European Psychiatry xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

European Psychiatry

journal homepage: http://www.europsy-journal.com

Original article

The adaptive decision-making, risky decision, and decision-making style of Internet gaming disorder

C.-H. Ko [a,b,c], P.-W. Wang [a], T.-L. Liu [a], C.-S. Chen [a,c], C.-F. Yen [a,c], J.-Y. Yen [a,d,*]

[a] Department of Psychiatry, Kaohsiung Medical University Hospital, Kaohsiung Medical University, Kaohsiung City, Taiwan 807
[b] Department of Psychiatry, Kaohsiung Municipal Hsiao-Kang Hospital, Kaohsiung Medical University, Kaohsiung City, Taiwan 812
[c] Department of Psychiatry, Faculty of Medicine, College of Medicine, Kaohsiung Medical University, Kaohsiung City, Taiwan 807
[d] Department of Psychiatry, Kaohsiung Municipal Ta-Tung Hospital, Kaohsiung Medical University, Kaohsiung, Taiwan 801

ARTICLE INFO

Article history:
Received 31 August 2016
Received in revised form 22 April 2017
Accepted 11 May 2017
Available online xxx

Keywords:
Internet gaming disorder
Decision-making
Risk-taking
Intuitive decision
Deliberative decision

ABSTRACT

Background: Persistent gaming, despite acknowledgment of its negative consequences, is a major criterion for individuals with Internet gaming disorder (IGD). This study evaluated the adaptive decision-making, risky decision, and decision-making style of individuals with IGD.
Methods: We recruited 87 individuals with IGD and 87 without IGD (matched controls). All participants underwent an interview based on the Diagnostic and Statistical Manual of Mental Disorders (5th Edition) diagnostic criteria for IGD and completed an adaptive decision-making task; the Preference for Intuition and Deliberation Scale, Chen Internet Addiction Scale, and Barratt Impulsivity Scale were also assessed on the basis of the information from the diagnostic interviews.
Results: The results demonstrated that the participants in both groups tend to make more risky choices in advantage trials where their expected value (EV) was more favorable than those of the riskless choice. The tendency to make a risky choice in advantage trials was stronger among IGD group than that among controls. Participants of both groups made more risky choices in the loss domain, a risky option to loss more versus sure loss option, than they did in the gain domain, a risky option to gain more versus sure gain. Furthermore, the participants with IGD made more risky choices in the gain domain than did the controls. Participants with IGD showed higher and lower preferences for intuitive and deliberative decision-making styles, respectively, than controls and their preferences for intuition and deliberation were positively and negatively associated with IGD severity, respectively.
Conclusions: These results suggested that individuals with IGD have elevated EV sensitivity for decision-making. However, they demonstrated risky preferences in the gain domain and preferred an intuitive rather than deliberative decision-making style. This might explain why they continue Internet gaming despite negative consequences. Thus, therapists should focus more on decision-making styles and promote deliberative thinking processes to mitigate the long-term negative consequences of IGD.

1. Introduction

The diagnostic criteria for Internet gaming disorder (IGD), which define Internet gaming addiction, are proposed as research criteria in section III of the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) [1]. A previous review suggested that the prevalence of IGD ranges from 0.5% to 6% [2]. Another study reported that IGD is associated with severe problems with academic performance, impaired social interaction, failure in a job, impaired family relationships, and failure in examination for a career opportunity [3]. A DSM-5 criterion for IGD, "continued excessive use of internet games despite knowledge of psychosocial problems", demonstrates impaired decision-making among Internet gamers. Nevertheless, strategic decision-making is essential for playing most of the popular massive multiple role-playing (e.g., World of Warcraft) or real-time strategy games [4], both of which are associated with IGD. Although such games may train Internet gamers in decision-making, the reason as to why their decision-making on persisting gaming is impaired remains unknown; thus, the decision-making

* Corresponding author at: Department of Psychiatry, Kaohsiung Municipal Ta-Tung Hospital, Kaohsiung, Taiwan.
E-mail address: yenjuyu@cc.kmu.edu.tw (J.-Y. Yen).

http://dx.doi.org/10.1016/j.eurpsy.2017.05.020
0924-9338/

characteristics of patients with IGD must be explored to clarify this paradoxical relationship.

1.1. IGD

The DSM-5 diagnostic criteria for IGD include several modifications to the diagnostic criteria used for substance use disorder, including tolerance, withdrawal, continued use despite negative consequences, failure to reduce Internet use, more than intended and consistent Internet use, and impaired psychosocial function. The criteria also include loss of interests in previous hobbies, escapism, and deceiving family members about the length of time spent playing games. Although a common diagnostic tool has been developed for evaluating IGD worldwide [9], the validity or mechanism of each DSM-5 criterion (such as impaired decision-making) has not been evaluated clearly. Previous studies have suggested an association between Internet addiction and substance use disorder [6,7] and have proposed many associated factors such as depression, attention deficit hyperactivity disorder, aggressive behavior, and behavioral characteristics [6,8,9]. However, whether IGD and substance use disorder share a common underlying mechanism has not been thoroughly evaluated.

1.2. Decision-making in IGD

The individual differences in decision-making, including decision-making style, risk-prone attitude, impulsivity, and personality, can influence decision-making in different situations. Risky decision-making involves evaluating the tradeoff between perceived risks and returns. Risk preferences can be evaluated by examining task-based decisions made under ambiguity, such as in the Iowa gambling task, or under estimated risk, such as in the adaptive decision-making task [10]. A study in college students showed that individuals with Internet addiction scored higher in the Iowa gambling task [11]. However, in another recent study, individuals with IGD scored the lowest in the final 60 trials involving the Iowa gambling task [12]. Differences in IGD definitions, diagnostic methods, severities, and statistical analyses may contribute toward the inconsistent results.

The diagnostic criteria for IGD include impaired decision-making despite the knowledge of negative consequences. Understanding the characteristics of risky decision-making is crucial. According to expected utility theory, people select a prospect from risky or uncertain prospects by comparing their expected utility value [13]. A study demonstrated that individuals with IGD could not use feedback in the Game of Dice Task to optimize their decision [14]. In two studies, Yao et al. have studied risky choices made in adaptive decision-making tasks [12,15]: individuals with IGD more frequently tended to select the loss block and incompletely estimate expected value (EV) during the risky decision-making task; however, the authors had diagnosed IGD by using a self-reported questionnaire, not psychiatric interviews.

Prospect theory [16] claims that people consider outcomes as gains or losses, relative to a reference point, suggesting that people favor risk aversion in the gain domain and favor risk-seeking in the loss domain [17]. Based on prospect theory, we hypothesized that people make more risky decisions in the loss domain. Brevers et al. [18] reported that subjects with alcohol dependence make more risky choices in the gain domain than did a group of controls. However, Yao et al. have found no difference in risky choices made in the gain domain but demonstrated more risky choices in disadvantage trials in the loss domain in people with IGD [12,15]. In the present study, we hypothesized that patients with IGD exhibit higher risk-taking in decision-making tasks.

1.3. Decision-making styles in IGD

Decision-making styles, which can indicate individual differences in decision-making, are assessed through decision-making strategies (e.g., rational or intuitive) [19]. They have a strong influence on the methods that a person uses in a decision-making situation. Betsch (2004) developed the Preference for Intuition and Deliberation Scale (PID) for measuring a person's tendency toward using intuitive or deliberative decision-making styles [20]. Dual-process theory of addiction suggests that a fast automatic appetitive response to addictive stimuli and a slow deliberative self-regulation system lead to addictive behaviors [21]. Because Internet gaming can be rewarding, individuals with IGD develop a positive implicit response toward it [22]. Individuals who tend to make intuitive decisions may be influenced by the emotional and motivational effects of gaming cues and thus have a higher vulnerability toward IGD. However, the association between decision-making style and IGD has not been evaluated thus far.

1.4. Impulsivity of IGD

Impulsivity is one of the most critical factors contributing to both substance use disorder and behavioral addiction [23], such as IGD [24,25]. Given that loss of control in online gaming is an essential criterion of IGD [26], high impulsivity could make people with IGD yield to the rewarding effect of gaming, which places them at a greater risk of IGD. Thus, a previous longitudinal study suggested that impulsivity could a risk factor for IGD among adolescents [27]. Impulsivity has been reported to be associated with disadvantageous decision-making under ambiguity in the Iowa gambling task [28]. However, the association between impulsivity and risk preference in tasks with explicit risk, such as in adaptive decision-making tasks, has not been comprehensively evaluated. Such an evaluation could elucidate the association between IGD and the decision-making characteristics of people with this disorder.

1.5. Study objectives

We hypothesized that individuals with IGD are prone to risky decision-making and insensitive toward EV; furthermore, they prefer the intuitive decision-making style. Considering these hypotheses, this study evaluated the following: (1) the impulsivity, decision-making style, and risky choice in adaptive decision-making task of individuals with and without IGD; and (2) the associations among risky decisions, decision-making style, impulsivity, and IGD severity.

2. Methods

2.1. Participants

Individuals with IGD (IGD group) and matched participants with no history of IGD (control group) were recruited through advertisements on campuses and the bulletin board systems of universities from September 2012 to October 2013. Based on a recent functional magnetic resonance imaging study of young adults with IGD [29], the following inclusion criteria were adopted for the IGD group in the present study: (1) aged 20–30 years with education of >9 years, (2) played Internet games for ≥ 4 hours per day on weekdays and ≥ 8 hours per day on weekends or for ≥ 40 hours per week, and (3) had maintained an Internet gaming pattern for >2 years. In other words, the recruited participants used most of their free time on Internet gaming chronically. For participants fulfilling the preceding criteria, a psychiatrist

Please cite this article in press as: Ko C-H, et al. The adaptive decision-making, risky decision, and decision-making style of Internet gaming disorder. European Psychiatry (2017), http://dx.doi.org/10.1016/j.eurpsy.2017.05.020