

BIROn - Birkbeck Institutional Research Online

Saunders, J.B. and Hao, W. and Long, J. and King, D.L. and Mann, K. and Fauth-Bühler, M. and Rumpf, H.-J. and Bowden-Jones, H. and Rahimi-Movaghar, A. and Chung, T. and Chan, E. and Bahar, N. and Achab, S. and Lee, H.K. and Potenza, M. and Petry, N. and Spritzer, D. and Ambekar, A. and Derevensky, J. and Griffiths, M.D. and Pontes, Halley and Kuss, D. and Higuchi, S. and Mihara, S. and Assangangkornchai, S. and Sharma, M. and Kashef, A.E. and Ip, P. and Farrell, M. and Scafato, E. and Carragher, N. and Poznyak, V. (2017) Gaming disorder: its delineation as an important condition for diagnosis, management, and prevention. *Journal of Behavioral Addictions* 6 (3), pp. 271-279. ISSN 2062-5871.

Downloaded from: <https://eprints.bbk.ac.uk/id/eprint/43502/>

Usage Guidelines:

Please refer to usage guidelines at <https://eprints.bbk.ac.uk/policies.html>

or alternatively

contact lib-eprints@bbk.ac.uk.

Gaming disorder: Its delineation as an important condition for diagnosis, management, and prevention

JOHN B. SAUNDERS^{1*}, WEI HAO², JIANG LONG², DANIEL L. KING³, KARL MANN⁴, MIRA FAUTH-BÜHLER⁴, HANS-JÜRGEN RUMPF⁵, HENRIETTA BOWDEN-JONES⁶, AFARIN RAHIMI-MOVAGHAR⁷, THOMAS CHUNG⁸, ELDA CHAN⁹, NORHARLINA BAHAR¹⁰, SOPHIA ACHAB¹¹, HAE KOOK LEE¹², MARC POTENZA¹³, NANCY PETRY¹⁴, DANIEL SPRITZER¹⁵, ATUL AMBEKAR¹⁶, JEFFREY DEREVENSKY¹⁷, MARK D. GRIFFITHS¹⁸, HALLEY M. PONTES¹⁸, DARIA KUSS¹⁸, SUSUMU HIGUCHI¹⁹, SATOKO MIHARA¹⁹, SAWITRI ASSANGANGKORNCHAI²⁰, MANOJ SHARMA²¹, AHMAD EL KASHEF²², PATRICK IP²³, MICHAEL FARRELL²⁴, EMANUELE SCAFATO²⁵, NATACHA CARRAGHER²⁶ and VLADIMIR POZNYAK²⁶

¹Centre for Youth Substance Abuse Research, The University of Queensland, Brisbane, QLD, Australia

²Mental Health Institute of the Second Xiangya Hospital, Central South University, Changsha, Hunan, China

³School of Psychology, The University of Adelaide, Adelaide, SA, Australia

⁴Central Institute of Mental Health, University of Heidelberg, Mannheim, Germany

⁵Department of Psychiatry and Psychotherapy, University of Lübeck, Lübeck, Germany

⁶Central North West London NHS Trust and Division of Brain Science, Imperial College London, London, UK

⁷Iranian National Center for Addiction Studies (INCAS), Tehran University of Medical Sciences, Tehran, Iran

⁸Department of Health, Hong Kong SAR, China

⁹Integrated Centre on Addiction Prevention and Treatment, Tung Wah Group of Hospitals, Hong Kong SAR, China

¹⁰Department of Psychiatry and Mental Health, Hospital Selayang, Selangor, Malaysia

¹¹Mental Health and Psychiatry Department, University Hospitals of Geneva, Geneva, Switzerland

¹²Department of Psychiatry, College of Medicine, The Catholic University of Korea, Seoul, South Korea

¹³Departments of Psychiatry and Neuroscience, Child Study Center, and The National Center on Addiction and Substance Abuse, Yale University School of Medicine, and Connecticut Mental Health Center, New Haven, CT, USA

¹⁴Department of Psychiatry, University of Connecticut School of Medicine, Farmington, CT, USA

¹⁵Study Group on Technological Addictions, Porto Alegre, Brazil

¹⁶Department of Psychiatry, National Drug Dependence Treatment Centre, All India Institute of Medical Sciences, New Delhi, India

¹⁷Applied Child Psychology and Department of Psychiatry, McGill University, Montreal, QC, Canada

¹⁸International Gaming Research Unit, Psychology Department, Nottingham Trent University, Nottingham, UK

¹⁹National Hospital Organization Kurihama Medical and Addiction Center, Yokosuka, Kanagawa, Japan

²⁰Epidemiology Unit and Centre for Alcohol Studies, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla, Thailand

²¹National Institute of Mental Health and Neurosciences, Bengaluru, Karnataka, India

²²National Rehabilitation Center, Abu Dhabi, United Arab Emirates

²³Department of Paediatrics & Adolescent Medicine, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, China

²⁴National Drug and Alcohol Research Centre, University of New South Wales, Randwick, NSW, Australia

²⁵National Observatory on Alcohol, National Institute of Health, Rome, Italy

²⁶Department of Mental Health and Substance Abuse, WHO Headquarters, Geneva, Switzerland

(Received: February 24, 2017; revised manuscript received: April 5, 2017; accepted: April 10, 2017)

Online gaming has greatly increased in popularity in recent years, and with this has come a multiplicity of problems due to excessive involvement in gaming. Gaming disorder, both online and offline, has been defined for the first time in the draft of 11th revision of the *International Classification of Diseases* (ICD-11). National surveys have shown prevalence rates of gaming disorder/addiction of 10%–15% among young people in several Asian countries and of 1%–10% in their counterparts in some Western countries. Several diseases related to excessive gaming are now recognized, and clinics are being established to respond to individual, family, and community concerns, but many cases remain hidden. Gaming disorder shares many features with addictions due to psychoactive substances and with gambling disorder, and functional neuroimaging shows that similar areas of the brain are activated. Governments and health agencies worldwide are seeking for the effects of online gaming to be addressed, and for preventive approaches to be developed. Central to this effort is a need to delineate the nature of the problem, which is the purpose of the definitions in the draft of ICD-11.

Keywords: gaming disorder, gaming addiction, diagnosis, intervention

* Corresponding author: John B. Saunders; Centre for Youth Substance Abuse Research, The University of Queensland, 1 Macquarie Street, Sydney, NSW 2000, Australia; Phone: +61 2 9252 0959; E-mail: mail@jbsaunders.net

This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium for non-commercial purposes, provided the original author and source are credited.

INTRODUCTION

This paper has been prepared by a group of clinicians and researchers who have participated in various meetings convened by the World Health Organization (WHO) in response to the concern of member countries about the upswing of problems due to gaming and especially games accessed through the Internet and electronic devices (“online gaming”). In part, we write in response to the commentary by Aarseth and colleagues which was recently published in this journal (Aarseth et al., 2016). We shall respond to several of their comments about the descriptions of gaming disorder which have been published in draft form by WHO as part of the development of the latest (11th) revision of the *International Classification of Diseases* (ICD-11) (World Health Organization, 2016). More broadly, we wish to express our concern about the attempt of these authors to understate – indeed trivialize – these conditions. The authors’ statements, such as “. . . moral panics about the harm of video gaming” and “. . . inclusion of Gaming Disorder . . . will cause significant stigma to the millions of children who play video games . . .” are unsubstantiated and unhelpful. This is equivalent to suggesting that because millions of people consume alcohol without problems that we should ignore the manifest harms (and mortality) that arise from its consumption for fear of stigmatizing those who are not harmed. We note too that none of the authors of Aarseth et al.’s (2016) commentary is based in Asia, where online gaming disorders are particularly prevalent and exert a considerable burden of harm on young people and their families.

PREVALENCE OF EXCESSIVE GAMING

More than 60 epidemiological studies of general populations and subgroups have been reported in the international literature (WHO, 2015). Many studies have examined Internet use problems including online gaming and others more specifically online gaming. An example of the former is a six-nation survey in Asia which showed the prevalence of problematic Internet use among adolescents was between 6% and 21% (Mak et al., 2014). In China, several surveys have been conducted, with prevalence rates for Internet addiction of 10%–15% (China Youth Network Association, People’s Republic of China, 2009). A recent large random sample survey of Chinese adolescents reported a prevalence of Internet addiction of 10% (Wu et al., 2016). Similar rates are found in several other countries in Asia with 13% of adolescents in Korea classified as at risk of “Internet over-dependence” (Ministry of Science, ICT and Future Planning, and the National Information Society Agency, 2015). Mostly, this reflects online gaming (see, e.g., Ministries of Education and Others, People’s Republic of China, 2013).

Studies specifically on Internet gaming have also been reported and a systematic review on cross-sectional and longitudinal epidemiological studies on Internet gaming disorder was published recently (Mihara & Higuchi, in press). The prevalence of the disorder in 37 cross-sectional studies widely ranged from 0.7% to 27.5%; it was higher

among males than females in the vast majority of studies and tended to be higher among younger rather than older people. In an analysis of four recent surveys, the prevalence of DSM-5 Internet gaming disorder was under 1% (Przybylski, Weinstein, & Murayama, 2016). When individual studies are examined the prevalence is found to vary not only by age but importantly by geographical location, and is around 10%–15% among young people in East and South-East Asian countries (Achab et al., 2015). Among 503 students from two secondary schools in Hong Kong, 94% used video or Internet games regularly, and nearly 16% met the criteria for probable gaming addiction in accordance with the Game Addiction Scale. Gaming addiction was significantly more likely in boys and significantly associated with (a) longer average time of gaming per week, (b) longer average periods of gaming, and (c) higher frequency of spending money on gaming (Wang et al., 2014). In Republic of Korea, a recent online survey found 14% of adults met the proposed DSM-5 criteria for Internet gaming disorder (Kim et al., 2016).

Among countries in Europe and North America, the prevalence of online gaming disorder is decrease overall but also ranges widely, from under 1% to 10%, with most studies finding prevalence rates in youth between 1% and 5% (Haagsma, Pieterse, & Peters, 2012; Lemmens, Valkenburg, & Gentile, 2015; Müller et al., 2015; Pontes & Griffiths, 2015; Rehbein, Kliem, Baier, Mößle, & Petry, 2015; Van Rooij, Schoenmakers, Vermulst, Van den Eijnden, & Van de Mheen, 2011). In Switzerland, a national survey of a representative sample of the general population in 2015 reported that gaming disorder affected 15% of people aged between 15 and 34 years of age as the main problematic online activity (Addiction Suisse, 2015). One study from several European countries suggests that Internet gaming disorders are on the rise (Kaess et al., 2016). In Iran in a study of 564 seventh-grade students, 17% were classified as being addicted to computer games (Zamani, Kheradmand, Cheshmi, Abedi, & Hedayati, 2010); several prevalence studies are presently being conducted by the Iranian National Center for Addiction Studies. In South America and Africa, the prevalence is decrease from 1% to 9% (Achab et al., 2015).

Methodological accuracy has steadily improved. While earlier studies had convenience samples, recent ones have examined representative samples from the general population. Likewise, earlier studies employed screening tests whose provenance is from the field of substance disorders (and might be seeking to confirm preconceived notions of addiction). Later studies have employed survey instruments which assume no theoretical construct of addiction (Mazhari, 2012; Sun et al., 2012; Thatcher, Wretschko, & Fisher, 2008). Furthermore, recent studies have adopted sophisticated diagnostic approaches, such as latent class analysis and identified a group of individuals suffering from problematic Internet use (Rumpf et al., 2014; Wartberg, Kriston, Kammerl, Petersen, & Thomasius, 2015) or addicted online gamers (Van Rooij et al., 2011). In these studies, the problematic groups were identified with an empirical approach without relying on cutoff points of questionnaires. This gives further evidence for the existence of this disorder irrespective of theoretical

considerations, and that the proportion of individuals suffering from Internet gaming disorder is clearly of concern (Rehbein et al., 2015; Rumpf et al., 2014). Other recent studies (Lemmens et al., 2015; Rehbein et al., 2015) have employed items based on DSM-5 criteria for Internet gaming disorder, the latter being designed to ensure that persons who meet five or more criteria are experiencing clinically significant harms related to gaming.

HEALTH BURDEN OF EXCESSIVE GAMING

Those of us in clinical practice might well look askance at the assumption in the Aarseth et al.'s (2016) commentary, not supported by any evidence, that gaming problems mainly represent a clash between cultures – between Internet-savvy youth and their technologically phobic elders. We see young people whose lives are dominated by online gaming to the extent that they spend 10 or more hours per day gaming and experience disorders due to consequent sleep deprivation, day–night reversal, dehydration, malnutrition, seizures, and pressure sores, as well as irritability, physical aggression, depression, and a range of social, academic, and vocational problems (Achab et al., 2011; Chuang, 2006; Mihara, Nakayama, Osaki, & Higuchi, 2016). In the clinic of the Tung Wah Group of Hospitals Integrated Centre on Addiction Prevention and Treatment in Hong Kong, the medical and psychosocial problems experienced by patients include mood problems, refusal of school and social activities, physical inactivity, extreme anger and aggression, family conflicts, reduced amount of food intake, and various other health consequences. In this clinic, those seeking help have been progressively younger, with most help seekers being in the early teenage years.

The world's first death from excessive gaming was reported in the media in 2004. A 24-year-old South Korean male suddenly died in the middle of gaming for four consecutive days with only minimal rest at an Internet café (Korea SBS News, 2004). The postmortem study conducted by the national forensic service revealed pulmonary thromboembolism, with complete obstruction of the two main pulmonary arteries. Thrombi were also found in his both deep veins in the lower extremities. Considering his young age and non-existing prior medical conditions, the forensic authority concluded that the “prolonged sitting at computer” was the direct cause of death (Lee, 2004). This deep vein thrombosis is not limited to the Asian region; there is also a case report of a 12-year British boy (Ng, Khurana, Yeang, Hughes, & Manning, 2003). The socioeconomic loss due to excessive Internet use in the Republic of Korea was estimated at between 1.5 and 4.5 billion US dollars in 2009 (Lee, Kim, & Lee, 2011). In Korea, “Internet addiction” mostly from gaming has been identified as the largest health problem experienced by young people (Ministry of Science, ICT and Future Planning, and the National Information Society Agency, 2015).

Population studies are now examining these health burdens. They demonstrate that people with Internet addiction due to gaming or other Internet activities exhibit impairments in several areas compared with those

without addiction. In one European population-based study (Rumpf et al., 2014; Zadra et al., 2016), individuals identified by a standardized diagnostic interview as having online gaming addiction reported inability to work or fulfill normal activities on 7.5 days in the last 12 months (Rumpf et al., 2014; Rumpf, 2015; Zadra et al., 2016), which compared with 4.1 days for depression, 7.5 days for social phobia, and 7.2 days for cardiovascular conditions (Alonso et al., 2011).

PUBLIC HEALTH RESPONSES TO EXCESSIVE GAMING

In response to widespread public and professional concern, many countries have developed strategic plans to address the clinical, personal, and societal impacts of gaming disorders. Prominent among these is a collaborative strategy by 15 national ministries and commissions in China “The program of comprehensive prevention and intervention for online games addiction among juveniles” (Ministries of Education and Others, People's Republic of China, 2013). In Hong Kong, the Department of Health in collaboration with government and non-government organizations has developed a multi-pronged approach to the monitoring, prevention, and treatment of Internet addiction including gaming addiction (Department of Health of Hong Kong, 2016). The Ministry of Health in the Republic of Korea, in cooperation with the Ministry of Science and several other government departments, is currently developing the “Second Internet Addiction Prevention and Resolution Comprehensive Plan.”

In Iran, the Ministry of Health has commissioned the preparation of (a) a prevention package for use in schools and in primary health care and (b) a treatment package based on a motivational interview and cognitive-behavioral approach for technology-based disorders (Rahimi-Movaghar & Hamzehzadeh, 2016).

In some Western countries, online gaming disorder has been recognized as a public health issue in the past few years. For example, in Switzerland, this has been the case since 2012. It is included by the Swiss Federal Office of Public Health as among addictive disorders in the National Addiction Strategy for 2017–2024 (Achab, 2016). In other countries, the response to date has been largely piecemeal, with academic bodies, professional associations, and local government drawing attention to the problem and lobbying governments for more comprehensive action.

CLINICAL RESPONSES TO EXCESSIVE GAMING

Clinics have now been established in the major cities of many countries in Asia (China, Japan, Hong Kong, Republic of Korea, Thailand, and India) and in some parts of Europe (Thorens et al., 2014), North America, and Australasia. Services are most fully developed in Asia. For example in Hong Kong in response to widespread community concern, preventive and treatment services for Internet and gaming disorders have been established, one

example as noted above, being the Tung Wah Group of Hospitals Integrated Centre on Addiction Prevention and Treatment. Between October 2012 and January 2017, 308 cases with problematic use of Internet were referred. Most involved online gaming (63%), with online pornography and cybersexual activities being the next most prevalent. Many showed signs of addiction, such as craving and compulsion, diminished control over gaming or other online activities, and inability to stop in spite of adverse consequences. The National Hospital Organization Kurihama Medical and Addiction Center near Tokyo, Japan started to provide the first specialist treatment for gaming disorder in Japan in 2011. The number of treatment facilities providing specialist treatment has increased to 28 throughout Japan by 2016 in response to the compelling need for the treatment of gaming disorder affecting predominantly young males (Mihara et al., 2016). Despite the concerns of parents and schools that gaming is affecting adolescents' daily functioning, school performance and mental health, clinical and support services in many parts of Asia, including Hong Kong, Japan, Korea, and China, remain very limited.

In North America and Europe, clinical services are also being established. They include the Center for Internet Addiction (Young, 2010) and reSTART in the United States, clinics within the National Problem Gambling Service in London, UK, the Bellvitge University Hospital in Barcelona, Spain, and a specialist clinic at the University Hospital of Geneva. In the latter clinic, nearly 200 of patients have sought help and had treatment for gaming disorder since 2007. Additional cases have been reported in young people who have become reclusive at home for months due to excessive gaming (Achab, 2016). It is noteworthy that, mainly, addiction services have taken the lead – adapting evidence-based approaches for substance disorders and gambling disorders to help those affected by excessive gaming, together with their families. In this context, the statement by Aarseth et al. (2016) that “patients can be hard to find” does not accord with either what is happening worldwide or our day-to-day experience in clinical practice or as clinical researchers.

Given the development of clinical services, formal diagnostic guidelines and criteria for gaming disorder are clearly required to provide adequate care and treatment. Ignoring this will result in failure of diagnosis, and potentially condemning people who need help to suffer a range of harms.

NATURE OF EXCESSIVE GAMING

The WHO initiative on excessive gaming did not start out with the preconception that it was an addictive disorder. The term used at the outset was “Excessive use of the Internet, computers, smartphones and similar electronic devices.” A series of international consultation meetings has been held to identify the types of electronic device and the content for which they provide a portal that cause harm (World Health Organization, 2015), a distinction highlighted by Griffiths (2000) more than 15 years ago. In these meetings, there was near unanimity that the greatest concern was the impact of playing

electronic games and in particular those accessed through the Internet. These include single-player shooting-type games and the “massively multiplayer online role-playing games” (MMORPGs) and their rapidly changing derivatives which typically involve teams or guilds of young people playing over extended periods of time. Thus, the content and the reinforcing nature of interactional experience were considered to be the addictive stimuli rather than the Internet itself. A decision was made that the delineation of disorders was to be based primarily on the content and behavior, such as gaming, pornography/sexting, and gambling. This notion corresponds with the recent DSM-5 including Internet gaming disorder as a “condition for further study.”

Literature reviews were commissioned and presented at these meetings on whether such game playing could represent or develop into a disorder and if so, what was the nature of the disorder, what were the antecedent risk factors, and what were the clinical and personal consequences. The literature reviews examined the phenomenology of excessive gaming and several central features were identified (see Billieux et al., 2015). These include:

- impaired control over online gaming;
- preoccupation with gaming;
- increasing priority given to gaming, which takes an increasingly central place within the person's life;
- a subjective awareness of craving to participate in online games; and
- continuation of gaming despite negative consequences.

These features clearly have their parallels with substance disorders and recognized behavioral addictions, such as gambling disorder (McBride & Derevensky, 2016).

Other features are more distinctly related to prolonged gaming and include:

- immersion into the virtual world of the game;
- what is termed by some “tolerance,” namely the need to engage in gaming for progressively longer periods of time and in more challenging games, previous games no longer producing the desired engagement and effects (King & Delfabbro, 2016);
- experiences, termed rebound phenomena or withdrawal states by some, where a person experiences moodiness and irritability, and/or abusive behavior when playing the game suddenly ceases (Kaptsis, King, Delfabbro, & Gradisar, 2016).

Participants in the WHO consultation meetings noted the approach of DSM-5 and the description and provisional diagnostic criteria of Internet gaming disorder (American Psychiatric Association, 2013). It is considered to have several features common to addictive disorders, such as diminished control over gaming, spending excessive amounts of time playing games, preoccupation with gaming so that schoolwork and interpersonal activities are neglected, and deception of family members regarding its extent (Petry et al., 2014). Both the ICD and DSM acknowledge that the specific criteria and distinguishing features of the condition are not yet fully delineated, but the bulk of the available evidence indicates that some individuals develop significant problems related to their gaming, that their gaming has certain features of addiction, and that it should be diagnosed as a disorder.

ANTECEDENTS AND ASSOCIATIONS OF GAMING DISORDERS

Mental, behavioral, and substance disorders have common antecedents (risk factors) and these are well recognized. They include genetic influences, family disruption in early life, abuse and trauma, parenting approaches, and other mental health disorders (Reinherz, Giaconia, Carmola Hauf, Wasserman, & Paradis, 2000). These distinguish in particular those who have developmental, behavioral, and substance disorders in the mid- and late teens and early 20s compared with later in life. Among the antecedent factors that have been identified for excessive gaming and gaming addiction are social phobia, attention-deficit hyperactivity disorder (ADHD), autism spectrum disorder, depression, personality tendencies, such as high impulsivity, conduct problems, and instability or breakdown in the parental relationship (Ceyhan & Ceyhan, 2008; Gentile, 2009; Haagsma, King, Pieterse, & Peters, 2013; King, Delfabbro, Zwaans, & Kaptsis, 2013; Ko, Yen, Yen, Chen, & Chen, 2012; Yen, Ko, Yen, Wu, & Yang, 2007; Zadra et al., 2016). At the same time, protective factors for gaming disorder have been suggested from longitudinal studies. These include (a) higher-level social competence and self-esteem (Lemmens, Valkenburg, & Peter, 2011), (b) school-related well-being (Rehbein & Baier, 2013), and (c) perceived behavioral control (Haagsma et al., 2013).

Antecedent and comorbid disorders are common throughout the spectrum of substance and other addictive disorders, with several mental disorders being associated with substance use disorders and with the development of these disorders (Kessler et al., 2012; Swendsen et al., 2010). Gaming disorder is also associated with substance use (Van Rooij et al., 2014). Co-occurring mental disorders as antecedents or consequences are therefore common in addictive disorders and do not serve as an argument against the concept of gaming disorder or Internet use disorder. If the patient has an underlying or comorbid mental health disorder, that would also be diagnosed in both the ICD and DSM systems.

NEUROBIOLOGY OF GAMING DISORDER

Functional neuroimaging studies in gaming disorder patients have concentrated on domains considered important in the development and maintenance of other addictive disorders. There is considerable overlap in the neurobiological underpinnings of gaming disorders and pathological gambling. Patients with gaming disorders exhibit (a) decreased sensitivity to losses, (b) enhanced reactivity to gaming cues, (c) more impulsive choice behaviors, (d) altered reward-based learning, and (e) no changes in cognitive flexibility, compared with controls, findings which are analogous to those in persons with gambling disorder (Fauth-Bühler & Mann, 2015). Other areas of research have concentrated on changes that are specific to excessive gamers, such as neurobiological correlates of gamers' physical self-concepts and self-identification with avatars in MMORPGs (Dieter et al., 2015; Leménager et al., 2014).

Brain regions implicated in core processes underlying gaming disorder are also similar to those involved in substance use and gambling disorders. For example, a craving-behavioral intervention (CBI) was associated with greater reductions in compulsive Internet use scores, weekly time gaming, and gaming cues-induced craving compared with a no treatment condition (Zhang et al., 2016b). There was greater activation of the insula to gaming cues and diminished connectivity between the insula and precuneus and lingual gyrus (Zhang et al., 2016b), regions linked to drug cravings. In this paradigm, CBI reduced resting-state functional connectivity between the orbitofrontal cortex and hippocampus, as well as between the posterior cingulate cortex- and motor-related regions (Zhang et al., 2016a). Together, these findings suggest that similar to substance use and gambling addictions, interventions targeting craving may reduce functional connectivity between brain regions involved in processing urges and linking urges to actions. In addition, decreased connectivity within executive control regions (e.g., frontoparietal regions) have been observed during cognitive control tasks in individuals with gaming disorder (Dong, Lin, & Potenza, 2015). Together, these findings support the contention that constructs relevant to substance and gambling addictions apply to gaming disorder (Brand, Young, Laier, Wölfling, & Potenza, 2016; Dong & Potenza, 2014).

TREATMENT AND PREVENTION RESEARCH

Delineating the nature of excessive gaming is essential to provide a rational basis for research into treatment of young people (and others) who have problems due to gaming and into early interventions for those who are developing patterns of excessive gaming. We share concerns with Aarseth et al. (2016) that "Army boot camp" approaches have sprung up in many countries, particularly in Asia, to where young people are compulsorily sent to break a cycle of excessive gaming. To our knowledge, this approach has no rationale and no evidence for a treatment effect. It is debatable whether such approaches should be permitted but that is a matter for the relevant state authorities. More broadly, there is a pressing need for the development of and research into preventive approaches, such as limitation on screen time for children and to provide a rationale for parents and other responsible adults to monitor and encourage responsible use of the Internet and enjoyable participation in challenging and interesting tasks, online games included. This is not an overbearing human rights affront to children. It's called parenting. Parenting technique and skill evolves with time, but in this digital age, technology would never be able to replace those essential parent-child interactions.

CONCLUSIONS

In conclusion, the WHO initiative is in response to global concerns about the impact of a range of Internet-based activities but overwhelmingly about the effects of problematic gaming and especially the online form. Governments

and health agencies around the world are seeking for the effects of online gaming to be addressed, and for evidence-based preventive approaches to be developed. Central to this effort is a need to delineate the nature of the problem, which from the work undertaken for the WHO consultation meetings points to addictive features in this disorder. This has led to the publication of a set of descriptions in the draft of ICD-11 embracing its central features. The descriptions in the beta draft are not an “off-the-shelf” description derived from substance disorders. Because of further work required to define whether tolerance and withdrawal are coherent and commonly occurring features of online gaming disorder, they do not at present feature in the descriptions. Gaming disorder has characteristics which have similarities but are also somewhat distinct from gambling disorder (Saunders, Degenhardt, & Farrell, 2017) and these distinctions will be addressed in further research. Gaming disorder is most certainly not subsumed within a category of “Other addictions – not otherwise specified.” These descriptions and diagnostic guidelines have already been evaluated empirically (Higuchi, Nakayama, Mihara, & Siste, 2016) and will be subjected to global field testing, in common with the other disorders contained within the draft of ICD-11.

As more information becomes available on a range of Internet-based activities, including but not limited to shopping, sexual behaviors including pornography viewing, and social networking, it is important to consider not only the possible benefits but also the potential negative impacts, including disorders related to their use. To promote individual, familial, and public health globally, examining such behaviors is imperative.

Funding sources: No financial support was received for the preparation of this review paper.

Authors' contribution: This paper was prepared by a group of researchers, medical practitioners and clinicians, and policy makers who work in the area of gaming and related disorders. The initial draft was prepared by JBS and all authors have contributed material to the paper and/or provided comments on it, and have approved the final version.

Conflict of interest: JBS, AR-M, and KM are members of the Substance Use and Related Disorders Work Group for ICD-11. JBS, NP, and MP have been involved in the research and/or editorial phases of the development of DSM-5. AR-M and SH are heads of WHO collaborating centers. All authors have participated in consultation meetings (in two cases not in person but by preparing material for them) convened by the WHO (together with government authorities in Japan, Republic of Korea, and Hong Kong, China) from 2014 onward. Participants in these meetings have received travel support from WHO or their national governments. VP is a staff member of the WHO. MP is supported by the US National Center on Addiction and Substance Abuse and a National Center for Responsible Gaming Center of Excellence grant. Apart from research funds received from government authorities, the

authors declare they have not received any remuneration from commercial, educational, or other organizations in relation to this paper. The statements made and views expressed in this paper are those of the authors and do not necessarily reflect those of the organizations to which they are affiliated, nor do they necessarily represent policies or decisions of the WHO.

Acknowledgement: The authors would like to thank Dr. Joël Billieux for his comments on an early draft of this paper.

REFERENCES

- Aarseth, E., Bean, A. M., Boonen, H., Colder Carras, M., Coulson, M., Das, D., Deleuze, J., Dunkels, E., Edman, J., Ferguson, C. J., Haagsma, M. C., Helmersson Bergmark, K., Hussain, Z., Jansz, J., Kardefelt-Winther, D., Kutner, L., Markey, P., Nielsen, R. K., Prause, N., Przybylski, A., Quandt, T., Schimmenti, A., Starcevic, V., Stutman, G., Van Looy, J., & Van Rooij, A. J. (2016). Scholars' open debate paper on the World Health Organization ICD 11 Gaming Disorder proposal. *Journal of Behavioral Addictions*. Advanced online publication. doi:10.1556/2006.5.2016.088
- Achab, S. (2016). Switzerland Report: Background paper prepared for the WHO Hong-Kong Meeting on Policy and Program Responses to Mental and Behavioral Disorders Associated with Excessive Use of the Internet and Other Communication and Gaming Platforms. Available through Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland.
- Achab, S., Meuli, V., Deluze, J., Thorens, G., Rothern, S., Khazaal, Y., Zullino, D., & Billieux, J. (2015). Challenges and trends of identification and treatment of disorders associated with problematic use of Internet. In *Public health implications of excessive use of the Internet, computers, smartphones and similar electronic devices*. World Health Organization, Geneva, Switzerland.
- Achab, S., Nicolier, M., Mauny, F., Monnin, J., Trojak, B., Vandel, P., Sechter, D., Gorwood, P., & Haffen, E. (2011). Massively multiplayer online role-playing games: Comparing characteristics of addict vs. non-addict online recruited gamers in a French adult population. *BMC Psychiatry*, 11, 144. doi:10.1186/1471-244X-11-144
- Addiction Suisse. (2015). *Monitoring of Internet use and problematic Internet use in Switzerland in 2015*. Addiction Suisse 2015 for Federal Office of Public Health. Retrieved from <http://www.bag.admin.ch/jugendprogramme/10047/13303/>
- Alonso, J., Petukhova, M., Vilagut, G., Chatterji, S., Heeringa, S., Ustun, T. B., & Kessler, R. C. (2011). Days out of role due to common physical and mental conditions: Results from the WHO World Mental Health surveys. *Molecular Psychiatry*, 16, 1234–1246. doi:10.1038/mp.2010.101
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed., pp. 795–798). Washington, DC: American Psychiatric Association.
- Billieux, J., Thorens, G., Khazaal, Y., Zullino, D., Achab, S., & Van der Linden, M. (2015). Problematic involvement in online games: A cluster analytic approach. *Computers in Human Behavior*, 43, 242–250. doi:10.1016/j.chb.2014.10.055

- Brand, M., Young, K. S., Laier, C., Wölfling, K., & Potenza, M. N. (2016). Integrating psychological and neurobiological considerations regarding the development and maintenance of specific Internet-use disorders: An Interaction of Person-Affect-Cognition-Execution (I-PACE) model. *Neuroscience and Biobehavioral Reviews*, *71*, 252–266. doi:10.1016/j.neubiorev.2016.08.033
- Ceyhan, A. A., & Ceyhan, E. (2008). Loneliness, depression, and computer self-efficacy as predictors of problematic Internet use. *CyberPsychology & Behavior*, *11*, 699–701. doi:10.1089/cpb.2007.0255
- China Youth Network Association, People's Republic of China. (2009). Report on Internet addiction in teenage. Retrieved from <http://mat1.gting.com/edu/pdf/wangyingaogao.pdf>
- Chuang, Y. C. (2006). Massively multiplayer online role-playing game-induced seizures: A neglected health problem in Internet addiction. *CyberPsychology & Behavior*, *9*, 451–456. doi:10.1089/cpb.2006.9.451
- Department of Health of Hong Kong. (2016). Healthy use of Internet and electronic screen products. Retrieved from http://www.studenthealth.gov.hk/english/internet/health_effects.html
- Dieter, J., Hill, H., Sell, M., Reinhard, I., Vollstädt-Klein, S., Kiefer, F., Mann, K., & Leménager, T. (2015). Avatar's neurobiological traces in the self-concept of massively multiplayer online role-playing game (MMORPG) addicts. *Behavioral Neuroscience*, *129*, 8–17. doi:10.1037/bne0000025
- Dong, G., Lin, X., & Potenza, M. N. (2015). Decreased functional connectivity in an executive control network is related to impaired executive function in Internet gaming disorder. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *57*, 76–85. doi:10.1016/j.pnpbp.2014.10.012
- Dong, G., & Potenza, M. N. (2014). A cognitive-behavioral model of Internet gaming disorder: Theoretical underpinnings and clinical implications. *Journal of Psychiatric Research*, *58*, 7–11. doi:10.1016/j.jpsychires.2014.07.005
- Fauth-Bühler, M., & Mann, K. (2015). Neurobiological correlates of Internet gaming disorder: Similarities to pathological gambling. *Addictive Behaviors*, *64*, 349–356. doi:10.1016/j.addbeh.2015.11.004
- Gentile, D. (2009). Pathological video-game use among youth ages 8 to 18: A national study. *Psychological Science*, *20*: 594–602. doi:10.1111/j.1467-9280.2009.02340.x
- Griffiths, M. D. (2000). Does Internet and computer addiction exist? Some early case evidence. *CyberPsychology & Behavior*, *3*, 211–218. doi:10.1089/109493100316067
- Haagsma, M. C., King, D. L., Pieterse, M. E., & Peters, O. (2013). Assessing problematic video gaming using the theory of planned behavior: A longitudinal study of Dutch young people. *International Journal of Mental Health and Addiction*, *11*, 172–185. doi:10.1007/s11469-012-9407-0
- Haagsma, M. C., Pieterse, M. E., & Peters, O. (2012). The prevalence of problematic video gamers in the Netherlands. *Cyberpsychology, Behavior, and Social Networking*, *15*, 162–168. doi:10.1089/cyber.2011.0248
- Higuchi, S., Nakayama, H., Mihara, S., & Siste, K. (2016). Application of gaming disorder criteria for treatment seeking patients. Paper presented at the WHO-Hong Kong SAR, China Meeting on Policy and Programme Responses to Mental and Behavioural Disorders Associated with Excessive Use of the Internet and Other Communication and Gaming Platforms, September 2016, Department of Health, Hong Kong, China.
- Kaess, M., Parzer, P., Brunner, R., Koenig, J., Durkee, T., Carli, V., & Wasserman, D. (2016). Pathological Internet use is on the rise among European adolescents. *Journal of Adolescent Health*, *59*, 236–239. doi:10.1016/j.jadohealth.2016.04.009
- Kaptsis, D., King, D. L., Delfabbro, P. H., & Gradisar, M. (2016). Withdrawal symptoms in Internet gaming disorder: A systematic review. *Clinical Psychology Review*, *43*, 58–66. doi:10.1016/j.cpr.2015.11.006
- Kessler, R. C., Avenevoli, S., McLaughlin, K. A., Green, J. G., Lakoma, M. D., Petukhova, M., & Merikangas, K. R. (2012). Lifetime co-morbidity of DSM-IV disorders in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). *Psychological Medicine*, *42*, 1997–2010. doi:10.1017/S0033291712000025
- Kim, N. R., Hwang, S. S., Choi, J. S., Kim, D. J., Demetrovics, Z., Kiraly, O., Nagygyorgy, K., Griffiths, M. D., Hyun, S. Y., Youn, H. C., & Choi, S. W. (2016). Characteristics and psychiatric symptoms of Internet gaming disorder among adults using self-reported DSM-5 criteria. *Psychiatry Investigation*, *13*, 58–66. doi:10.4306/pi.2016.13.1.58
- King, D. L., & Delfabbro, P. H. (2016). Defining tolerance in Internet gaming disorder: Isn't it time? *Addiction*, *111*, 2064–2065. doi:10.1111/add.13448
- King, D. L., Delfabbro, P. H., Zwaans, T., & Kaptsis, D. (2013). Clinical features and axis comorbidity of Australian adolescent pathological Internet and video game users. *Australian and New Zealand Journal of Psychiatry*, *47*, 1058–1067. doi:10.1177/0004867413491159
- Ko, C. H., Yen, J. Y., Yen, C. F., Chen, C. S., & Chen, C. C. (2012). The association between Internet addiction and psychiatric disorder: A review of the literature. *European Psychiatry*, *27*, 1–8. doi:10.1016/j.eurpsy.2010.04.011
- Korea SBS News. (2004). Computer death: World's first case. Retrieved February 28, 2017, from http://news.sbs.co.kr/news/endPage.do?news_id=N0311617389
- Lee, H. (2004). A new case of fatal pulmonary thromboembolism associated with prolonged sitting at computer in Korea. *Yonsei Medical Journal*, *45*, 349–351. doi:10.3349/ymj.2004.45.2.349
- Lee, H. K., Kim, H. S., & Lee, T. J. (2011). *Cost-effect analysis on the introduction of online game shut down regulation*. Seoul, Republic of Korea: Ministry of Gender Equality & Family.
- Leménager, T., Dieter, J., Hill, H., Koopmann, A., Reinhard, I., Sell, M., Kiefer, F., Vollstädt-Klein, S., & Mann, K. (2014). Neurobiological correlates of physical self-concept and self-identification with avatars in addicted players of massively multiplayer online role-playing games (MMORPGs). *Addictive Behaviors*, *39*, 1789–1797. doi:10.1016/j.addbeh.2014.07.017
- Lemmens, J. S., Valkenburg, P. M., & Gentile, D. A. (2015). The Internet Gaming Disorder Scale. *Psychological Assessment*, *27*, 567–582. doi:10.1037/pas0000062
- Lemmens, J. S., Valkenburg, P. M., & Peter, J. (2011). Psychosocial causes and consequences of pathological gaming. *Computer and Human Behavior*, *27*, 144–152. doi:10.1016/j.chb.2010.07.015
- Mak, K. K., Lai, C. W., Watanabe, H., Kim, D. I., Bahar, N., Milen Ramos, M., Young, K. S., Ho, R. C. M., Aum, N. R., & Cheng, C. (2014). Epidemiology of Internet behaviors and addiction among adolescents in six Asian countries. *Cyberpsychology, Behavior, and Social Networking*, *17*, 720–728. doi:10.1089/cyber.2014.0139

- Mazhari, S. (2012). Association between problematic Internet use and impulse control disorders among Iranian university students. *Cyberpsychology, Behavior, and Social Networking, 15*, 270–273. doi:10.1089/cyber.2011.0548
- McBride, J., & Derevensky, J. (2016). Gambling and video game playing among youth. *Journal of Gambling Issues, 34*, 156–178. doi:10.4309/jgi.2016.34.9
- Mihara, S., & Higuchi, S. (in press). Cross-sectional and longitudinal epidemiological studies of Internet gaming disorder: A systematic review of the literature. *Psychiatry and Clinical Neuroscience*. doi:10.1111/pcn.12532
- Mihara, S., Nakayama, H., Osaki, Y., & Higuchi, S. (2016). Report from Japan. Background paper prepared for the WHO Hong-Kong Meeting on Policy and Program Responses to Mental and Behavioral Disorders Associated with Excessive Use of the Internet and Other Communication and Gaming Platforms. Available through Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland.
- Ministries of Education and Others, People's Republic of China. (2013). *The program of comprehensive prevention and intervention for online games addiction among juveniles*. Retrieved from www.ccm.gov.cn/swordcms/publish/default/static/gfxwj/284303648.htm
- Ministry of Science, ICT and Future Planning, and the National Information Society Agency. (2015). *The survey on Internet overdependence*. Seoul, South Korea: National Information Society Agency.
- Müller, K. W., Janikian, M., Dreier, M., Wölfling, K., Beutel, M. E., Tzavara, C., & Tsitsika, A. (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*, 565–574. doi:10.1007/s00787-014-0611-2
- Ng, S. M., Khurana, R. M., Yeang, H. W., Hughes, U. M., & Manning, D. J. (2003). Is prolonged use of computer games a risk factor for deep venous thrombosis in children? Case study. *Clinical Medicine (London), 3*, 593–594. doi:10.7861/clinmedicine.3-6-593
- Petry, N. M., Rehbein, F., Gentile, D. A., Lemmens, J. S., Rumpf, H. J., Mößle, T., Bischof, G., Tao, R., Fung, D. S., Borges, G., Auriacombe, M., González Ibáñez, A., Tam, P., & O'Brien, C. P. (2014). An international consensus for assessing Internet gaming disorder using the new DSM-5 approach. *Addiction, 109*, 1399–1406. doi:10.1111/add.12457
- Pontes, H., & Griffiths, M. D. (2015). Measuring DSM-5 Internet gaming disorder: Development and validation of a short psychometric scale. *Computers in Human Behavior, 45*, 137–143. doi:10.1016/j.chb.2014.12.006
- Przybylski, A. K., Weinstein, N., & Murayama, K. (2016). Internet gaming disorder: Investigating the clinical relevance of a new phenomenon. *American Journal of Psychiatry, 174*, 230–236. doi:10.1176/appi.ajp.2016.16020224
- Rahimi-Movaghar, A., & Hamzehzadeh, M. (2016). Report from Iran. Background paper prepared for the WHO Hong-Kong Meeting on Policy and Program Responses to Mental and Behavioral Disorders Associated with Excessive Use of the Internet and Other Communication and Gaming Platforms. Available through Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland.
- Rehbein, F., & Baier, D. (2013). Family-, media-, and school-related risk factors of video game addiction. *Journal of Media Psychology, 25*, 118–128. doi:10.1027/1864-1105/a000093
- Rehbein, F., Kliem, S., Baier, D., Mößle, T., & Petry, N. M. (2015). Prevalence of Internet gaming disorder in German adolescents: Diagnostic contribution of the nine DSM 5 criteria in a state wide representative sample. *Addiction, 110*, 842–851. doi:10.1111/add.12849
- Reinherz, H. Z., Giaconia, R. M., Carmola Hauf, A. M., Wasserman, M. S., & Paradis, A. G. (2000). General and specific childhood risk factors for depression and drug disorders by early adulthood. *Journal of the American Academy of Child & Adolescent Psychiatry, 39*, 223–231. doi:10.1097/00004583-200002000-00023
- Rumpf, H. J. (2015). Analyses of survey data on behavioral disorders associated with excessive use of the Internet. Paper presented at the WHO–Republic of Korea Meeting on Behavioural Disorders Associated with Excessive Use of Internet, Computers, Smartphones and Similar Electronic Devices, August 2015, Catholic University of Korea, Seoul, Republic of Korea.
- Rumpf, H. J., Vermulst, A. A., Bischof, A., Kastirke, N., Gürtler, D., Bischof, G., & Meyer, C. (2014). Occurrence of Internet addiction in a general population sample: A latent class analysis. *European Addiction Research, 20*, 159–166. doi:10.1159/000354321
- Saunders, J. B., Degenhardt, L., & Farrell, M. (2017). Excessive gambling and gaming: Addictive disorders? *The Lancet Psychiatry, 4*, 433–435. doi:10.1016/S2215-0366(17)30210-9
- Sun, P., Johnson, C. A., Palmer, P., Arpawong, T. E., Unger, J. B., Xie, B., Rohrbach, L. A., Spruijt-Metz, D., & Sussman, S. (2012). Concurrent and predictive relationships between compulsive Internet use and substance use: Findings from vocational high school students in China and the USA. *International Journal of Environmental Research and Public Health, 9*, 660–673. doi:10.3390/ijerph9030660
- Swendsen, J., Conway, K. P., Degenhardt, L., Glantz, M., Jin, R., Merikangas, K. R., & Kessler, R. C. (2010). Mental disorders as risk factors for substance use, abuse and dependence: Results from the 10-year follow-up of the National Comorbidity Survey. *Addiction, 105*(6), 1117–1128. doi:10.1111/j.1360-0443.2010.02902.x
- Thatcher, A., Wretschko, G., & Fisher, J. (2008). Problematic Internet use among information technology workers in South Africa. *CyberPsychology & Behavior, 11*, 785–787. doi:10.1089/cpb.2007.0223
- Thorens, G., Achab, S., Billieux, J., Khazaal, Y., Khan, R., Pivin, E., Gupta, V., & Zullino, D. (2014). Characteristics and treatment response of self-identified problematic Internet users in a behavioral outpatient clinic. *Journal of Behavioral Addictions, 3*, 78–81. doi:10.1556/JBA.3.2014.008
- Van Rooij, A. J., Kuss, D. J., Griffiths, M. D., Shorter, G. W., Schoenmakers, T. M., & Van de Mheen, D. (2014). The co-occurrence of problematic video gaming, substance use, and psychosocial problems in adolescents. *Journal of Behavioral Addictions, 3*(3), 157–165. doi:10.1556/JBA.3.2014.013
- Van Rooij, A. J., Schoenmakers, T. M., Vermulst, A. A., Van den Eijnden, R. J., & Van de Mheen, D. (2011). Online video game addiction: Identification of addicted adolescent gamers. *Addiction, 106*, 205–212. doi:10.1111/j.1360-0443.2010.03104.x

- Wang, C. W., Chan, C. L. W., Mak, K. K., Ho, S. Y., Wong, P. W. C., & Ho, R. T. H. (2014). Prevalence and correlates of video and Internet gaming addiction among Hong Kong adolescents: A pilot study. *The Scientific World Journal*, 2014, 874648, 9 pages. doi:10.1155/2014/874648
- Wartberg, L., Kriston, L., Kammerl, R., Petersen, K. U., & Thomasius, R. (2015). Prevalence of pathological Internet use in a representative German sample of adolescents: Results of a latent profile analysis. *Psychopathology*, 48, 25–30. doi:10.1159/000365095
- World Health Organization. (2015). *Public health implications of excessive use of the Internet, computers, smartphones and similar electronic devices*. Geneva, Switzerland: World Health Organization. ISBN: 978 92 4 150936 7.
- World Health Organization. (2016). *ICD-11 beta draft*. Retrieved from <http://apps.who.int/classifications/icd11/browse/l-m/en#>
- Wu, X. S., Zhang, Z. H., Zhao, F., Wang, W. J., Li, Y. F., Bi, L., & Gong, F. F. (2016). Prevalence of Internet addiction and its association with social support and other related factors among adolescents in China. *Journal of Adolescence*, 52, 103–111. doi:10.1016/j.adolescence.2016.07.012
- Yen, J. Y., Ko, C. H., Yen, C. F., Wu, H. Y., & Yang, M. J. (2007). The comorbid psychiatric symptoms of Internet addiction: Attention deficit and hyperactivity disorder (ADHD), depression, social phobia and hostility. *Journal of Adolescent Health*, 41, 93–98. doi:10.1016/j.jadohealth.2007.02.002
- Young, K. S. (2010). *Internet addiction: A handbook and guide to evaluation*. Hoboken, NJ: John Wiley & Sons.
- Zadra, S., Bischof, G., Besser, B., Bischof, A., Meyer, C., John, U., & Rumpf, H. J. (2016). The association between Internet addiction and personality disorders in a general population-based sample. *Journal of Behavioral Addictions*, 5, 691–699. doi:10.1556/2006.5.2016.086
- Zamani, E., Kheradmand, A., Cheshmi, M., Abedi, A., & Hedayati, N. (2010). Comparing the social skills of students addicted to computer games with normal students. *Addiction and Health*, 2, 59–65.
- Zhang, J.-T., Yao, Y.-W., Potenza, M. N., Xia, C.-C., Lan, J., Liu, L., Wang, L.-J., Liu, B., Ma, S.-S., & Fang, X.-Y. (2016a). Altered resting-state neural activity and changes following a craving behavioral intervention for Internet gaming disorder. *Scientific Reports*, 6, 28109. doi:10.1038/srep28109 (PMC4933876)
- Zhang, J.-T., Yao, Y.-W., Potenza, M. N., Xia, C.-C., Lan, J., Liu, L., Wang, L.-J., Liu, B., Ma, S.-S., & Fang, X.-Y. (2016b). Effects of craving behavioral intervention on neural substrates of cue-induced craving in Internet gaming disorder. *Neuro-Image: Clinical*, 12, 591–599. doi:10.1016/j.nicl.2016.09.004