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Addictive Behaviors

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

Association between Internet gaming disorder and adult attention deficit and hyperactivity disorder and their correlates: Impulsivity and hostility

Ju-Yu Yen^{a,b,c}, Tai-Ling Liu^a, Peng-Wei Wang^a, Cheng-Sheng Chen^{a,c}, Cheng-Fang Yen^{a,c}, Chih-Hung Ko^{a,d,*}

^a Department of Psychiatry, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung City 807, Taiwan

^b Department of Psychiatry, Kaohsiung Municipal Ta-Tung Hospital, Kaohsiung Medical University, Kaohsiung 801, Taiwan

^c Department of Psychiatry, Faculty of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung City 807, Taiwan

^d Department of Psychiatry, Kaohsiung Municipal Hsiao-Kang Hospital, Kaohsiung Medical University, Kaohsiung City 812, Taiwan

HIGHLIGHTS

- Adult ADHD associated with IGD among young adults.
- Both impulsivity and hostility associated with IGD and adult ADHD.
- They also mediated the association between IGD and adult ADHD.

ARTICLE INFO

Article history:

Received 28 May 2015

Received in revised form 15 April 2016

Accepted 27 April 2016

Available online xxxxx

Keywords:

Internet gaming disorder

Adult ADHD

Hostility

Impulsivity

ABSTRACT

Internet gaming disorder (IGD) and attention deficit and hyperactivity disorder (ADHD) are associated with impulsivity and hostility. This study evaluated the associations among ADHD, impulsivity, hostility, and IGD. We recruited 87 individuals with IGD and 87 controls without a history of IGD. All participants underwent a diagnostic interview based on the DSM-5 IGD criteria and DSM-IV-TR ADHD criteria and completed a questionnaire regarding impulsivity and hostility. The information from the diagnostic interviews was assessed using the clinical global impression scale. The results suggested that IGD is associated with ADHD among young adults and that young adults with both IGD and ADHD have higher impulsivity and hostility. Furthermore, impulsivity and hostility mediate the association between ADHD and IGD. Thus, ADHD is a common comorbidity of IGD among young adults, and impulsivity and hostility are major factors involved in comorbid ADHD and IGD. Young adults with ADHD should be thoroughly assessed, particularly for their impulsivity and hostility, and interventions for IGD should be developed.

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1. Introduction

Loss of control during Internet gaming presents a cluster of cognitive and behavioral symptoms similar to those of substance use disorder (Ko et al., 2014). The diagnostic criteria for Internet gaming disorder (IGD) was classified as a research criteria in section III of the DSM-5 (American Psychiatric Association, 2013). However, further evidence is required for including IGD as a standard disorder in the DSM system (American Psychiatric Association, 2013). Comorbidities are essential for understanding the mechanism of addictive disorder (Buckley & Brown, 2006; Kessler, 2004). Although attention deficit and hyperactivity disorder (ADHD) is a major comorbidity of Internet addiction (Carli, Durkee, Wasserman, et al., 2013; Ko, Yen, Chen, Chen, & Yen, 2008),

the association between ADHD and IGD has not been evaluated comprehensively.

Young adulthood—a distinct period of life for young people in industrialized societies—is characterized by changes and exploration for most people (Arnett, 2000). Internet addiction is prevalent among young adults (Bakken, Wenzel, Götestam, Johansson, & Oren, 2009), and excessive Internet gaming can prevent them from interacting with others in the real world, thus altering their exploration. Furthermore, the inattentive symptoms could be improved in young adults with ADHD. However, their psychosocial problems persist in this stage (Altszuler, Page, Gnagy, et al., 2015). Investigating comorbid IGD and ADHD among young adults may provide essential information regarding interventions required for these disorders during young adulthood.

1.1. IGD

The DSM-5 IGD criteria include several modifications to the diagnostic criteria used for substance use disorder, including tolerance,

* Corresponding author at: Department of Psychiatry, Faculty of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung City, Taiwan.
E-mail address: yenjuyu@cc.kmu.edu.tw (C.-H. Ko).

withdrawal, continued use despite negative consequences, failure to reduce Internet use, consistent Internet use that is greater than intended, and impaired psychosocial function. Furthermore, loss of interest in previously pursued hobbies, escapism, and deceiving family regarding gaming activities have been included in the DSM-5 IGD criteria. According to a diagnostic interview-based study, the diagnostic accuracy of these criteria is 96.9% (Ko et al., 2014). These criteria are used to diagnose IGD worldwide (Petry, Rehbein, Gentile, et al., 2014).

1.2. Association between ADHD and IGD

A cross-sectional diagnostic interview-based study reported an odds ratio (OR) of 4.53 to have Internet addiction among college students with ADHD, concluding that ADHD and Internet addiction are associated in these students (Ko et al., 2008). Weinstein and Weizman (2012) demonstrated the importance of evaluating the common mechanisms leading to comorbid ADHD and IGD because identifying common factors underlying the two disorders can aid in providing suitable concurrent interventions. However, the association between IGD and adult ADHD has not been validated, and the common factors contributing to IGD and ADHD have not been identified.

1.3. Impulsivity in IGD and ADHD

As in substance use disorder (Crews & Boettiger, 2009; Gullo, Loxton, & Dawe, 2014), impulsivity is a major factor contributing to IGD (Ding, Sun, Sun, et al., 2014; Ko, Hsieh, Wang, et al., 2015). A diagnostic questionnaire study showed that adolescents with IGD have higher scores on the Barratt Impulsivity Scale (Ding et al., 2014). Another study evaluating young adults with IGD through diagnostic interviewing revealed a similar result regarding self-reported impulsivity (Ko et al., 2015). These results support the association between impulsivity and IGD. Loss of control in Internet gaming is an essential criterion of IGD (Petry et al., 2014); therefore, high impulsivity could make individuals yield to the rewarding effects of gaming and contribute to the vulnerability to IGD.

A self-reported questionnaire-based longitudinal study suggested that impulsivity is a risk factor for IGD among adolescents (Gentile, Choo, Liao, et al., 2011). Furthermore, individuals with ADHD show higher impulsivity scores, as measured using various tasks such as stop-signal reaction time and delay-discounting tasks (Winstanley, Eagle, & Robbins, 2006). A review suggested that impulsivity is involved in vulnerability to substance addiction among individuals with ADHD (Shirley & Sirocco, 2014; Urcelay & Dalley, 2012). Because adults with ADHD have higher impulsivity scores than healthy adults do, they have more difficulty in controlling their Internet gaming. Thus, we hypothesize that higher impulsivity levels in adults with ADHD contribute to vulnerability to IGD.

1.4. Hostility in IGD and ADHD

Hostility—a psychiatric symptom reflected during unfriendly cognition, affect, and behavior (Lin et al., 2008)—is associated with IGD (Choo et al., 2010; Yen, Ko, Yen, Wu, & Yang, 2007). An experimental study suggested that increase in violent gaming can significantly increase aggression levels compared with the baseline levels (Barlett, Harris, & Baldassarro, 2007). In another prospective study among adolescents, hostility was shown to predict Internet addiction (Ko, Yen, Chen, Yeh, & Yen, 2009). Therefore, hostility contributes to vulnerability to IGD.

ADHD is associated with aggressive behavior (McKay & Halperin, 2001). Children with ADHD have a more hostile outlook toward school (Ghanizadeh & Haghghi, 2010). In addition, both genetic and environmental factors contribute to the hostile behavior in ADHD (Ercan et al., 2014; Farbiash, Berger, Atzaba-Poria, & Auerbach, 2014). Finally, we hypothesize that the hostility in adults with ADHD contributes to their vulnerability to IGD.

1.5. Study objectives

Because both IGD and ADHD are associated with impulsivity and hostility, we hypothesize that IGD is associated with adult ADHD and that impulsivity and hostility are involved in this association. Thus, this study evaluate: 1) the association between IGD and adult ADHD; 2) the associations between ADHD, impulsivity, and hostility and these associations among subjects with IGD; 3) the associations between impulsivity, hostility, and IGD; and 4) the association between ADHD and IGD in control of impulsivity and hostility.

2. Methods

2.1. Participants

Individuals with current IGD (IGD group) and without a history of IGD (control group) were recruited using advertisements in University campuses and bulletin board systems. Our recruitment criteria for the IGD group, which were based on an fMRI study for young adults with IGD (Ko et al., 2015), were as follows: (1) young adults aged 20–30 years with education of >9 years, (2) those playing Internet games for 4 or more hours per day on weekdays and 8 or more hours per day on weekends or for 40 or more hours per week, and (3) those who had maintained this pattern of Internet gaming for >2 years. The enrolled participants chronically spent most of their free time in Internet gaming. Participants who met the recruitment criteria underwent a DSM-5 IGD criteria-based interview by a psychiatrist (American Psychiatric Association, 2013). Those fulfilling both the recruitment criteria and IGD criteria were classified into the IGD group.

The recruitment criterion for the control group was that the nonessential Internet use by the participants was <4 h per day in their daily life. For each participant in the IGD group, we enrolled a participant in the control group who was matched for gender, education level, and age (within a range of 1 year). These participants were classified into the control group after they underwent the aforementioned diagnostic interview.

The diagnostic interview comprised three sections: (1) a diagnostic interview based on the Chinese version of the Mini International Neuropsychiatric Interview (MINI) to determine the presence of psychotic, bipolar I, and substance use disorders; (2) a diagnostic interview based on DSM-IV-TR (American Psychiatric Association, 2000) to determine the presence of adult ADHD; and (3) a history-taking interview to determine psychotropic medication use, mental retardation, severe physical disorder, and brain injury. Those who had psychotic disorder, bipolar I disorder, substance use disorder, psychotropic medication use, mental retardation, severe physical disorder, or brain injury were excluded. In total, 87 participants in the IGD group and 87 in the control group were recruited after obtaining their informed consent.

Based on the diagnostic interviews, 34 (39.1%) and 4 (4.6%) participants in the IGD and control groups, respectively, were diagnosed with adult ADHD and classified into the ADHD group. This study was approved by the institutional review board of Kaohsiung Medical University Hospital.

2.2. Measures

2.2.1. DSM-5 diagnostic criteria of IGD (American Psychiatric Association, 2013)

The diagnostic criteria of IGD in the DSM-5 comprise nine items, namely preoccupation, withdrawal, tolerance, unsuccessful attempts to control, loss of other interests, continued excessive use despite psychosocial problems, deception regarding Internet gaming activities, escape, and functional impairment (American Psychiatric Association, 2013). We developed a semistructured interview schedule to examine the DSM-5 IGD criteria. Individuals with positive responses to five or more criteria of IGD were classified into the IGD group.

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