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“Game (not) Over”: A Systematic Review of Video Game Disorder in Adolescents

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SCIENTIFIC RESEARCH ARTICLE

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Abstract

This study aims to characterize video game use disorder in adolescents, identifying the particularities of those who present it, its effects at the brain level, related factors, and existing measurement instruments. A systematic review of the scientific publications available in Scopus was carried out, between the period 2014-2018 on video game use disorder in adolescents. Adolescents with this disorder are characterized by being mostly men, spending more time daily and weekly playing than adolescents without this disorder, showing diverse symptoms in the behavioral, affective, and cognitive areas. At brain level, it is referred that in this disorder there is an increase and decrease in the activation of specific areas of the brain. Likewise, the presence of some psychological disorder and impulsivity are considered factors that increase the risk of suffering from it. However, there are protective factors as school commitment and parental supervision, among others.

Keywords: addiction, adolescents, gaming disorder, systematic review, video games.

“Game (not) Over”: una Revisión Sistemática del Trastorno por Uso de Videojuegos en Adolescentes

Resumen

Este estudio pretende caracterizar el trastorno por uso de videojuegos en adolescentes, identificando las particularidades de quienes lo presentan, sus efectos a nivel cerebral, los factores relacionados y los instrumentos de medición existentes. Para ello, se llevó a cabo una revisión sistemática de las publicaciones científicas disponibles en Scopus, entre el periodo 2014-2018, sobre el trastorno por uso de videojuegos en adolescentes. Sus resultados describen que adolescentes con este trastorno se caracterizan por ser en su mayoría hombres, dedicar más tiempo diario y semanal de juego que adolescentes sin este trastorno, mostrando diversos síntomas en el área conductual, afectiva y cognitiva. A nivel cerebral se refiere que en este trastorno se presenta una elevación y disminución en la activación de determinadas zonas específicas del cerebro. Asimismo, la presencia de algún trastorno psicológico y la impulsividad, son considerados factores que aumentan el riesgo de padecerlo. Sin embargo, existen factores protectores como el compromiso escolar y la supervisión parental, entre otros.

Palabras clave: adicción, adolescentes, revisión sistemática, trastorno por uso de videojuegos, videojuegos.

Introduction

VIDEO GAMES, in general terms, are defined as interactive applications accessed through various electronic devices (e.g., consoles, smartphones, tablets, and computers). They can be played online—this involves the use of the Internet— or offline— where no connection is required—, which suggests that users are put against an electronic device or set to explore an electronic world (Mills, Mettler, Sornberger, & Heath, 2016).

Video game addiction, gambling disorder, pathological use of video games, problematic gambling behavior, or internet gambling disorder are some of the different names that have been used to signal when excessive or compulsive use of video games interferes with daily life in a significant way (Benarous et al., 2019; Dieris-Hirche et al., 2020; Esposito et al., 2020; Fumero, Marrero, Bethencourt, & Peñate, 2020; Kim, Hughes, Park, Quinn, & Kong, 2016; Stockdale & Coyne, 2020; Yesilyurt, 2020). The term “internet gaming disorder” (IGD) was proposed by the American Psychiatric Association in the fifth edition of its Diagnostic and Statistical Manual (DSM-5), where it presents the condition and the need for more clinical studies on the subject (American Psychiatric Association, 2013). Currently, the World Health Organization (WHO) has incorporated the concept of “video game use disorder” (VGD) in its 11th revision of the International Classification of Diseases (ICD-11), and it describes it as a persistent or recurrent pattern of gambling behavior online or offline, primarily characterized by: (a) a loss of control over gambling, (b) an increase in the priority given to gambling (over other interests and daily activities), and (c) the maintenance or increase of gambling despite negative consequences. All of this in addition to a significant impairment of personal, familial, social, educational, occupational, and other important areas of functioning, and the fact that this pattern of behavior continues for at least 12 months or less if all diagnostic requirements are met and symptoms are severe (WHO, 2020).

Using video games is one of the most popular leisure activities for children and adolescents, and while many of them are able to regulate their interaction with games, a significant proportion do not (Brunborg et al., 2013; Mohammadi et al., 2020). As a result, some European studies report that adolescents (secondary-school pupils of 13–14 years on average) with excessive use of video games may present various signs of addiction, such as constant preoccupation with the act of playing, multiple problems both in family and social relations, and a considerable fluctuation in mood (Bonnaire & Phan, 2017; Griffiths, Király, Pontes, & Demetrovics, 2015; Vadlin, Åslund, Hellström, & Nilsson, 2016; Wartberg, Kriston, Kramer, Schwedler, Lincoln, & Kammerl, 2017). Latin American evidence on VGD or its effects on adolescents is rather limited, and previous reviews have not reported relevant findings (Brandão et al., 2019; Loayza-Jerjes, 2010; Sánchez-Domínguez, Telumbre-Terrero, & Castillo Arcos, 2021). Because of this and the growing and progressive expansion of video games on various digital platforms, it is justified and relevant to clearly establish the manifestation of this disorder in adolescents, the different elements that characterize it, and provide evidence that advances its understanding and approach.

Thus, in this study we intend to characterize video game use disorder in adolescents, identifying the particularities of those who present it, its effects on the brain, the related risk factors, and the existing measurement instruments. To accomplish this objective, we performed a systematic review of scientific publications available on Scopus over a period of five years (2014-2018). This database has the largest coverage within the scientific world, with more than 24,600 titles from 5,000 international publishers and 16 million author profiles, of diverse topics and disciplines, which makes it a valid and reliable source of evidence on this subject (Ferrer & Delgado, 2018; Polanco-Carrasco, 2016; Rojas-Jara et al., 2019).

Method

This review was guided by the PRISMA method, which allows to organize the exploration, classification, and analysis of evidence (Liberati et al., 2009; Moher et al., 2009). Thus, the selection procedure was divided into four progressive stages: (a) design of a literature search strategy, (b) selection of publications according to defined inclusion and exclusion criteria, (c) data extraction from selected studies, and (d) critical analysis of the information according to the quality of the evidence.

The inclusion criteria defined in this review considered the search for: (a) scientific articles only, (b) empirical studies about vGD in adolescent population, (c) published between the years 2014 and 2018, and (d) research in English language.

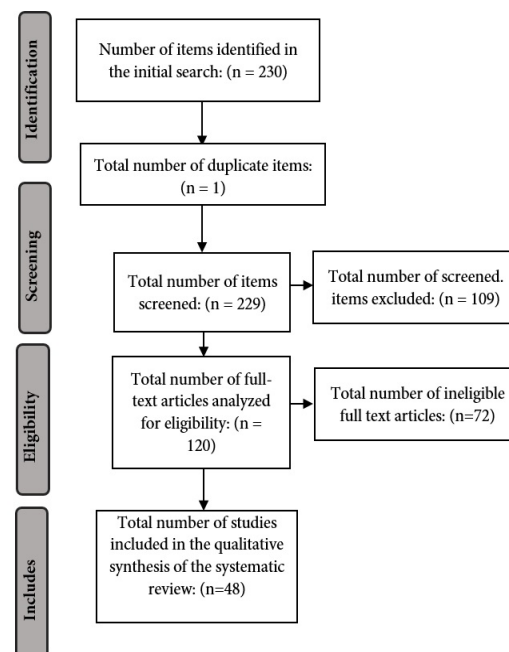
The search for articles, carried out on September 16, 2019 in the Elsevier Scopus database, included the terms “Gaming disorder”, “Video-games addiction”, “Videogames use disorder”, “Adolescents”, “Adolescence”, “Teens”, and “Youth” in titles, abstracts, and keywords, according to the mesh (Medical Subject Descriptors) and decs (Health Science Descriptors) thesaurus, and the use of the respective Boolean operators for the search algorithm [“Gaming disorder” OR “Videogames addiction” OR “Videogames use disorder” AND “Adolescents” OR “Adolescence” OR “Teens” OR “Youth”]. The result was a total of 230 matches.

In this search, we excluded: (a) editorials, letters, books, and book chapters, (b) other systematic reviews, (c) purely theoretical articles on vGD, (d) articles on vGD in children or adults, (e) articles outside the established publication range (2019 was not considered since that editorial year was still ongoing at the time of the search), (f) research in languages other than English, and (g) duplicated articles. This left an initial total of 120 full-text records. Subsequently, we evaluated their eligibility using a single ad hoc form designed for this purpose. Taking as a basis the inclusion

criteria and the suitability of the content for the central objectives of this research, 72 of the texts were discarded for presenting incomplete, partial, or irrelevant information, leaving a final count of 48 articles for the qualitative analysis. This analysis involved distributing the evidence in clusters that coincided among the articles, in order to organize their description and further presentation in the following sections (see Figure 1).

Results

Figure 1. Flow chart of the article selection process.



Source: Own elaboration.

In the end, the screening process rendered 48 scientific publications, which were considered for this review. Initially, we will present their bibliometric information (i.e., authors, year of publication, country, journal, objectives, and main results; see Table 1), and then, in the discussion, we will provide a narrative analysis and synthesis of their central contents.

Table 1
Summary of articles included in the review

Authors	Year	Country	Journal	Study objectives	Main results
Park, J., Sung, J. Y., Kim, D. K., Kong, I. D., Hughes, T. L., & Kim, N.	2018	South Korea	<i>BMC Psychiatry</i>	Investigate the association between video game addiction and stress-related genetic variants.	Results indicate that <i>CRHR1</i> gene polymorphism may play an important role in the susceptibility of <i>VCD</i> in the Korean adolescent male population.
Seok, H. J., Lee, J. M., Park, C. Y., & Park, J. Y.	2018	South Korea	<i>Children and Youth Services Review</i>	Explore teens' motivations for playing video games, what their lives are like, how they perceive games, what they won and lost, and how they made sense of the <i>VCD</i> .	<i>VCD</i> is related to adolescents' desire to interact with others. In addition, adolescents who exhibit online <i>VCD</i> are aware of both their physical and mental changes.
Evans, C., King, D. L., & Delfabbro, P. H.	2018	Australia	<i>Computers in Human Behavior</i>	To examine the impact of abstinence from 84 hours of play, its effect, and the psychological distress on regular teenage gamblers.	Abstinent adolescents felt bored without a daily play routine but developed new play attitudes and participated in family and physical outdoor activities.
Choi, E. J., Taylor, M. J., Hong, S. B., Kim, C., Kim, J. W., McIntyre, R. S., & Yi, S. H.	2018	South Korea	<i>Psychiatry Research: Neuroimaging</i>	Examine whether teens make inferences about the mental state of their online video game characters and whether teens with <i>VCD</i> perceived their in-game character to be similar to them.	Activation patterns on functional MRI showed that adolescents with <i>VCD</i> were more attached to their game characters and equated their game characters to humans.
Schneider, L. A., King, D. L., & Delfabbro, P. H.	2018	Australia	<i>International Journal of Mental Health and Addiction</i>	Research the <i>VCD</i> in relation to the type of coping, including emotion- and problem-centered coping styles.	Adolescents who are susceptible to avoidance, cognitive and behavioral, as a coping method have an increased risk of developing symptoms of <i>VCD</i> .
Su, P., Yu, C., Zhang, W., Liu, S., Xu, Y., & Zhen, S.	2018	China	<i>Frontiers in Psychology</i>	Study how peer victimization in 7 th grade is associated with <i>VCD</i> in 9 th grade.	Victimization of 7 th graders was significantly associated with the level of attachment to conflicting peers of 8 th graders and predicted the level of normative beliefs about aggression and the level of <i>VCD</i> in 9 th graders.
Colder Carras, M., & Kardefelt-Winther, D.	2018	Germany	<i>European Child & Adolescent Psychiatry</i>	Check if <i>VCD</i> -related symptoms and problems occur consistently at the same levels which would mean that the biaxial model of addiction is fulfilled.	For correct identification of the disorder and appropriate treatment, it is necessary to establish clear measures and criteria to differentiate habitual and non-pathological gambling from <i>VGD</i> .
Peeters, M., Koning, I., & van den Eijnden, R.	2018	Netherlands	<i>Computers in Human Behavior</i>	To test the hypothesis that attention problems, social vulnerability, and life satisfaction are unique and interactive predictors of increased <i>VGD</i> symptoms.	Adolescents with attention problems are at increased risk of developing <i>VGD</i> . This risk is compounded by social vulnerability and life dissatisfaction.
Tian, M., Tao, R., Zheng, Y., Zhang, H., Yang, G., Li, Q., & Liu, X.	2018	China	<i>Computers in Human Behavior</i>	Identify behavioral characteristics of adolescents with <i>VCD</i> to promote early diagnosis and intervention.	The results propose that adolescents with <i>VGD</i> showed a higher degree of impulsivity in decision making. Furthermore, that impulsivity and personality traits (but not risk-taking) may be associated with <i>VCD</i> in adolescents.

Authors	Year	Country	Journal	Study objectives	Main results
Torres-Rodriguez, A., Griffiths, M. D., Carbonell, X., & Oberst, U.	2018	Spain	<i>Journal of Behavioral Addictions</i>	Explore the characteristics of clinical samples with vcd to help delineate the construction of the gambling disorder and inform future treatment studies.	Adolescents with vcd reported a high presence of stressful life events in the majority of the sample. High scores were found on scales assessing depression, anxiety, and somatic disorders. Several personality traits were found to be strongly associated with vcd.
Kim, E., Yim, H.W., Jeong, H., Jo, S.J., Lee, H.K., Son, H.J., & Han, H.H.	2018	South Korea	<i>Epidemiology and Health</i>	To investigate the mediating effects of parent-child communication styles on the relationship with adolescent aggressiveness and the risk of a vcd.	Father-child communication style mediated the relationship between aggression and risk of vcd, but mother-child communication style had no such mediating effect.
Chiu, Y. C., Pan, Y. C., & Lin, Y. H.	2018	China	<i>Journal of Behavioral Addictions</i>	Validate the Chinese version of the Ten-item Internet Gambling Disorder Test (IGDT-10), a self-reported questionnaire based on the gambling criteria in the DSM-5, and estimate the prevalence in adolescents.	The Chinese version of the IGDT-10 showed good internal consistency and adequate diagnostic efficacy. The prevalence of vcd among adolescents was 3.1%. The findings evidence the validity and diagnostic accuracy of the IGDT-10 in the assessment of vcd.
Yuh, J.	2018	South Korea	<i>Social Behavior and Personality: An International Journal</i>	Check whether aggression and social factors predict vcd in Korean teenagers.	The results showed that aggressiveness, family conflict, and lower school engagement predict vcd.
Saqub, N., Saqub, J., Wahid, A., Ahmed, A. A., Dhuhayr, H. E., Zaghoul, M. S., Ewid, M., & Al-Mazrou, A.	2017	Saudi Arabia	<i>Addictive Behaviors Reports</i>	To assess the prevalence of vcd and its correlation with mental health in a sample of expatriate high school students from the Al-Qassim region of Saudi Arabia.	About 32% of adolescents were overweight or obese, 75% had screen time \geq 2 hours/day, 20% slept $<$ 5 hours/night, 16% had vcd, and 54% had psychological problems. vcd was strongly associated with psychological distress.
King, D. L., & Defabro, P.H.	2017	Australia	<i>International Journal of Mental Health and Addiction</i>	Investigate the characteristics of the parent-child relationship, including trust, communication, and alienation, in the context of teenagers' problems with video games.	Adolescents with vcd reported significantly lower trust and communication, and more anger and alienation in their maternal and paternal relationships, compared to adolescents without vcd. Adolescents at high risk for vcd reported significantly more hours of play with strangers.
Bonnaire, C., & Phan, O.	2017	France	<i>Psychiatry Research</i>	To examine the relationships between parental attitudes, adolescents' perception of family functioning and vcd, exploring gender differences.	Non-problem adolescent gamblers have better family cohesion, whereas problem gamblers have more family conflict and worse family relationships. For both genders, parental control, conflict, and family relationship are associated with vcd.
Du, X., Liu, L., Yang, Y., Qi, X., Gao, P., Zhang, Y., Zhu, J., Du, G., Dai, S., Li, X., & Zhang, Q.	2017	China	<i>Brain and Behavior</i>	To evaluate the relationship between impulsivity and white matter integrity in adolescents with vcd.	Altered correlations in adolescents with vcd may reflect possible microstructural changes in the white matter of the brain. These changes may be associated with increased impulsivity in adolescents with vcd.

Authors	Year	Country	Journal	Study objectives	Main results
Che, D., Hu, J., Zhen, S., Yu, C., Li, B., Chang, X., & Zhang, W.	2017	China	<i>Frontiers in Psychology</i>	To examine the associations between the four dimensions of emotional intelligence, two facets of stress perception, and VGD in adolescent males.	Perceived self-efficacy mediates the relationship between self-control, social skills, empathy, and VGD. Perceived helplessness mediates the relationship with emotional intelligence, that is, self-control and the use of emotions and VGD.
Lyu, S.	2017	South Korea	<i>Journal of Child and Family Studies</i>	To offer a better understanding of the way in which VGD in adolescents is associated with the family environment.	Affective dysfunction and leisure time limitations are more relevant factors than family functioning in determining the degree of adolescent attachment to the VGD.
Hu, J., Zhen, S., Yu, C., Zhang, Q., & Zhang, W.	2017	China	<i>Frontiers in Psychology</i>	Reveal the underlying mechanisms of the relationship between sensation-seeking and VGD in adolescents.	Sensation seeking, positive affective associations with video games, and impulsivity were significantly and positively associated with VGD in adolescents. Positive affective associations mediated the relationship between sensation seeking and VGD.
Han, D., Kim, M., Bae, S., Renshaw, F., & Anderson, S.	2017	South Korea	<i>Addiction Biology</i>	To investigate the main effects of VGD in adolescents on brain development by means of an fMRI.	Results showed an association between chronic exposure to video games and increased connectivity between the salience network (anterior insula and dorsal anterior cingulate) and frontal eye fields, and between the auditory and motor cortices.
Mérelle, S., Kleiboer, M., Schotanus, M., Cluitmans, T., Waardenburg, C., Kramer, D., van de Mheen, D., & van Rooij, A.	2017	Netherlands	<i>Clinical Neuropsychiatry</i>	Gain a better understanding of health-related issues and demographics associated with VGD or social networking in early adolescence.	Most mental health problems were associated with VGD as well as problematic use of social networks. A sedentary lifestyle was the only lifestyle factor that was strongly associated with VGD or social networking. Men were more at risk for VGD and women were more at risk for social network addiction.
Martin-Fernández, M., Matalí, J., García-Sánchez, S., Pardo, M., Lleras, M., & Castellano-Tejedor, C.	2017	Spain	<i>Adicciones</i>	Describe the profiles of adolescents with VGD according to comorbidity (internalizing or externalizing) and analyze the response to treatment at 3 and 6 months.	Externalizing adolescents have a recreational purpose for using video games. Internalizing adolescents preferentially use role-playing video games as a coping strategy for interpersonal problems. Profiles both show high rates of problems in the family and school environment.
Park, J., Hong, J., Han, D., Min, K., Lee, Y., Kee, B., & Kim, S.	2017	South Korea	<i>Journal of Korean Medical Science</i>	To compare the neurobiological differences between comorbid ADHD with VGD (ADHD+VGD) and ADHD without comorbidity (ADHD) by analyzing the findings of the quantitative electroencephalogram.	Results showed that the ADHD+VGD group showed lower relative delta band power and higher relative beta band power values in the temporal regions compared to the ADHD-only group.
Koo, H., Han, D., Park, S., & Kwon, J.	2017	South Korea	<i>Psychiatry Investigation</i>	Develop and validate a Structured Clinical Interview for the VGD in adolescents.	The Structured Clinical Interview for VGD proved to be a quite valid and reliable tool for diagnosing this disorder in adolescents.

Authors	Year	Country	Journal	Study objectives	Main results
Ong, R., Peh, C., & Guo, S.	2016	Singapore	<i>International Journal of Mental Health and Addiction</i>	To examine whether adolescent Substance Use Disorder and vcd are associated with similar risk factors.	vcd appears to be associated with risk factors other than Substance Use Disorder.
King, D., & Delfabbro, P.H.	2016	Australia	<i>Journal of Abnormal Child Psychology</i>	To describe and quantitatively examine the presence of problematic beliefs about gambling in a sample of adolescents with and without vcd.	Adolescents with vcd may have specific maladaptive beliefs. These cognitions are: (a) overvaluation of rewards and identities from gambling, (b) inflexible rules and biases that arise in gambling, (c) overreliance on gambling to satisfy self-esteem needs, and (d) gambling as a method of gaining social acceptance.
Park, J., Lee, Y., Sohn, J., & Han, D.	2016	South Korea	<i>Human Psychopharmacology</i>	To compare the effectiveness of atomoxetine (atm) and methylphenidate (mpn) in adolescents with vcd and abhd.	mpn and atm treatments improved clinical symptoms of cov, showing a decrease in impulsivity in adolescents with abhd. There were no significant differences between the mpn and atm groups in terms of changes in the severity of vcd.
Kim, N., Hughes, T., Park, C., Quinn, L., & Kong, D.	2016	South Korea	<i>Cyberpsychology, Behavior, and Social Networking</i>	Identify differences in autonomic functions and Type D personality traits between adolescent males with and without vcd.	vcd was associated with alterations in autonomic functions and Type D personality traits in early-onset adolescent males.
Yu, H., & Cho, J.	2016	South Korea	<i>American Journal of Health Behavior</i>	To examine the prevalence rates of vcd among South Korean high school students, the dominant symptoms, and the interrelationships between vcd and non-psychotic psychological symptoms (anxiety, depression, and impulsivity).	vcd can cause severe distress that would be associated with comorbid symptoms that are relevant to the development or continuation of vcd.
Mills, D., Mettler, J., Sorbenberger, M., & Heath, N.	2016	Canada	<i>International Journal of Cyber Behavior, Psychology and Learning</i>	Explore the relationship between the vcd and self-perception.	There were subtle differences in the self-perception profile of men and women with more severe vcd.
Pontes, H., Macur, M., & Griffiths, M.	2016	Slovenia	<i>Journal of Behavioral Addictions</i>	To examine the psychometric properties of icps9-sf in addition to investigating the prevalence rates of vcd in a representative sample of adolescents in Slovenia.	The icps9-sf is psychometrically reliable, as all three reliability coefficients were above the recommended thresholds, and the results showed that the prevalence rates of vcd were relatively low in the sample.
Qi, X., Yang, Y., Dai, S., Gao, P., Du, X., Zhang, Y., Du, G., Li, X., & Zhang, Q.	2016	China	<i>NeuroImage: Clinical</i>	Identify how feedback (decision-making outcomes) affects subsequent risky decision-making in adolescents with vcd.	Results showed covariance between risk level and activation of brain regions related to value estimation, reward anticipation, and emotion-related learning, which may be one of the underlying neural factors for risky and disadvantageous decision making in adolescents with vcd.
Wu, J. Y. W., Ko, H. C., Wong, T. Y., Wu, L. A., & Oei, T. P.	2016	China	<i>Cyberpsychology, Behavior, and Social Networking</i>	To examine the role of expectation of positive outcomes in the relationship between peer/parent influence and vcd in adolescents in Taiwan.	Results provide evidence of the important role of peer influence and the expectation of positive outcomes in video games and the development of a vcd in adolescents.

Authors	Year	Country	Journal	Study objectives	Main results
Müller, K. W., Janikian, M., Dreier, M., Wölfling, K., Beutel, M. E., Tzavara, C., Richardson, C., & Tsitsika, A.	2015	Greece	<i>European Child & Adolescent Psychiatry</i>	To evaluate the prevalence and psychopathological correlations of vcd in seven European countries.	vcd is associated with psychopathological symptoms, especially aggressive behavior, noncompliance with rules, and social problems. vcd is common in European adolescents and is related to psychosocial problems.
Wang, H., Jin, C., Yuan, K., Shakir, T.M., Mao, C., Niu, X., Niu, C., Guo, L., & Zhang, M.	2015	China	<i>Frontiers in Behavioral Neuroscience</i>	To investigate the relationship between altered grey matter volume and cognitive impairment in adolescents with vcd.	The results indicated that altered gray matter volume is associated with a change in cognitive control performance in adolescents with vcd.
Wang, Y., Yin, Y., Sun, Y., Zhou, Y., Chen, X., Ding, W., Wang, W., Li, W., Xu., & Du, Y.	2015	China	<i>PLoS ONE</i>	To investigate alterations in whole-brain interhemispheric functional connectivity at rest (rsFC) in adolescent participants with vcd.	Findings point to the important role of altered interhemispheric rsFC of the bilateral prefrontal lobe in the neuropathological mechanism of vcd, and provide further supporting evidence for the reclassification of vcd as a behavioral addiction.
Hong, S. B., Harrison, B. J., Dandash, O., Choi, E. J., Kim, S. C., Kim, H.H., Shim, D. H., Kim, C. D., Kim, J. W., Yi, S. H.	2015	South Korea	<i>Brain Research</i>	To comprehensively delineate the subdivisions of the functional striatal connectivity involved in the vcd in adolescents.	Longer playtime predicted significantly greater functional connectivity between the dorsal putamen and bilateral primary somatosensory cortices in adolescents with vcd and significantly less functional connectivity between the dorsal putamen and bilateral sensorimotor cortices in healthy controls.
Vadlin, S., Åslund, C., & Nilsson, K. W.	2015	Sweden	<i>Scandinavian Journal of Psychology</i>	Describe the development of a tool for detecting vcd in adolescents: the Game Addiction Identification Test (GAIT).	The GAIT showed good content validity for the detection of vcd. However, its psychometric properties of construct and criterion validity, as well as its reliability in clinical and community settings, need further investigation.
Lee, J., Lee, S., Chun, J. W., Cho, H., Kim, D., & Jung, Y. C.	2015	South Korea	<i>Cyberpsychology, Behavior, and Social Networking</i>	To test whether adolescents with vcd would be more disturbed by emotional interference and demonstrate compromised activation of the dorsal anterior cingulate cortex (dACC) during a Stroop Match-to-Sample task.	The results provide evidence for the involvement of prefrontal cognitive control over emotional interference in adolescents with vcd.
Helström, C., Nilsson, K. W., Leppert, J., & Åslund, C.	2015	Sweden	<i>Upsala Journal of Medical Sciences</i>	To investigate whether adolescents' online playtime and the additive effect of play motifs were associated with depressive, musculoskeletal, and psychosomatic symptoms.	Excessive time spent gambling and motivation to gamble were associated with an increased likelihood of poor health among adolescents. Motives for gambling may identify gamblers who need support to reduce risky gambling behaviors.
Rehbein, F., Kliem, S., Baier, D., Mößle, T., & Petry, N. M	2015	Germany	<i>Addiction</i>	Assess how specific criteria contribute to diagnosis and estimate vcd prevalence rates based on DSM-5 recommendations.	Results indicate that passing five or more DSM-5 criteria for vcd occurred in 1.16% of students, and these show greater impairment compared to students without vcd.

Authors	Year	Country	Journal	Study objectives	Main results
Donati, M. A., Chiesi, F., Ammannato, G., & Pini, C.	2015	Italy	<i>Cyberpsychology, Behavior, and Social Networking</i>	Test the predictive power of the versatility of games (i.e., the number of video game genres) in the vcd on teenage boys by monitoring the time they spend on games.	The results show that the versatility of games can be considered as one of the risk factors related to vcd.
Van Rooij, A. J., Kuss, D. J., Griffiths, M. D., Shorter, G. W., Schoenmakers, T. M., & van de Mheen, D.	2014	Netherlands	<i>Journal of Behavioral Addictions</i>	Explore the nature of video games and their association with gaming, psychosocial health, and substance use.	A small subgroup of gamblers showed lower psychosocial functioning and lower scores. In addition, associations were found with alcohol, nicotine, and cannabis use. The results encourage further exploration of the role of psychoactive substance use in video game use.
Ding, W., Sun, J., Sun, Y., Chen, X., Zhou, Y., Zhuang, Z., Li, L., Zhang, Y., Xu, J. R., & Du, Y.	2014	China	<i>Behavioral and Brain Functions</i>	To test whether different facets of trait impulsivity may be specifically related to brain regions with poor impulse suppression function in adolescents with vcd.	Results suggest that the prefrontal cortex may be involved in the circuitry that modulates impulsivity, while its malfunction may be related to high impulsivity in adolescents with vcd, which may directly contribute to the process of video game addiction.
Hofstein, B. E., Pedersen, T. P., Bendtsen, P., Madsen, K. R., Meistrup, C. R., Nielsen, L., & Rasmussen, M.	2014	Denmark	<i>BMC Public Health</i>	Develop and present a new short non-clinical measurement tool for perceived problems related to computer and video game use among adolescents and study the association between screen time and perceived problems.	An increased risk of perceived problems was found with increasing time spent playing video games. However, the majority of schoolchildren who used video games and the Internet did not experience problems.
Rasmussen, M., Meistrup, C. R., Bendtsen, P., Pedersen, T. P., Nielsen, L., Madsen, K. R., & Holstein, B. E.	2014	Denmark	<i>International Journal of Public Health</i>	Examine whether perceived problems with computer games and internet communication are associated with adolescent social relationships.	Although the study is cross-sectional in nature, the results suggest that computer games and Internet use may be detrimental to adolescents' social relationships.
Wang, C., Chan, C. L. W., Mak, K. K. H., S. Y., Wong, P. W. C., & Ho, R. T. H.	2014	China	<i>The Scientific World Journal</i>	To investigate the patterns of video game use and the prevalence and correlation of vcd in Hong Kong's teenagers.	The risk of vcd is significantly higher in males who had low academic achievement. vcd was associated with mean weekly gaming time, frequency and period of gaming expenditure, perceived family conflict, and having more close friends.

Source: Own elaboration.

Discussion

Characteristics of adolescents with VGD

Context of the appearance of VGD in adolescents. Adolescents with vgd are usually incorporated into the world of games since childhood when they grow up in family environments where parents and siblings enjoy games. Therefore, they develop a progressive interest in playing and use games as a mechanism for interaction with their peers during their adolescence (Seok, Lee, Park, & Park, 2018).

Various authors agree that the essential factors for the appearance of vgd in adolescents are: (a) difficulties in recreating themselves through an alternative to video games, (b) the pleasure in winning, (c) the value given to the successful player, (d) the desire to relate to others through play, and (e) the perception of video games as a refuge for adolescent suffering or as an escape from a deteriorated family environment (Bonnaire & Phan, 2017; Choi et al., 2018; Lyu, 2017; Martín-Fernández et al., 2017; Seok et al., 2018).

Families, in general, tend to be permissive towards the use of video games and do not necessarily exercise extensive control over this behavior. Some of them establish rules as time limits, schedules, or the prohibition of playing. However, in the case of adolescents with vgd these rules are not considered, which leads to longer than allowed playtime or adolescents playing at non-agreed times (Bonnaire & Phan, 2017; Seok et al., 2018). Along the same lines, some studies report that teens with vgd have significantly more screens available at home and often have a laptop or game console in their room (Bonnaire & Phan, 2017; King & Delfabbro, 2016).

Furthermore, research on adolescents with vgd has observed the presence of various problems in their psychosocial relationships, as difficulties in interpersonal contact, low emotional support and relational tension, deficits in social skills, feelings of loneliness, social anxiety, decreased self-esteem, and alterations in school performance. Based on this, the desire of adolescents with vgd to relate to

others through video games would be understandable (Bonnaire & Phan, 2017; Martín-Fernández et al., 2017; Seok et al., 2018; Rasmussen et al., 2014; Van Rooij et al., 2014).

Other findings in this area show that adolescents with vgd consider playing as a positive influence on their social interactions as they experience a warm social exchange in meeting their playmates (Bonnaire & Phan, 2017; Seok et al., 2018). On this basis, some research argues that vgd influences increasing problems in the development and maintenance of real social relationships, as social interaction through play fails to replace other types of social relationships (Mills et al., 2016; Rasmussen et al., 2014).

Characteristics of adolescents with vgd.

The average teenager with vgd is mostly male (King & Delfabbro, 2017; Mérelle et al., 2017; Park et al., 2018; Schneider, King, & Delfabbro, 2018; Van Rooij et al., 2014; Yu & Cho, 2016), uses five times more hours per week to play than teenagers without vgd (King & Delfabbro, 2016; Schneider et al., 2018), spends eight times more hours per week playing with strangers online (King & Delfabbro, 2017) and devotes more than three hours per day playing (Bonnaire & Phan, 2017; Yu & Cho, 2016). Additionally, adolescent males with vgd spend a greater amount of time playing compared to females with the same disorder (Bonnaire & Phan, 2017) and prefer to use weekends or vacations for gaming since they must use their time during the week for schoolwork (Seok et al., 2018).

Research also indicates a preference for action games, shooting games, sports games, massively multiplayer online games, role-playing games, and online battle arenas. Several studies agree that due to high accessibility, visibility, and immersion time these last two types of games are associated with increased addictive power (Bonnaire & Phan, 2017; Choi et al., 2018; King & Delfabbro, 2016; Donati, Chiesi, Ammannato, & Primi, 2015; Martín-Fernández et al., 2017; Torres-Rodríguez, Griffiths, Carbonell, & Oberst, 2018; Van Rooij et al., 2014).

Adolescents with vGD show greater symptoms of anxiety, depression, aggression, loneliness, impulsivity, poor school performance, and low self-esteem than individuals without this disorder (Saqib et al., 2017; Su et al., 2018; Tian et al., 2018; Van Rooij et al., 2014; Yu & Cho, 2016). Specifically, regarding low self-esteem, studies indicate that adolescent males and females with vGD have lower perceptions of themselves in the domains of school competence and general social skills (Mills et al., 2016). In addition, one would expect to find in adolescents with vGD fluctuations in mood, intra and interpersonal conflicts, social withdrawal, relapse symptoms, presence of suicidal thoughts, and behavioral problems (Mérelle et al., 2017; Yu & Cho, 2016).

The evidence refers to the predominance of a distressed personality type (described by some researchers as Type D personality) among adolescents with vGD, which is characterized by a negative view of themselves and the world, the experience of negative emotions over time, and a disconnect between external signs and internal feelings. In addition, they exhibit certain personality traits such as introversion, inhibition, submission, interpersonal sensitivity, obsessive-compulsive tendencies, phobic anxiety, and hostility, as well as paranoid and borderline traits (Kim et al., 2016; Torres-Rodríguez et al., 2018).

At the family level, adolescents with vGD present severe conflicts that interfere with family interaction, communication, and cohesion (Bonnaire & Phan, 2017; Müller et al., 2015; Seok et al., 2018; Torres-Rodríguez et al., 2018).

In adolescents with comorbidity there is also an increase in problems in both family and school environments (Martín-Fernández et al., 2017), and, unlike males, adolescent females are given greater support by their families (Torres-Rodríguez et al., 2018; Yuh, 2018).

Psychological changes in the adolescent derived from the vgd. vgd progressively generates diverse psychological alterations in adolescents, as emotional instability and changes in their

personality, mood, diet, sleep patterns, and behavior (aggressive and obsessive). These adolescents are generally aware of the appearance of these changes but do not consider them problematic (Rasmussen et al., 2014; Seok et al., 2018).

At a mental level, vGD generates maladaptive cognitions regarding gambling: (a) overvaluing the rewards and identities of the characters, (b) inflexibility and prejudices in gambling situations, (c) excessive dependence on social acceptance to satisfy self-esteem needs, and (d) overvaluing the immediate result and neglecting the future (King & Delfabbro, 2016; Tian et al., 2018). Moreover, male adolescents with vGD are perceived to have a greater sense of self within the domains of athletic competition and physical appearance, while females prioritize the domains of behavior and close friendship. These results challenge the stereotype of the vGD player as an anti-social, non-athletic, and unattractive teenage male (Mills et al., 2016).

Different research reports that teenagers with vGD show greater interest in the virtual world than in the real world, which affects the way they act and think. Thus, adolescents become deeply immersed in games to the point of rumination in different contexts (e.g., school, home, and other activities), and distance themselves from the demands of the real world (e.g., schoolwork, housework, or socialization), considering them unimportant, too difficult, or uncontrollable (Rehbein, Kliem, Baier, Mößle, & Petry, 2015; Schneider et al., 2018; Seok et al., 2018). When teenagers with vGD are very accustomed to the virtual world, they may begin to believe that the virtual self or the game character is a real person or even themselves. Teens may present significant identity conflicts and require help exploring their real self, due to their excessive attachment to the virtual self (Choi et al., 2018).

On a behavioral level, teens with vGD can be seen playing for hours. This is reinforced by obtaining greater rewards from the video game as more time is dedicated to it, however, at the same time, their functioning in the real world is diminished, leading to deprivation of adequate sleep, omission of food,

chronic fatigue, and, as previously noted, neglect of other important activities (Choi et al., 2018; Seok et al., 2018; Yu & Cho, 2016). When play is restricted for adolescents with vGD, they may experience negative emotions, such as frustration and irritability, or the feeling of being unable to cope with the deprivation or forced reduction of play (Evans, King, & Delfabbro, 2018; Martín-Fernández et al., 2017).

Keys to the psychological treatment of the vgd.

Several studies establish crucial suggestions for the treatment of vgd in adolescents. Among them are: (a) to identify the motivation to play since it offers a conative parameter to understand the behavior (Hellström, Nilsson, Leppert, & Åslund, 2015), (b) to strengthen the level of family cohesion since the evidence shows the mediating value of this variable in the presentation of the playing behavior (Bonnaire & Phan, 2017), and (c) to act on impulsivity through the use of drugs for the management of attention deficit hyperactivity disorder (adhd) (e.g., atomoxetine, methylphenidate, etc.), as they reduce the impulsive symptoms characteristic of vgd (Park, Lee, Sohn, & Han, 2016).

Effects of vgd on the brain

At the brain level, research has found links between impulsivity—which, as we have reviewed, has a close relationship with vGD in adolescents—and increased or decreased activation in certain areas of the brain (Qi et al., 2016). For example, scientists have observed that alterations in the prefrontal cortex—involved in the circuitry that modulates impulsivity—may be the basis of thoughtless behavior (Ding et al., 2014). Studies on cerebral connections have revealed a decrease in areas (e.g., prefrontal lobe, upper and lower frontal gyri) related to cognitive control, decision making, and impulsive management (Wang, Yin, et al., 2015). Additionally, it has been observed that microstructural changes in the right occipital subcortical white matter could also be related to high impulsivity (Du et al., 2017; Wang, Jin, et al., 2015). And other studies of adolescents with vGD show a

weaker activation of the anterior cingulate cortex, implying altered prefrontal cognitive control and difficulty in emotional regulation (Lee et al., 2015).

Under functional magnetic resonance imaging (fMRI), researchers have observed significantly more activations (in post-central, lower frontal and pre-central convolutions, cerebellum, occipital lobe, anterior cingulate cortex, temporal pole, and medial prefrontal cortex) in adolescents with vGD than in adolescents without this disorder. During testing, teens with vGD showed higher brain activity (medial prefrontal cortex and anterior cingulate cortex) when thinking about their virtual self in comparison to their real self (Choi et al., 2018).

According to other findings, there is an inverse relationship between playtime and brain functional connectivity, as longer playtime predicted significantly lower functional connectivity between the dorsal putamen and overlapping brain regions—including the right precentral and postcentral cortices—and, at the same time, predicted significantly higher functional connectivity between the dorsal putamen and bilateral inferior temporal cortices, which could underlie the vGD (Hong et al., 2015).

Through the evaluation of quantitative electroencephalograms (QEEG), adolescents with vGD in comorbidity with ADHD showed decreased relative delta-band power and higher relative beta-band power values in temporal regions compared to adolescents with ADHD alone, which could be associated with the requirement of a certain degree of alertness and agile attention management. Following the same line, the severity of ADHD symptoms was found to be positively correlated with intrahemispheric coherence of delta, theta, alpha, and beta bands in parieto-occipital regions in the ADHD and vGD group (Park et al., 2017).

Furthermore, adolescents with vGD in comorbidity with ADHD or major depression disorder displayed an association between chronic exposure to games with increased connectivity in all regions (anterior insula, dorsal anterior cingulate and frontal eye fields; ipsilateral dorsolateral prefrontal cortex and temporoparietal junction; and between

auditory and motor cortex) that are linked to rapid motor responses to visual and audiovisual stimuli and semantic memory (Han et al., 2017).

vgd-related risk factors

Different factors may increase the risk of VGD in adolescents. Among them are being male (Chiu, Pan, & Lin, 2018; King & Delfabbro, 2017); having anxiety, a depressive disorder (Yu & Cho, 2016) or ADHD; being impulsive (Park et al., 2016; Seok et al., 2018) or aggressive (Kim et al., 2018; Yuh, 2018); and having low self-esteem, low emotional self-control (Che et al., 2017; Seok et al., 2018), high sensation seeking (Hu, Zhen, Yu, Zhang, & Zhang, 2017), problems with social skills (Martín-Fernández et al., 2017), and negative coping styles (Schneider et al., 2018).

Adolescents in contexts of vulnerability and attention problems have a higher risk of presenting VGD (Peeters, Koning, & van den Eijnden, 2018). Likewise, the use of illegal drugs, in adolescents as cannabis according to Mérelle et al., (2017), or legal, such as nicotine and alcohol, increase the chances of presenting VGD (Van Rooij et al., 2014).

Game-specific risk factors that may increase the likelihood of VGD include playing with strangers online (King & Delfabbro, 2017), preference for multiplayer games (Wang et al., 2014), game versatility (Donati et al., 2015), and free access to games (Bonnaire & Phan, 2017; Seok et al., 2018).

Risk factors can also be found in family settings, where adolescents are prone to conflicts (Bonnaire & Phan, 2017; Yuh, 2018), lack of communication (Lyu, 2017), low cohesion (Yuh, 2018; Seok et al., 2018), disharmony (Wang et al., 2014), poor parental supervision (Lyu, 2017), lack of rules on video game use (Bonnaire & Phan, 2017), high parental video game use (Wu, Ko, Wong, Wu, & Oei, 2016), and low level of closeness with parents (King & Delfabbro, 2017; Seok et al., 2018).

However, certain factors may decrease the risk of presenting VGD: (a) school engagement, as it facilitates real and healthy social relationships that prevent excessive video game use (Yuh, 2018), (b) self-control combined with brief abstinence

(Evans et al., 2018), and, against all expectations, (c) having a criminal record (Ong, Peh, & Guo, 2016).

vgd measuring instruments

Several authors have based their research on nine criteria established for Internet Gaming Disorder in the DSM-V, to develop different measurement instruments (Chiu, Pan, & Lin, 2018; Koo, Han, Park, & Kwon, 2017; Pontes, Macur, & Griffiths, 2016; Vadlin, Åslund, & Nilsson, 2015). Among them is the Game Addiction Identification Test (GAIT) developed in Sweden. This instrument was created to measure game-related addictive factors in adolescents aged 12 and older, and to be used in clinical settings, communities, school health care, social services, etc. (Vadlin et al., 2015).

Instruments as the School-based Child Health Behavior Survey (HBSC) standardized in Denmark—which covers 11 to 15-year-old adolescents in school settings—aim to develop new and short measurement tools for non-clinical research on problems related to video games and internet use (Holstein et al., 2014). Other ones, as the Internet Gaming Disorder Scale – Short-Form (IGDS9-SF), validated in Slovenia with a representative sample of 12 to 16-year-olds, consist of nine Likert scale items (Pontes, Macur, & Griffiths, 2016).

In South Korea, researchers developed the Structured Clinical Interview for Internet Gambling Disorder (SCI-IGD) based on a sample of 236 high school students of 13 years on average. This interview consists of 12 items that assess six components that meet VGD criteria: concern, abstinence and tolerance, loss of control, mood modification, and negative consequences. It is important to note that the test-retest reliability examined in the interview over four weeks showed significant estimates from a moderate level to a near-perfect level (Koo et al., 2017).

In Taiwan, the Chinese version of the Internet Gaming Disorder Ten-item Internet Gaming Disorder Test (IGDT-10) was also validated based on the nine DSM-V criteria for the assessment of VGD. This test was administered to adolescents

between 10 and 18 years, and it established a 3.1% prevalence rate of VGD in Taiwanese students, with a predominance of males (Chiu, Pan, & Lin, 2018).

Conclusions

Evidence on VGD in adolescents comes from different latitudes of the world, with studies from Asia (58.3%), Europe (31.3%), Oceania (8.3%), and North America (2.1%). However, this review found no documentation on VGD for adolescents in Latin America.

Considering our main objective and the results of the analysis of the aforementioned investigations, we can characterize VGD in adolescents according to the following elements:

First, regarding the context of adolescents with VGD, it can be pointed out that they come from environments with high availability of electronic devices that facilitate early contact with video games and where a permissive family culture in the use of video games is maintained until adolescence. Additionally, the evidence demonstrates that adolescents with VGD present important relational problems with their families and/or group of peers and avoid them through virtual interactions with games. Thus, video games and their virtuality are described as a safeguard for adolescent suffering or as an alternative to real contexts (e.g., home, school, etc.) that can be seen as aversive.

Second, on the characteristics of adolescents with VGD, the evidence reviewed indicates that they are mostly boys who spend more hours—daily and weekly—playing than those without this disorder, and display a significant level of anxious, depressive, aggressive, impulsive, low self-esteem, isolation, and distressing personality traits. In addition, they have a greater preference for role-playing and battleground games, which turn out to be the most addictive because of their accessibility, visibility, and time spent on them.

Third, the psychological changes caused by VGD in adolescents can be differentiated. On an emotional level, we find affective instability, mood swings, and the appearance of anxious-depressive

states. At a cognitive level, we observe a ruminant thought about the game and an attachment to the virtual identity over the real one, which generates relevant conflicts in the self-concept. At a behavioral level, research has identified alterations in behavior that influence a lower amount of sleeping hours, quality and feeding times, and a distancing from real social interactions, generating progressive isolation.

Fourth, at a cerebral level, the studies consulted agree that VGD causes an increase or decrease in the activation of different areas in the brain, and that this has an effect on the appearance and evolution of this disorder. Thus, elements that we have described as typical of VGD in adolescents (impulsivity, problems of emotional regulation, and a predilection for a virtual self in replacement of the real self) would have a cerebral correlate linked, on the one hand, to an under-activation of the prefrontal lobe, the upper and lower frontal gyrus, and the anterior cingulate cortex, and on the other hand, to an over-activation of the occipital lobe, the cerebellum, and the post and pre-central gyrus.

Fifth, evidence shows the presence of various risk factors with respect to VGD in adolescents. On a personal level, they refer to being male, having low emotional control, difficulties in basic social skills, negative or insufficient coping styles, low self-esteem, impulsivity, drug use, and the presence of other disorders such as ADHD, anxiety, and depression. At the familial level, there are conflicts, low communication and cohesion, and poor or absent parental supervision. At the gaming level, risk factors involve playing with strangers, multiplayer video games, versatile games (different modalities and roles), and free access games. However, the observed studies also demonstrate the existence, although to a lesser extent, of some protective factors, such as school commitment and maintaining real social exchange relationships, positive family communication and supervision, and self-supervision in the use of video games.

Sixth, it should be noted that all the measuring instruments are designed based on the DSM-5's criteria and come mainly from Asia and

Europe. Nevertheless, the progress being made in the description of this disorder, as the definition of new diagnostic criteria by the World Health Organization, poses a challenge: developing new instruments to include it.

Despite this study's limitations, in order to expand its results, it is desirable to broaden the search for evidence in other databases and explore more specific documentation on the intervention and approach to vGD in adolescents. Additionally, the low number of Latin American publications related to this topic not only reveals the state of the research developed in these countries but also presents an opportunity to increase them (Polanco-Carrasco, 2017).

Finally, the evidence consulted offers key elements to better understand vGD in adolescents. This includes the identification of gaming motives, both conscious and unconscious, the value of family cohesion in the manifestation and treatment of vGD, and the importance of multilevel approaches where a therapeutic process can be complemented by psychoactive drugs that are indicated for the impulse regulation of other disorders such as anxiety or ADHD.

References

- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th Ed.). American Psychiatric Publishing. <https://doi.org/10.1176/appi.books.9780890425596>
- Benarous, X., Morales, P., Mayer, H., Iancu, C., Edel, Y., & Cohen, D. (2019). Internet gaming disorder in adolescents with psychiatric disorder: Two case reports using a developmental framework. *Frontiers in Psychiatry*, 10, 336. <https://doi.org/10.3389/fpsy.2019.00336>
- Bonnaire, C., & Phan, O. (2017). Relationships between parental attitudes, family functioning and Internet gaming disorder in adolescents attending school. *Psychiatry Research*, 255, 104-110. <https://doi.org/10.1016/j.psychres.2017.05.030>
- Brandão, I., Whitaker, M., Oliveira, M., Lessa, A., Lopes, T., Camargo, C., Josielson, C., & Moraes, J. (2019). Juegos electrónicos en la atención en salud de niños y adolescentes: revisión integradora. *Acta Paulista de Enfermagem*, 32(4), 464-469. <https://dx.doi.org/10.1590/1982-0194201900063>
- Brunborg, G. S., Mentzoni, R. A., Melkevik, O. R., Torsheim, T., Samdal, O., Hetland, J., Andreassen, C. S., & Palleson, S. (2013). Gaming addiction, gaming engagement, and psychological health complaints among Norwegian adolescents. *Media Psychology*, 16(1), 115-128. <http://dx.doi.org/10.1080/15213269.2012.756374>
- Che, D., Hu, J., Zhen, S., Yu, C., Li, B., Chang, X., & Zhang, W. (2017). Dimensions of emotional intelligence and online gaming addiction in adolescence: the indirect effects of two facets of perceived stress. *Frontiers in Psychology*, 8, 1206. <https://doi.org/10.3389/fpsyg.2017.01206>
- Chiu, Y. C., Pan, Y. C., & Lin, Y. H. (2018). Chinese adaptation of the Ten-Item Internet Gaming Disorder Test and prevalence estimate of internet gaming disorder among adolescents in Taiwan. *Journal of Behavioral Addictions*, 7(3), 719-726. <https://doi.org/10.1556/2006.7.2018.92>
- Choi, E. J., Taylor, M. J., Hong, S. -B., Kim, C., Kim, J. -W., McIntyre, R. S., & Yi, S. -H. (2018). Gaming-addicted teens identify more with their cyber-self than their own self: Neural evidence. *Psychiatry Research: Neuroimaging*, 279, 51-59. <https://doi.org/10.1016/j.psychresns.2018.05.012>
- Colder Carras, M., & Kardefelt-Winther, D. (2018). When addiction symptoms and life problems diverge: A latent class analysis of problematic gaming in a representative multinational sample of European adolescents. *European Child & Adolescent Psychiatry*, 27(4), 513-525. <https://doi.org/10.1007/s00787-018-1108-1>
- Dieris-Hirche, J., Pape, M., te Wildt, B. T., Kehyayan, A., Esch, M., Aicha, S., Herpertz, S., & Böttel, L. (2020). Problematic gaming behavior and the personality traits of video gamers: a cross-sectional survey. *Computers in Human Behavior*, 106, 106272. <https://doi.org/10.1016/j.chb.2020.106272>
- Ding, W., Sun, J., Sun, Y., Chen, X., Zhou, Y., Zhuang, Z., Li, L., Zhang, Y., Xu, J. R., & Du, Y. (2014).

- Trait impulsivity and impaired prefrontal impulse inhibition function in adolescents with internet gaming addiction revealed by a Go/No-Go fMRI study. *Behavioral and Brain Functions*, 10, 20. <https://doi.org/10.1186/1744-9081-10-20>
- Donati, M. A., Chiesi, F., Ammannato, G., & Primi, C. (2015). Versatility and addiction in gaming: The number of video-game genres played is associated with pathological gaming in male adolescents. *Cyberpsychology, Behavior, and Social Networking*, 18(2), 129–132. <https://doi.org/10.1089/cyber.2014.0342>
- Du, X., Liu, L., Yang, Y., Qi, X., Gao, P., Zhang, Y., Zhu, J., Du, G., Dai, S., Li, X., & Zhang, Q. (2017). Diffusion tensor imaging of the structural integrity of white matter correlates with impulsivity in adolescents with internet gaming disorder. *Brain and Behavior*, 7(8), e00753. <https://dx.doi.org/10.1002%2Fbrb3.753>
- Esposito, M. R., Serra, N., Guillari, A., Simeone, S., Sarracino, F., Continisio, G. I., & Rea, T. (2020). An investigation into video game addiction in pre-adolescents and adolescents: a cross-sectional study. *Medicina*, 56(5), e221. <https://doi.org/10.3390/medicina56050221>
- Evans, C., King, D., & Delfabbro, P. H. (2018). Effect of brief gaming abstinence on withdrawal in adolescent at-risk daily gamers: A randomized controlled study. *Computers in Human Behavior*, 88, 70–77. <https://doi.org/10.1016/j.chb.2018.06.024>
- Ferrer, C., & Delgado, A. (2018). Revisión sistemática de las medidas del trastorno por estrés postraumático. *Cuadernos de Neuropsicología/Panamerican Journal of Neuropsychology*, 12(1), 42–54. <http://dx.doi.org/10.7714/CNPS/12.1.205>
- Fumero, A., Marrero, R., Bethencourt, J., & Peñate, W. (2020). Risk factors of internet gaming disorder symptoms in Spanish adolescents. *Computers in Human Behavior*, 111, 106416. <https://doi.org/10.1016/j.chb.2020.106416>
- Griffiths, M., Király, O., Pontes, H., & Demetrovics, Z. (2015). An overview of problematic gaming. In E. Aboujaoude & V. Starcevic (Eds.), *Mental health in the digital age: Grave dangers, great promise* (pp. 27–45). Oxford University Press. <https://doi.org/10.1093/med/9780199380183.003.0002>
- Han, D., Kim, M., Bae, S., Renshaw, F., & Anderson, S. (2017). Brain connectivity and psychiatric comorbidity in adolescents with Internet gaming disorder. *Addiction Biology*, 22(3), 802–812. <https://psycnet.apa.org/doi/10.1111/adb.12347>
- Hellström, C., Nilsson, K., Leppert, J., & Åslund, C. (2015). Effects of adolescent online gaming time and motives on depressive, musculoskeletal, and psychosomatic symptoms. *Uppsala Journal of Medical Sciences*, 120(4), 263–275. <https://doi.org/10.3109/03009734.2015.1049724>
- Holstein, B., Pedersen, T., Bendtsen, P., Madsen, K., Meilstrup, C., Nielsen, L., & Rasmussen, M. (2014). Perceived problems with computer gaming and internet use among adolescents: Measurement tool for non-clinical survey studies. *BMC Public Health*, 14, 361. <https://doi.org/10.1186/1471-2458-14-361>
- Hong, S., Harrison, B., Dandash, O., Choi, E., Kim, S., Kim, H., Shim, D., Kim, C., Kim, J., & Yi, S. (2015). A selective involvement of putamen functional connectivity in youth with internet gaming disorder. *Brain Research*, 1602, 85–95. <https://doi.org/10.1016/j.brainres.2014.12.042>
- Hu, J., Zhen, S., Yu, C., Zhang, Q., & Zhang, W. (2017). Sensation seeking and online gaming addiction in adolescents: A moderated mediation model of positive affective associations and impulsivity. *Frontiers in Psychology*, 8, 699. <https://doi.org/10.3389/fpsyg.2017.00699>
- Kim, E., Yim, H. W., Jeong, H., Jo, S. J., Lee, H. K., Son, H. J., & Han, H. H. (2018). The association between aggression and risk of internet gaming disorder in Korean adolescents: the mediation effect of father-adolescent communication style. *Epidemiology and Health*, 40, e2018039. <https://doi.org/10.4178/epih.e2018039>
- Kim, N., Hughes, T., Park, C., Quinn, L., & Kong, D. (2016). Altered autonomic functions and distressed personality traits in male adolescents with internet gaming addiction. *Cyberpsychology, Behavior, And Social Networking*, 19(11), 667–673. <https://doi.org/10.1089/cyber.2016.0282>
- King, D., & Delfabbro, P. H. (2016). The cognitive psychopathology of internet gaming disorder in adolescence. *Journal of Abnormal Child Psychology*,

- 44(8), 1635–1645. <https://psycnet.apa.org/doi/10.1007/s10802-016-0135-y>
- King, D., & Delfabbro, P. H. (2017). Features of parent-child relationships in adolescents with internet gaming disorder. *International Journal of Mental Health and Addiction*, 15(6), 1270–1283. <https://psycnet.apa.org/doi/10.1007/s11469-016-9699-6>
- Koo, H., Han, D., Park, S., & Kwon, J. (2017). The structured clinical interview for DSM-5 internet gaming disorder: development and validation for diagnosing IGD in adolescents. *Psychiatry Investigation*, 14(1), 21–29. <https://doi.org/10.4306/pi.2017.14.1.21>
- Lee, J., Lee, S., Chun, J. W., Cho, H., Kim, D., & Jung, Y. C. (2015). Compromised prefrontal cognitive control over emotional interference in adolescents with internet gaming disorder. *Cyberpsychology, Behavior, and Social Networking*, 18(11), 661–668. <https://doi.org/10.1089/cyber.2015.0231>
- Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *PLoS Medicine*, 6(7), e1000100. <https://doi.org/10.1371/journal.pmed.1000100>
- Loayza-Jerjes, J. (2010). Los videojuegos on-line en Latinoamérica: impacto en las redes sociales y de consumo. *ICONO 14, Revista de Comunicación y Tecnologías Emergentes*, 8(1), 59–74. <https://doi.org/10.7195/ri14.v8i1.280>
- Lyu, S. (2017). Developmental process of internet gaming disorder among South Korean adolescents: Effects of family environment and recreation experience. *Journal of Child and Family Studies*, 26, 1527–1535. <https://doi.org/10.1007/s10826-017-0686-8>
- Martín-Fernández, M., Matalí, J., García-Sánchez, S., Pardo, M., Lleras, M., & Castellano-Tejedor, C. (2017). Adolescents with internet gaming disorder (IGD): Profiles and treatment response. *Adicciones*, 29(2), 125–133. <https://doi.org/10.20882/adicciones.890>
- Mérelle, S., Kleiboer, M., Schotanus, M., Cluitmans, T., Waardenburg, C., Kramer, D., van de Mheen, D., & Van Rooij, A. (2017). Which health-related problems are associated with problematic video-gaming or social media use in adolescents? A large-scale cross-sectional study. *Clinical Neuropsychiatry*, 14(1), 11–19.
- Mills, D., Mettler, J., Sornberger, M., & Heath, N. (2016). Adolescent problematic gaming and domain-specific perceptions of self. *International Journal of Cyber Behavior, Psychology and Learning*, 6(4), 44–56. <https://doi.org/10.4018/IJCPL.2016100104>
- Mohammadi, B., Szycik, G. R., te Wildt, B., Heldmann, M., Samii, A., & Münte, T. F. (2020). Structural brain changes in young males addicted to video-gaming. *Brain and Cognition*, 139, 105518. <https://doi.org/10.1016/j.bandc.2020.105518>
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Altman, D., & The PRISMA Group (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, 6(7), e1000097. <https://doi.org/10.1371/journal.pmed.1000097>
- Müller, K., Janikian, M., Dreier, M., Wölfling, K., Beutel, M., Tzavara, C., Richardson, 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(5), 565–574. <https://doi.org/10.1007/s00787-014-0611-2>
- Ong, R., Peh, C., & Guo, S. (2016). Differential risk factors associated with adolescent addictive disorders: A comparison between substance use disorders and internet/gaming addiction. *International Journal of Mental Health and Addiction*, 14, 993–1002. <https://doi.org/10.1007/s11469-016-9676-0>
- Park, J., Hong, J., Han, D., Min, K., Lee, Y., Kee, B., & Kim, S. (2017). Comparison of QEEG findings between adolescents with attention deficit hyperactivity disorder (ADHD) without comorbidity and ADHD comorbid with internet gaming disorder. *Journal of Korean Medical Science*, 32(3), 514–521. <https://dx.doi.org/10.3346%2Fjkms.2017.32.3.514>
- Park, J., Lee, Y., Sohn, J., & Han, D. (2016). Effectiveness of atomoxetine and methylphenidate for problematic online gaming in adolescents with attention deficit hyperactivity disorder. *Human Psychopharmacology*, 31(6), 427–432. <https://doi.org/10.1002/hup.2559>

- Park, J., Sung, J., Kim, D., Kong, I., Hughes, T., & Kim, N. (2018). Genetic association of human Corticotropin-Releasing Hormone Receptor 1 (CRHR1) with Internet gaming addiction in Korean male adolescents. *BMC Psychiatry*, 18(1), 396. <https://doi.org/10.1186/s12888-018-1974-6>
- Peeters, M., Koning, I., & van den Eijnden, R. (2018). Predicting internet gaming disorder symptoms in young adolescents: A one-year follow-up study. *Computers in Human Behavior*, 80, 255–261. <https://doi.org/10.1016/j.chb.2017.11.008>
- Polanco-Carrasco, R. (2016). La publicación científica como placebo. *Cuadernos de Neuropsicología/Panamerican Journal of Neuropsychology*, 10(2), 8–12. <http://dx.doi.org/10.7714/Cnps/10.2.101>
- Polanco-Carrasco, R. (2017). ¿Quién es el responsable del éxito o fracaso de una publicación? *Cuadernos de Neuropsicología/Panamerican Journal of Neuropsychology*, 11(3), 11–12. <http://dx.doi.org/10.7714/CNPS/11.3.101>
- Pontes, H., Macur, M., & Griffiths, M. (2016). Internet gaming disorder among Slovenian primary schoolchildren: Findings from a nationally representative sample of adolescents. *Journal of Behavioral Addictions*, 5(2), 304–310. <https://doi.org/10.1556/2006.5.2016.042>
- Qi, X., Yang, Y., Dai, S., Gao, P., Du, X., Zhang, Y., Du, G., Li, X., & Zhang, Q. (2016). Effects of outcome on the covariance between risk level and brain activity in adolescents with internet gaming disorder. *NeuroImage: Clinical*, 12, 845–851. <https://doi.org/10.1016/j.nicl.2016.10.024>
- Rasmussen, M., Meilstrup, C., Bendtsen, P., Pedersen, T., Nielsen, L., Madsen, K., & Holstein, B. (2014). Perceived problems with computer gaming and internet use are associated with poorer social relations in adolescence. *International Journal of Public Health*, 60(2), 179–188. <https://doi.org/10.1007/s00038-014-0633-z>
- Rehbein, F., Kliem, S., Baier, D., Mößle, T., & Petry, N. (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(5), 842–851. <https://doi.org/10.1111/add.12849>
- Rojas-Jara, C., Polanco-Carrasco, R., Cisterna, A., Hernández, V., Miranda, F., Moreno, A., & Alarcón, L. (2019). Uso medicinal de cannabis: una revisión de la evidencia. *Terapia Psicológica*, 37(2), 166–180. <https://doi.org/10.4067/S0718-48082019000200166>
- Sánchez-Domínguez, J. P., Telumbre-Terrero, J. Y., & Castillo-Arcos, L. C. (2021). Descripción del uso y dependencia a videojuegos en adolescentes escolarizados de Ciudad del Carmen, Campeche. *Health and Addictions*, 21(1), 1–14. <https://doi.org/10.21134/haaj.v21i1.558>
- Saqib, N., Saqib, J., Wahid, A., Ahmed, A., Dhuhayr, H., Zaghoul, M., Ewid, M., & Al-Mazrou, A. (2017). Video game addiction and psychological distress among expatriate adolescents in Saudi Arabia. *Addictive Behaviors Reports*, 6, 112–117. <https://doi.org/10.1016/j.abrep.2017.09.003>
- Schneider, L. A., King, D. L., & Delfabbro, P. H. (2018). Maladaptive coping styles in adolescents with internet gaming disorder symptoms. *International Journal of Mental Health and Addiction*, 16, 905–916. <https://doi.org/10.1007/s11469-017-9756-9>
- Seok, H., Lee, J., Park, C., & Park, J. (2018). Understanding internet gaming addiction among South Korean adolescents through photovoice. *Children and Youth Services Review*, 94, 35–42. <https://doi.org/10.1016/j.childyouth.2018.09.009>
- Stockdale, L., & Coyne, S. (2020). Parenting paused: Pathological video game use and parenting outcomes. *Addictive Behaviors Reports*, 11, 100244. <https://doi.org/10.1016/j.abrep.2019.100244>
- Su, P., Yu, C., Zhang, W., Liu, S., Xu, Y., & Zhen, S. (2018). Predicting Chinese adolescent internet gaming addiction from peer context and normative beliefs about aggression: A 2-year longitudinal study. *Frontiers in Psychology*, 9, 1143. <https://doi.org/10.3389/fpsyg.2018.01143>
- Tian, M., Tao, R., Zheng, Y., Zhang, H., Yang, G., Li, Q., & Liu, X. (2018). Internet gaming disorder in adolescents is linked to delay discounting but not probability discounting. *Computers in Human Behavior*, 80, 59–66. <https://doi.org/10.1016/j.chb.2017.10.018>
- Torres-Rodríguez, A., Griffiths, M. D., Carbonell, X., & Oberst, U. (2018). Internet gaming disorder in adolescence: Psychological characteristics of a clinical sample. *Journal of Behavioral Addictions*, 7(3), 707–718. <https://doi.org/10.1556/2006.7.2018.75>

- Vadlin, S., Åslund, C., & Nilsson, K. (2015). Development and content validity of a screening instrument for gaming addiction in adolescents: The Gaming Addiction Identification Test (GAIT). *Scandinavian Journal of Psychology*, 56(4), 458–466. <https://doi.org/10.1111/sjop.12196>
- Vadlin, S., Åslund, C., Hellström, C., & Nilsson, K. (2016). Associations between problematic gaming and psychiatric symptoms among adolescents in two samples. *Addictive Behaviors*, 61, 8–15. <https://doi.org/10.1016/j.addbeh.2016.05.001>
- Van Rooij, A., Kuss, D., Griffiths, M., Shorter, G., Schoenmakers, T., & 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. <https://doi.org/10.1556/jba.3.2014.013>
- Wang, C., Chan, C., Mak, K., Ho, S., Wong, P., & Ho, R. (2014). Prevalence and correlates of video and internet gaming addiction among Hong Kong adolescents: A Pilot Study. *The Scientific World Journal*, 2014, 1–9. <https://doi.org/10.1155/2014/874648>
- Wang, H., Jin, C., Yuan, K., Shakir, T. M., Mao, C., Niu, X., Niu, C., Guo, L., & Zhang, M. (2015). The alteration of gray matter volume and cognitive control in adolescents with internet gaming disorder. *Frontiers in Behavioral Neuroscience*, 9, 64. <https://doi.org/10.3389/fnbeh.2015.00064>
- Wang, Y., Yin, Y., Sun, Y., Zhou, Y., Chen, X., Ding, W., Wang, W., Li, W., Xu, & Du, Y. (2015). Decreased prefrontal lobe interhemispheric functional connectivity in adolescents with internet gaming disorder: A primary study using Resting-State fMRI. *PLoS One*, 10(3), e0118733. <https://doi.org/10.1371/journal.pone.0118733>
- Wartberg, L., Kriston, L., Kramer, M., Schwedler, A., Lincoln, T. M., & Kammerl, R. (2017). Internet gaming disorder in early adolescence: Associations with parental and adolescent mental health. *European Psychiatry*, 43, 14–18. <https://doi.org/10.1016/j.eurpsy.2016.12.013>
- World Health Organization. (2020). *Gaming disorder*. <https://icd.who.int/dev11/l-m/en#/http%3a%2f%2fid.who.int%2ficd%2fentity%2fi448597234>
- Wu, J., Ko, H., Wong, T., Wu, L., & Oei, T. (2016). Positive outcome expectancy mediates the relationship between peer influence and internet gaming addiction among adolescents in Taiwan. *Cyberpsychology, Behavior, and Social Networking*, 19(1), 49–55. <https://doi.org/10.1089/cyber.2015.0345>
- Yesilyurt, F. (2020). Internet gaming disorder: Remarks of psychiatrists. *World Journal on Educational Technology: Current Issues*, 12(2), 98–106. <https://doi.org/10.18844/wjet.v12i2.4813>
- Yu, H., & Cho, J. (2016). Prevalence of internet gaming disorder among Korean adolescents. *American Journal of Health Behavior*, 40(6), 705–716. <https://doi.org/10.5993/ajhb.40.6.3>
- Yuh, J. (2018). Aggression, social environment, and internet gaming addiction among Korean adolescents. *Social Behavior and Personality: An International Journal*, 46(1), 127–138. <https://doi.org/10.2224/sbp.6664>