, $p < 0.001$) supported the criterion validity of the C-IGDS. In addition, the C-IGDS exhibited strict measurement invariance for sex and at least strong measurement invariance for age. In addition to providing the first Chinese scale for measuring IGD based on the DSM-5′s proposed criteria, this study provides empirical support for the validity of these diagnostic criteria as the basis for a universal measure of IGD. Most important, this study is the first to reveal the criteria's measurement invariance, thereby indicating their suitability for use with diverse demographic groups.

1. Introduction

1.1. Problematic gaming as a global public health issue

In the present Cyberage, excessive game playing can lead to what is known as Internet gaming disorder (IGD) that is detrimental to mental health (e.g., Sarda, Bègue, Bry, & Gentile, 2016) The prevalence rates of IGD are estimated to range from 5% to 8% in North America (e.g., Desai, Krishnan-Sarin, Cavallo, & Potenza, 2010; Gentile, 2009), from 0.2% to 12% in Europe (e.g., Festl, Scharkow, & Quandt, 2013; Wittek et al., 2016), and from 8% to 46% in Asia (e.g., Gentile et al., 2011; Wan & Chiou, 2006). Such wide ranges in prevalence rate may be attributable to the varied conceptualizations and assessments for IGD found in the rapidly growing literature. In the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorder, IGD is included as a "condition for further study" (American Psychiatric Association, 2013, p. 795). Hence, the proposed diagnostic criteria and cutoff are not set in stone and need to be validated.

In 2015, there were almost 400 million Chinese online gamers (China Internet Network Information Center, 2016). Studies have shown positive associations between IGD and a wide range of issues, including substance-related addictions, behavioral addictions, and emotional disorders (e.g., Sigerson, Li, Cheung, & Cheng, 2017; Zhang et al., 2016). However, there is a lack of standardized tools for assessing IGD in Chinese populations. The availability of a reliable and valid Chinese assessment tool is thus of paramount importance for further research on this problem. The present study thus aims to (a) develop and validate a Chinese IGD scale (C-IGDS) based on the DSM-5's proposed diagnostic criteria; and (b) conduct measurement invariance tests to determine the applicability of the C-IGDS for a demographically-diverse Chinese community sample.

1.2. DSM-5 proposed diagnostic criteria for IGD

Since their proposal, the DSM-5 diagnostic criteria for IGD have been transformed and adapted to distinguish between average and problematic gamers in several countries (e.g., Lemmens, Valkenburg, & Gentile, 2015; Pontes & Griffiths, 2015; Rehbein, Kliem,

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http://dx.doi.org/10.1016/j.addbeh.2017.05.031
Received 18 February 2017; Received in revised form 30 April 2017; Accepted 23 May 2017
Available online 25 May 2017

Baier, Mößle, & Petry, 2015). Yet, in Asia, only one study conducted in Taiwan has developed a semi-structured interview schedule to assess IGD (Ko et al., 2014). To the best of our knowledge, there is no existing Chinese IGD self-report scale that has been constructed for epidemiological research, constituting a significant research gap given the pervasiveness of video gaming in Chinese societies.

To meet the urgent need for such tools, this study aimed to develop a reliable and valid scale for measuring IGD in Chinese populations, namely, the Chinese IGD Scale (C-IGDS). Accordingly, we translated the DSM-5's proposed diagnostic criteria for IGD into Chinese, transformed the items into a self-report scale, and tested the scale's psychometric properties in a representative, heterogeneous Chinese sample.

1.3. Evaluation of scale stability across demographic groups

This study also aimed to evaluate whether the C-IGDS assesses IGD consistently across different respondents within the population by testing its measurement invariance across groups with distinct demographic characteristics (i.e., men and women, younger and older adults). Measurement invariance indicates that respondents' scores on a scale depend on their levels of the variable being assessed by the scale rather than their membership of a particular demographic group (Meredith & Millsap, 1992).

IGD is known to be more prevalent among the young and among males (e.g., Fuster, Carbonell, Pontes, & Griffiths, 2016; Zanetta Dauriat et al., 2011), and these imbalances could introduce systematic bias into the measurement of IGD. As epidemiological research typically involves large samples with assorted demographic profiles, the establishment of measurement invariance is required to facilitate meaningful comparisons across diverse demographic groups. Given that the C-IGDS is designed for use in heterogeneous Chinese samples, it is thus essential to test for its measurement invariance.

2. Methods

2.1. Data collection and participants

Prior research ethics approval has been obtained from the Human Research Ethics Committee of the University of Hong Kong. Data were collected via a population-based telephone survey using random digit dialing, and an adult member from each household was selected according to the most-recent-birthday criterion. Upon completion of the interviews, participants were entered into a lucky draw for ten 500 Hong Kong dollars (approximately 65 US dollars) supermarket vouchers.

Within two months, 1045 participants had successfully completed the survey. Any participants who reported 0 hours per week of gaming were excluded from the analyses, leaving a final sample of 502 gamers. The final sample's demographics are presented in Table 1. This sample was evenly balanced by gender (49.8% female) and featured a wide age range (mean = 37.1, *SD* = 13.3, range = 18–60). According to the most recent census data, this sample is roughly representative of the Hong Kong population (Hong Kong Census and Statistics Department, 2016).

2.2. Development of the C-IGDS

The DSM-5 (see Section 3) proposes nine symptoms indicative of IGD. In adapting these symptoms into a scale for our survey, we first converted each symptom into a self-report item, altering the DSM's original wording as little as possible. For instance, one of the proposed DSM symptoms is "Use of Internet games to escape or relieve a negative mood (e.g., feelings of helplessness, guilt, anxiety)" (American Psychiatric Association, 2013, p. 795). For our survey, we converted it into "Do you play Internet games in order to escape or relieve a negative mood (e.g., feelings of helplessness, guilt, anxiety)?" To emulate the DSM's original format, we included "yes" or "no" response options for each item. A complete list of the converted items is available in the Appendix.

To develop a Chinese version of the IGD scale, we adopted the back-translation method recommended by Brislin (1986). A bilingual researcher first translated the DSM-5 IGD diagnostic criteria from English into Chinese, and another bilingual researcher then back-translated them into English. In the final stage, one of the authors (Li) reviewed and resolved any discrepancies with both translators before finalizing the scale.

Table 1
Demographic data for the entire sample and all sub-samples involved in testing measurement invariance for sex and age.

Grouping variable	Sub-sample	*n*	Mean age (SD) (range)	% female
Entire sample				
	–	502	37.1 (13.3) (18–60)	49.8
Gender				
	Men	252	34.9 (12.9) (18–60)	0.0
	Women	250	39.4 (13.3) (18–60)	100.0
Age (Median split)				
	Younger	238	25.0 (5.5) (18–36)	42.9
	Older	251	48.5 (6.9) (37–60)	54.2
Age (Tripartite split)				
	Younger	164	21.9 (2.9) (18–27)	40.2
	Middle	169	37.2 (5.3) (28–45)	46.7
	Older	156	53.0 (4.3) (46–60)	59.6

2.3. Additional measures

We administered the Social Interaction Anxiety Scale-Short form (SIAS; Peters, Sunderland, Andrews, Rapee, & Mattick, 2012). The Chinese version has been validated by Yang (1997). The Chinese SIAS displayed good reliability in this study (Cronbach's $\alpha = 0.78$).

The Center for Epidemiologic Studies Depression Scale-Short Form (CES-D; Cole, Rabin, Smith, & Kaufman, 2004) was used. The Chinese version has been validated by Cheung, Liu, and Yip (2007). The Chinese CES-D was found to reliably measure depressive symptoms in the present sample (Cronbach's $\alpha = 0.79$).

Participants were asked to report their sex and age. In addition, we assessed participants' amount of weekly gaming with two items asking how many hours per day, on average, they played during the week and on weekends, respectively. The responses were then multiplied and summed together to assess how many hours per week each participant spent on gaming.

3. Results

3.1. Psychometric properties of Chinese IGD scale

To examine whether the C-IGDS is adequate for assessing IGD in Hong Kong, we assessed its three major psychometric properties: reliability, structural validity, and criterion validity. These analyses were conducted in Lavaan version 5.20 (Rosseel, 2012), and R version 3.2.2 (R Core Team, 2015).