Association between Internet gaming disorder and generalized anxiety disorder

CHAO-YANG WANG¹, YU-CHEN WU², CHEN-HSIANG SU³, PAI-CHENG LIN³, CHIH-HUNG KO³⁴,⁵ and JU-YU YEN³⁵,⁶*

¹Department of Psychiatry, Taoyuan Armed Forced General Hospital, Taoyuan, Taiwan
²Department of Nursing, Kaohsiung Municipal Ta-Tung Hospital, Kaohsiung Medical University, Kaohsiung City, Taiwan
³Department of Psychiatry, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung City, Taiwan
⁴Faculty of Medicine, Department of Psychiatry, College of Medicine, Kaohsiung Medical University, Kaohsiung City, Taiwan
⁵Department of Psychiatry, Kaohsiung Municipal Ta-Tung Hospital, Kaohsiung Medical University, Kaohsiung City, Taiwan
⁶Department of Psychiatry, Kaohsiung Municipal Ta-Tung Hospital, Kaohsiung Medical University, Kaohsiung City, Taiwan

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INTRODUCTION

Along with the popularization and progression of technology, the high availability of the Internet and the information it contains not only bring us convenience but also changes our daily lives. Despite the Internet’s benefits, a loss of control over Internet use, defined as Internet addiction, might negatively affect life function and performance in our daily lives, family and peer relationships, and emotional stability (Anderson, 2001; Lin & Tsai, 2002; Ryu, Choi, Seo, & Nam, 2004; Young & Rogers, 1998). Internet gaming is one of the most popular online activities, and Internet gaming disorder (IGD) is the most prevalent subtype (57.5%) of Internet addiction (Kishi et al., 2009). IGD has been associated with a higher prevalence of anxiety disorder (Gentile et al., 2011). However, whether IGD is comorbid with generalized anxiety disorder (GAD) has not been well studied.

Internet gaming disorder (IGD)

IGD was first included in the fifth edition of appendix of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) in May 2013 as a condition warranting further study. The classification of IGD is similar to gambling disorder and contains nine criteria: (a) preoccupation with Internet games; (b) withdrawal symptoms when Internet gaming is discontinued; (c) tolerance: the need to spend increasing amount of time engaged in Internet gaming; (d) unsuccessful attempts to control participation in Internet gaming; (e) loss of interest in hobbies and entertainment as a result of, and with the exception of, Internet gaming; (f) continued excessive use of Internet games, despite the knowledge of psychosocial problems; (g) deception of family members, therapists, or others regarding the amount of Internet gaming; (h) use of Internet gaming to escape or relieve a negative mood; and (i) loss of a significant relationship, job, or educational or career opportunity because of participation in Internet games (APA, 2013).

The diagnostic validity of the DSM-5 criteria has been supported by an interview study (Ko et al., 2014). However, there are debates about the validity, reliability, and content of DSM-5 criteria of IGD (Griffiths et al., 2016; Király, Griffiths, & Demetrovics, 2015; Kuss, Griffiths, & Pontes, 2017). The characteristics and intricacies of each criterion should be evaluated and validated in the future (Király et al., 2017). Nevertheless, having a common tool for clinicians to

* Corresponding author: Ju-Yu Yen, MD, PhD; Department of Psychiatry, Kaohsiung Municipal Ta-Tung Hospital, Kaohsiung City 807, Taiwan; E-mail: yenjuyu@cc.kmu.edu.tw

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IGD and GAD

diagnose IGD and for researchers to compare their results is useful (Petry et al., 2014). Thus, we recruited participants with IGD based on the DSM-5 IGD criteria.

Generalized anxiety disorder (GAD)

GAD is characterized by excessive and persistent worrying and stress that is difficult to control and is often accompanied by insomnia, restlessness, muscle tension, and concentration problems. According to DSM-5, the symptoms must occur on the majority of days for at least 6 months. General anxiety disorder is one of the most common mental disorders in the community and primary care facilities (Wittchen et al., 2002), with a 4%–7% lifetime prevalence and 1%–4% reported annual incidence (Hoge, Ivkovic, & Fricchione, 2012; Katzman et al., 2014). The presence of comorbidity with major depression or other anxiety disorders has been commonly observed and associated with a poorer prognosis compared with isolated GAD (Kessler et al., 2008). This disorder may also be associated with increased rates of substance abuse. Although studies have suggested that those with GAD are prone to addictive behaviors, such as alcohol abuse, to cope with their anxiety (Smith & Book, 2008, 2010; Smith & Randall, 2012), whether they have a manifestly increased risk for IGD has yet to be evaluated.

Association between IGD and general anxiety disorder

Previous reports have suggested that Internet addiction is associated with various psychiatric disorders. Studies have shown a high comorbidity between Internet addiction and psychiatric disorders, especially affective disorders (e.g., depression) and anxiety disorders (e.g., GAD and social anxiety disorder) (Caplan, 2007; Cole & Griffiths, 2007; Lehenbauer-Baum et al., 2015; Morahan-Martin & Schumacher, 2003; Weinstein & Lejoyeux, 2010; Yen et al., 2012). Furthermore, a study of South Korean participants found that an IGD risk group had significantly higher anxiety symptom scores (Kim et al., 2016). As anxiety symptoms are the core presentation of GAD, we hypothesize that GAD is associated with IGD. In addition, comorbidity with GAD might further deteriorate the ability to cope with the negative consequences of addiction. This could contribute to a decline in emotional well-being. Thus, we hypothesized that those with IGD comorbid with GAD might manifest more anxiety and depression.

Associations between behavioral inhibition, IGD, and general anxiety disorder

Eysenck (1997) suggested that certain personality traits are prominent vulnerability factors for all types of addiction. According to Gray’s reinforcement sensitivity theory, the behavioral inhibition system (BIS) responds to punishment and results in behavior withdrawal and arousal (Carver & White, 1994). Yen, Ko, Yen, Chen, and Chen (2009) reported that college students with Internet addiction had high BIS scores and for college students with high anxiety about immediate consequences, the Internet virtual world provides an environment with fewer anxiety triggers than real-world activities, consequently promoting Internet use. Those with high BIS scores have a tendency to be sensitive to aversive results and are vulnerable to anxiety. High BIS scores are also reported to be a predisposing characteristic of social anxiety (Kasch, Rottenberg, Arnow, & Gotlib, 2002; Marcin & Nemeroff, 2003; Morgan et al., 2009; Schofield, Coles, & Gibb, 2009; Yen et al., 2012). These results suggest that behavior inhibition is associated with both IGD and GAD. We hypothesized that if IGD is comorbid with GAD, behavior inhibition would be involved in the association between GAD and IGD.

Study objective

We hypothesized that IGD is associated with GAD and that both disorders are associated with behavior inhibition. Those who have IGD with GAD as a comorbid condition could have pronounced depression and anxiety. Under these hypotheses, the study aims to evaluate (a) the association between IGD and GAD; (b) the effect of behavior inhibition in the association between IGD and GAD; and (c) the association between GAD, depression, and anxiety among subjects with IGD.

METHODS

Participants

The participants included those who currently had IGD (IGD group) and those who had never had IGD (control group). All participants were recruited by advertisement from September 2012 to October 2013. The advertisement was posted on the most popular bulletin board system in Taiwan. The recruitment criteria in the IGD group were as follows: (a) young adults of age 20–30 years and an educational level greater than 9 years; (b) those who played Internet games for 4 or more hours per day on weekdays and 8 or more hours per day on weekends or 40 or more hours per week; and (c) those who had maintained a pattern of Internet gaming for more than 2 years. Those participants responded to the advertisement and met all three criteria were invited to participate in this study after informed consent was obtained. Furthermore, they were interviewed by a psychiatrist based on the IGD criteria of DSM-5 to determine the diagnosis of IGD. Those diagnosed with IGD were classified as the participants of the IGD group.

When we enrolled a participant in the IGD group, we enrolled a corresponding participant – of the same gender, educational level, and age (within a range of 1 year) – in the control group by posting an advertisement on the bulletin board system. The recruitment criterion of the participants in the control group was that their non-essential Internet use was less than 4 hr/day. They were classified into the control group after a diagnostic interview conducted by the psychiatrist. All participants underwent a three-part interview: (a) a diagnostic interview with a psychiatrist based on the Chinese version of Mini-International Neuropsychiatric Interview (M.I.N.I.) to determine the existence of GAD and
exclude those diagnosed with psychotic disorders, bipolar I disorder, and substance use disorders; (b) a history-taking interview to exclude those who used psychotropic medication were mentally retarded, had a severe physical disorder, or disclosed a previous brain injury; (c) an IGD-determination interview to ensure that the participants of the control group had never met the criteria for IGD.

Measures

The diagnostic criteria of IGD in DSM-5. Nine items comprise the diagnostic criteria of IGD in the DSM-5: preoccupation, withdrawal, tolerance, unsuccessful attempts to control, loss of other interests, continued excessive use despite psychosocial problems, deception regarding online gaming, escape, and functional impairment (APA, 2013). We developed a semistructured interview schedule to determine whether five or more of the DSM-5 criteria of IGD were present, and such participants were classified as the IGD group. The threshold of the DSM-5’s IGD criteria was supported by a previous study (Király et al., 2017; Ko et al., 2014).

Chinese version of the M.I.N.I. We conducted a diagnostic interview based on the modules of GAD, psychotic disorders, bipolar I disorder, and substance use disorders using the Chinese version of the M.I.N.I. (Sheehan et al., 1998) to determine the existence of GAD and to exclude psychiatric disorders.

Center for Epidemiological Studies’ Depression Scale (CES-D). The 20-item Mandarin Chinese version (Chien & Cheng, 1985) of CES-D (Radloff, 1977) is a self-administered evaluation assessing participants’ frequency of depressive symptoms over the previous week. Cronbach’s α of CES-D in this study was .92 and was utilized to evaluate depression. Skewness and kurtosis were 0.87 and 0.48, respectively.

Penn State Worry Questionnaire (PSWQ). The PSWQ (Meyer, Miller, Metzger, & Borkovec, 1990) has 16 items, and each item is rated on a scale from 1 (“not at all typical of me”) to 5 (“very typical of me”). Eleven items are worded to evaluate whether pathological worry is a problem. The remaining five items are worded to determine whether worry is not a problem and is scored reversed. The PSWQ was found to significantly differentiate college samples which met all, some, or none of the revised third edition of DSM (American Psychiatric Association, 1987) diagnostic criteria for GAD, providing good internal consistency and validity and a valid measure to assess anxiety symptoms. Cronbach’s α of PSWQ in this study was .92 and used to evaluate the anxiety symptoms; skewness and kurtosis were 0.19 and −0.06, respectively.

Behavior inhibition system and behavior approach system scales (Gray, 1991). The Behavioral Inhibition System and Behavioral Approach System Scales (BIS/BAS scales) (Gray, 1991) were designed to assess individual differences in the sensitivity of the two motivational systems proposed by Gray (1970). The BIS scale measured the degree to which respondents expected to feel anxiety when confronted with cues for punishment. The test–retest reliability of the BIS subscales was 0.66 (Carver & White, 1994). We used the BIS scale to assess the vulnerability to anxiety. The higher score indicates the higher behavior inhibition. Cronbach’s α of the BIS scale was .78 in this study; skewness and kurtosis were −0.2 and 0.52, respectively.

Procedures

All the matched participants from the IGD and control groups underwent a diagnostic interview by a psychiatrist to determine the existence of each diagnostic criterion of GAD. All participants completed the aforementioned assessments after the diagnostic interview.

Statistical analysis

We evaluated the association between IGD and GAD with χ² and logistic regression analysis. Then, we evaluated the differences in depression, anxiety, and behavior inhibition between subjects with IGD and those without using an independent t test. The independent t test was used to evaluate the association between behavior inhibition and GAD. Next, we evaluated the association between IGD and GAD with logistic regression under the control of behavior inhibition. Finally, we evaluated the differences in depression, anxiety, and behavior inhibition between IGD participants with GAD and those without using an independent t test. The p value less than .05 was considered significant for all analyses, which were performed using the SPSS software package.

Ethics

A total of 87 participants in the IGD group and 87 in the control group were recruited into this study. A detailed explanation of the study was given; subsequently, informed consent was obtained from all participants. This study was approved by the Institutional Review Board of Kaohsiung Medical University Hospital.

RESULTS

Comparisons of depression, anxiety, and behavior inhibition between IGD and control groups

A total of 87 participants in the IGD group and 87 participants in the control group were recruited into this study. Table 1 presents the differences in gender, age, educational level, depression, anxiety, behavior inhibition, and behavior activation between the IGD and control groups. There were no significant differences in gender, age, and educational level between the two groups. The IGD group had higher scores on depression, anxiety, and behavior inhibition.

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χ² analysis revealed the significant association between IGD and GAD. Model I of the logistic regression in Table 2 is to regress IGD on GAD to determine the odds ratio (OR) of IGD among participants with GAD, controlling for age, gender, and educational level. Model I demonstrates that...
Adults with GAD were more likely (OR = 8.11, 95% CI = 1.78–37.09) to have IGD than those without GAD.

**Association between IGD and general anxiety disorder with control of behavior inhibition**

Behavior inhibition was included as an independent variable in regression Model I of Table 2 and named Model II. The OR of adults with GAD to have IGD decreased to 5.6 (95% CI = 1.19–26.32) when behavior inhibition was input to the regression model (Model II in Table 2). In addition, an independent t test demonstrated that subjects with GAD had a higher score in BIS ($t = 3.76, p < .001$). These results indicate that behavior inhibition is associated with both IGD and GAD. General anxiety disorder is also significantly associated with IGD in the final model (Model II in Table 2). According to the mediating theory of Baron and Kenny (1986), this result indicated that behavior inhibition partially mediated the association between IGD and GAD. As the Wald’s value of behavior inhibition was higher than that of GAD, it had a stronger effect on IGD than GAD in the final model.

Finally, among subjects with IGD, comorbidity with GAD was associated with higher depression and anxiety than those without GAD (Table 3).
DISCUSSION

Association between IGD and general anxiety disorder

Internet addiction has previously been associated with anxiety disorder in adults and adolescents (Caplan, 2007; Morahan-Martin & Schumacher, 2003; Winstanley, Eagle, & Robbins, 2006; Yen et al., 2012). This present investigation is the first to reveal the positive association between IGD and GAD: the participants with IGD were more likely to be comorbid with GAD compared with those without IGD. The association persisted after controlling for both age and educational level, indicating that the association could not solely be explained by age or educational level. Furthermore, subjects with IGD had higher anxiety symptoms, suggesting that subjects with IGD had not only high anxiety symptoms but also a higher risk of comorbidity with GAD.

A previous study suggested that the primary motivations for online gaming were “escape” and “coping” (Kim et al., 2016). Another study using the Internet Motive Questionnaire for Adolescents also demonstrated that “coping” was a major motivation for online gaming use in subjects diagnosed with IGD (Bischof-Kastner, Kuntsche, & Wolstein, 2014). Evidence shows that worry evokes and sustains a negative affect among subjects with IGD, thereby precluding sharp increases in negative emotion and demonstrating their avoidance behavior (Newman, Llera, Erickson, Przeworski, & Castonguay, 2013). Online gaming provided a virtual world for the player to escape and forget about their worries in real life. To keep avoiding the real world, subjects with GAD might escape to the Internet and spend excessive time online gaming. Without effective intervention for their anxiety symptoms, repeatedly escaping to online gaming could increase the risk of addiction to online gaming.

On the contrary, excessive online gaming could result in negative consequences, such as academic failure or inadequate social interaction. These might make some vulnerable subjects overtly worry about their performance and social interaction. The vicious cycle of negative consequences and escaping behavior could contribute to the association between IGD and GAD. A previous study found that escape mediated the association between psychiatric symptoms and problematic online gaming (Kiraly, Urban, et al., 2015). Regarding the negative effect of comorbid disorder on the course of the addictive disorder, more attention and intervention should be paid to GAD when treating subjects with IGD to prevent the vicious cycle.

Role of behavior inhibition in the association between IGD and general anxiety disorder

Comorbidity between two disorders might indicate a causal relationship, because they share the same associated factors or common etiology and bidirectional interaction (Mueser, Drake, & Wallach, 1998). We evaluated the possible confounding factors playing a role in the association between IGD and GAD. In this study, our mediational model hypothesized that the GAD was associated with the mediating factor, which in turn was associated with IGD. The mediating factors served to explore the mechanism of the association between these two disorders and may elucidate the psychopathology of Internet addiction.

Behavior inhibition represents sensitivity to aversive stimuli. A previous review suggested that behavioral inhibition could be a stable characteristic from childhood and a risk factor for anxiety disorders when subjects grow up (Svihra & Katzman, 2004). In line with a previous claim (Yen et al., 2009), we found that subjects with GAD had higher behavior inhibition. In addition, we found that behavior inhibition is associated with IGD. Behavior inhibition indicates the consistent tendency to demonstrate fear and withdrawal in novel situations (Svihra & Katzman, 2004). High behavior inhibition could prohibit subjects from trying activities and interaction in real-world social interactions. However, anonymity, a lack of direct physical harm, and the ability to enter and leave without restriction in online gaming could allow the user to feel relief from immediate anxiety. Furthermore, online gaming is designed to satisfy the user in a group behavioral setting. Subjects with higher behavior inhibition may experience fewer aversive situations in online gaming. Thus, behavior inhibition could play an important role in retaining effect on vulnerability to IGD.

In this study, behavior inhibition partially mediated the association between IGD and the diagnosis of GAD, indicating that behavior inhibition plays a role in the comorbidity of IGD and GAD. Gray (1978, 1981, 1987, 1990) has also held that BIS functioning is responsible for the experience of negative feelings, such as fear, anxiety, frustration, and sadness in response to these cues. Regarding individual differences in personality, greater BIS sensitivity should be reflected in greater susceptibility to anxiety, provided the person is exposed to the proper situational cues. The participants with GAD had higher behavior inhibition, which might make them prone to the desire to escape from real-world relationships and interaction and to consequently use online gaming as an alternative means to facelessly interact with others or relieve their emotional difficulty. However, regarding their high behavior inhibition, they could experience higher anxiety symptoms when they want to change their social interaction from online gaming to the real world. This would result in a vicious cycle and contribute to the addiction process. Thus, counseling for behavior inhibition should be provided to subjects with IGD with GAD. In addition, GAD affects IGD even under the control of behavior addiction. Apart from intervention for behavior inhibition, we must assess and treat GAD among subjects with IGD.

Role of depression in the association between IGD and general anxiety disorder

This study showed that the participants with IGD had higher scores on the depression scale, which has been reported to be associated with increased levels of personal Internet use because it provides an environment without real-life interpersonal difficulties (Cheng & Li, 2014; Ho et al., 2014; Yen, Ko, Yen, Wu, & Yang, 2007; Young & Rogers, 1998). In addition, since GAD and depression share the same genetic mechanisms and display substantial comorbidity in both clinical and epidemiological samples (Kendler, 1996;
IGD and GAD

Kendler, Neale, Kessler, Heath, & Eaves, 1992; Moffitt et al., 2007), patients with GAD had higher severity of depression; this was also true in this study.

We also found that participants with IGD with GAD had higher depressive symptoms than those without. Addiction to Internet gaming might result in negative psychosocial consequences (Ko, et al., 2014). As subjects with GAD had higher behavior inhibition (Fox, Henderson, Marshall, Nichols, & Ghera, 2005), they might be more sensitive to these negative consequences.

However, any intervention must focus on finding alternative activities to replace heavy online gaming use. The anxiety symptoms of GAD and behavior inhibition characteristics might prevent trying new activities and could result in the vicious cycle and make them more depressed. The inadequate coping strategy among those with GAD (Ko, et al., 2014; Kuss, Louws, & Wiers, 2012) might increase their desire escape from the real world to online gaming to prevent negative feelings. In addition, behavior inhibition and depression are major contributors to comorbid GAD and IGD. Moreover, we demonstrated that individuals with GAD and IGD have higher behavior inhibition, depression, and anxiety severity than those with IGD and without GAD do. Individuals with GAD may play Internet games to satisfy their need for achievement and social support, experience fewer aversive situations, and compensate for their difficulties in coping with the real world. Therefore, aggressive intervention for both disorders should be provided as soon as possible to attenuate the accompanying depression in both disorders.

LIMITATIONS

This study had several limitations. First, the cross-sectional research design of the study could not confirm potentially causal relationships among IGD, behavior inhibition, and GAD. Second, the diagnosis of IGD was based on only a diagnostic interview without information provided by the family, which could have resulted in a misclassification of this diagnosis. Third, the sample was small and included a higher proportion of college students than exists in the general population; hence, some meaningful associations may not have been detected as statistically significant and the findings may not be generalizable. In addition, the small number of participants limits the possibility to compare the role of comorbid GAD on depression, anxiety, and behavior inhibition between the IGD and control groups. Finally, lack of control for other confounding variables may have affected the results. Future studies should evaluate and control for the life events, social support, and other personality characteristics that might affect IGD or GAD.

CONCLUSIONS

We found that participants with IGD were more likely to have GAD. Behavior inhibition was associated with GAD among participants with IGD and mediated the association between IGD and GAD. GAD should be assessed and appropriate interventions should be designed for subjects with IGD, particularly among those with behavior inhibition. Effective management of behavior inhibition and anxiety counseling to attenuate the severity of comorbid GAD are therefore suggested when treating subjects with IGD. In addition, participants presenting IGD comorbid with GAD had higher depressive symptoms. Early and aggressive intervention for both disorders is necessary to prevent a self-perpetuating cycle. Ultimately, larger longitudinal studies would be useful to understand how behavior inhibition affects IGD and GAD. More research is needed to clarify the temporal relationships between IGD, GAD, and the factors that modify the risk.

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Authors’ contribution: C-YW wrote the first draft of the manuscript. Y-CW and C-HS managed the literature searches and analyses. P-CL and C-HK undertook the statistical analysis. C-HK and J-YY designed the study and wrote the protocol. J-YY approved the final manuscript. All authors contributed to and have approved the final manuscript.

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