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TECHNOLOGY ADDICTION (J BILLIEUX, SECTION EDITOR)

Personality and Internet Gaming Disorder: a Systematic Review of Recent Literature

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Abstract
Purpose of Review In this study, we present a systematic review of empirical studies that have addressed the relationship between Internet gaming disorder (IGD) and personality in the last 10 years (2007–2016). A systematic search of scientific literature identified 27 peer-reviewed empirical studies that examined the relationship between IGD and personality dimensions.
Recent Findings The findings of recent empirical studies suggest that IGD is linked to a wide range of personality traits, domains, and disorders.
Summary Although some personality factors such as high neuroticism, high impulsivity, and high aggressiveness emerged quite consistently as significant predictors of IGD across the studies, the overall result of this systematic review showed that different personality traits (more frequently, in combination) may play a pivotal role in the acquisition, development, and maintenance of IGD. Therefore, further research is needed to understand whether specific patterns of personality traits may predispose people to IGD.

Keywords Internet gaming disorder · Video game addiction · Personality · Personality traits · Systematic review

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Introduction

In the context of scientific debate about the nature of problematic Internet use, it has been shown that different Internet services and applications may have some addictive properties [1, 2••]. This is reflected in empirical research related to compulsive buying on the Internet, excessive social networking, watching online pornography, online gambling, and online computer gaming [3]. It is noteworthy that increasing scientific reports have begun to focus on the preoccupation some people develop with certain aspects of the Internet, and online games in particular, in part as a result of the inclusion of Internet gaming disorder (IGD) among the conditions for further study in the last edition of the *Diagnostic and Statistical Manual of Mental Disorders* [4]. Criticisms have been expressed about the consistency and validity of the diagnosis [1, 5•, 6, 7], including the tendency of researchers to compensate for a lack of theoretical conceptualizations and clinical evidence related to the disorder by adapting criteria of addictive disorders (e.g., substance abuse), with the assumption that a conceptual overlap or similarity exists [6–9]. In fact, some scholars have observed that excessive Internet gamers display symptoms related to their gaming behaviors that are similar to those of people suffering from substance use disorder, such as playing compulsively, frequent and obsessive thoughts regarding the game to the exclusion of other interests, social isolation, psychological discomfort when gaming is reduced, reduction of social, recreational, work, educational, household, and/or other activities, disregard about one's own and others' needs because of the behavior, withdrawal when pulled away from gaming, and persistent and recurrent online activity resulting in clinically significant impairment or distress [10, 11].Therefore, excessive Internet gaming behaviors are increasingly recognized as an issue of psychological and psychiatric relevance, due to the potentially negative effect of

excessive Internet gaming on multiple domains of functioning [7, 12–15]. In this respect, it is possible that the scientific debate resulting from the inclusion of IGD diagnosis and its criteria in the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) may help researchers to overcome the relevant methodological weaknesses of extant quantitative and clinical studies on problematic Internet gaming [7, 16–18].

A number of factors have been identified that may contribute to an increased vulnerability for developing IGD [19]. Among these factors, research suggests that personality traits may have a critical role in predisposing certain people to developing IGD [20••, 21, 22, 23•]. Personality traits can be conceived as habitual patterns of attitude, behavior, emotion, and thought; these patterns are relatively stable over time, differ across individuals, and influence behavior [24]. A combination of dysfunctional and/or maladaptive personality traits may also result in personality disorder [4]. In this article, we present a systematic review of the empirical studies that have linked personality traits and disorders to IGD symptoms in the last 10 years (2007–2016). Our choice to systematically review only articles published after 2006 is justified by the fact that online gaming has evolved with the development of technologies. Thus, we thought it was inappropriate to include research that was older than 10 years, as the inclusion of this research might have led to misleading or even non-extant conclusions.

Method

Search Strategies

A systematic search strategy was used to identify relevant studies. Research was conducted between November 2016 and January 2017, and included studies published in the last 10 years (January 2007–December 2016). Studies were identified by searching the following databases: MEDLINE/PubMed and PubMed Central, Scopus (Elsevier), ProQuest Psychology Journal, SpringerLink and SpringerLink Open Access, Directory of Open Access Journals, Taylor & Francis Online, Karger Journals, SAGE Journals, PsycArticles, and PsycINFO.

We used a three-step literature search. First, we used a combination of the keywords "personality" OR "trait" AND "Internet gaming" OR "online gaming" to identify the relevant studies. For the publication year, we selected the period between 2007 and 2016 as an additional criterion.

Secondly, a database search was performed using the names of the authors of all the articles identified in the first step. Finally, reference lists of articles selected were manually checked for any studies not retrieved by the automatic literature search. Article eligibility was independently evaluated by AC, AMG, and LLM. Any discrepancy regarding the inclusion/exclusion of articles was discussed within the research group up until an agreement was reached.

Selection Criteria

This systematic review is in compliance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines for the search, systematization, and reporting of systematic reviews [25]. Progressive exclusion was performed by reading the abstract and, finally, the full text. Including criteria were (a) published within the given time interval (2007–2016); (b) articles in English language; (c) articles published in peer-reviewed journals; and (d) articles focusing on personality traits and disorders associated with IGD. Newspaper articles and dissertations were excluded from the analysis. The database search resulted in a total of 503 articles. Duplicate articles resulted in a total of 17. Another 461 articles were excluded based on full-text evaluation, because they either: (a) analyzed Internet use as a whole, rather than Internet gaming behaviors, and/or (b) examined online video game activity but not personality traits, and/or (c) focused on the psychosocial outcomes and mental health of gamers rather than on IGD, and/or (d) examined neurobiological correlates of IGD, and/or (e) were literature reviews. Two additional articles were identified through a manual search. The 27 articles resulting from electronic and manual literature searches underwent close scrutiny, data extraction, and qualitative analysis. The entire article selection procedure is displayed in Fig. 1.

Data Analysis

Data analysis was carried out by considering the aims of the studies, the methodologies employed, and the results. Coded data included authors of the article, year of publication, sample characteristics (age, gender, country), personality variables investigated, IGD and personality measures, and the main findings of the study.

Results

In this section, we summarize the results of our review. We reviewed the findings for personality dimensions, traits and disorders examined in their relationship with IGD, including personality domains of the "Big Five" model [26], sociability, self-directedness, cooperativeness, impulsivity, self-regulation, aggressiveness, interpersonal dependency, narcissism, and clusters of personality disorders. A brief description of each investigated personality variable is provided in Table 1. For clarity of presentation, we separated the constructs to be studied into different categories, but as it is known in the

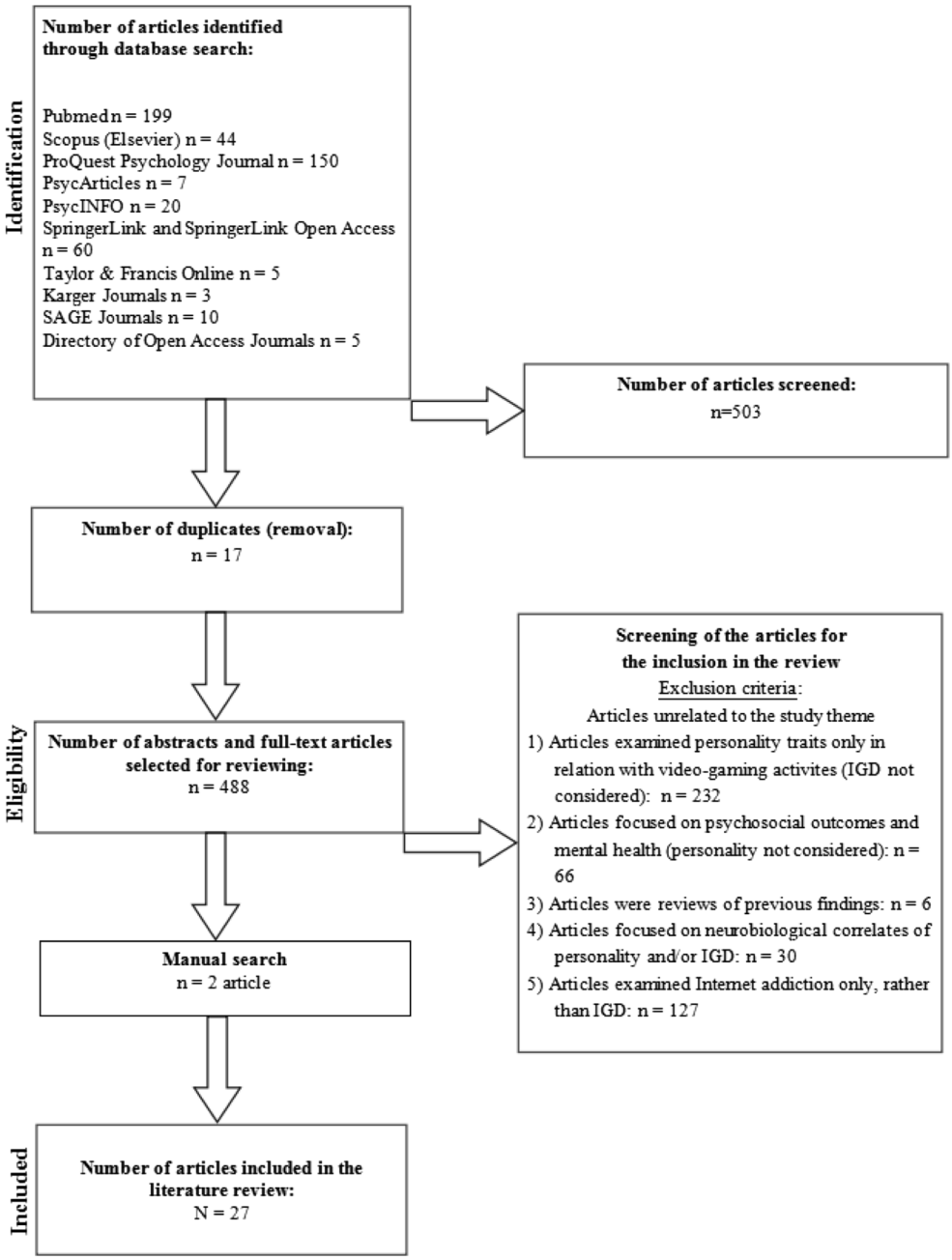

Fig. 1 Flow chart of the search strategy and selection procedure

literature [27–29] and as Table 1 illustrates, many of these constructs are often interrelated. Table 2 summarizes the results of the review.

Big Five Dimensions

The Big Five model of personality conceives of personality as a result of the interactions among five broad personality dimensions, namely, neuroticism, openness to experience, conscientiousness, extraversion, and agreeableness [26]. The theoretical framework provided by the Big Five model has generated several studies in video game-related research.

Mehroof and colleagues [19] suggested that neuroticism may be important in the acquisition, development, and maintenance of IGD. These authors found in a sample of students that neuroticism predicted their measure of online gaming addiction. Similarly, Montag and colleagues [20••] showed in a large and ecologically valid sample of first-person shooter video gamers that IGD scores were positively associated with neuroticism. Cole and Hooley [21] found that players of massively-multiplayer online (MMO) games with high levels of problematic Internet use were more neurotic than other participants. Also, Peters and Malesky [45] found a moderate and positive correlation between neuroticism and IGD in

Table 1 Personality traits and disorders associated with IGD in the research (2007–2016)

Neuroticism (Big Five dimension) describes an overall vulnerability to unpleasant feelings such as anxiety, sadness, nervousness, and a tendency to worry. It is associated with a predisposition to experiencing negative affects, so that neurotic people react worse to stressors and interpret ordinary situations as intimidating and minor frustrations as hopelessly difficult.

Openness to experience (Big Five dimension) describes a tendency toward curiosity, creativity, and preference for novelty and variety. People who are open to experience are intellectually curious, appreciative of art, and sensitive to beauty. They also tend to be more aware of their feelings than closed people.

Conscientiousness (Big Five dimension) is a tendency to show self-discipline and to act dutifully. People who are high in conscientiousness rely on organization, tend to work hard, and take a methodical approach to achieving their goals. They are also willing to spend a great amount of time and effort to succeed.

Extraversion (Big Five dimension) is characterized by the presence of energy, positive emotions, sociability, assertiveness, and the tendency to seek stimulation in the company of others. Extroverted individuals tend to prefer to be in the presence of other people, and they sometimes engage in thrill-seeking behavior.

Agreeableness (Big Five dimension) describes a tendency to be cooperative toward others rather than suspicious and antagonistic. People who are agreeable are also empathetic and altruistic. They tend to seek the best in everyone and they prove to be generous, dependable, honest, and concerned about the well-being of others.

Sociability is a component of extraversion. It describes the ability to be fond of the company of others. Sociable people are inclined to seek out the opportunity to have social contact with others. People high in this trait usually communicate their ideas well, are skilled in social interactions, and are able to resolve conflicts.

Cooperativeness is a component of agreeableness. It concerns the degree to which a person is generally agreeable in his or her relations with other people. People who are cooperative usually show high empathy and social tolerance, and they are ready to share with others a common purpose.

Self-directedness refers to self-determination. It is positively associated with conscientiousness and is inversely related to neuroticism. It represents the ability to regulate and adapt one's own behaviors in order to achieve personal goals. Self-directedness is also conceptually related to locus of control, so that low self-directedness is associated with external locus of control, whereas high self-directedness is associated with internal locus of control.

Impulsivity is a multifactorial construct that involves a tendency to display behavior characterized by little or no reflection, forethought, and/or consideration of the consequences. It can be conceived as a combination of distinct psychological components that are strictly related to the overarching dimension of impulsivity, such as urgency (the tendency to experience strong reactions, frequently in situations of negative affect), lack of premeditation (the tendency to disregard the consequences of an act before engaging in that action), lack of perseverance (a difficulty remaining focused on goal achievements), and sensation seeking (a tendency to pursue sensory pleasure and excitement, by the readiness to take risks). Other multifactorial models of impulsivity have highlighted the components of cognitive impulsiveness (the inability to focus on tasks), motor impulsiveness (acting on the spur of the moment), non-planning (acting without self-control), or the difference between functional impulsivity (a tendency to make quick in times when this cognitive style is beneficial for decisions) and dysfunctional impulsivity (a tendency to act with less forethought and an inability to both delay gratification and to control one's own behavior despite the negative consequences).

Self-regulation describes the ability to control impulses, thoughts, feelings, and behaviors. This ability allows individuals to manage and adaptively respond on emotional and cognitive levels to changes in external and internal stimuli.

Aggressiveness describes the tendency to harm oneself, other persons, or objects. It is often related to impulsivity and feelings such as anger, hate, and inferiority. Aggressive people are more likely to engage in violent behaviors.

Interpersonal dependency describes how affective responses, cognition, motivation, and actual patterns of behavior are affected by relationships to others, and how people relate with others.

Narcissism describes a pervasive pattern of grandiosity (in fantasy or behavior), need for admiration, and lack of empathy. Narcissistic people have an excessive need for admiration by others, and a sense of superiority and entitlement, so that they tend to consider themselves better than others, to exaggerate their skills, to excessively praise their successes, and to expect special treatment by others.

Cluster C personality disorders (DSM-5 mental disorders) include the avoidant, dependent, and obsessive-compulsive personality disorders. These three personality disorders share pervasive patterns of inflexible thoughts and behaviors resulting in social awkwardness and social withdrawal due to unprocessed feelings of inadequacy and relational fears.

another sample of massive multiplayer online role-playing game (MMORPG) players of World of Warcraft. In another study, Müller and colleagues [42] found that personality traits, and neuroticism in particular, were positively associated with Internet addiction and computer game addiction scores. In more detail, they compared four groups of participants in terms of personality traits: an IGD group (comprising patients in treatment for IGD), a pathological gambling group (comprising patients in treatment for gambling disorder), a clinical control group (comprising individuals seeking treatment), and a non-clinical control group (comprising healthy subjects recruited through local advertisements). Significant differences among groups emerged in different domains, with a large effect size for increased neuroticism in the IGD group. Khazaal and colleagues [23•] found in a large sample of late adolescents and young adults a positive association between gaming addiction scores and neuroticism scores. Another study by Lehenbauer-Baum and colleagues [39] showed that addicted gamers displayed more neurotic traits than engaged gamers, and Li and colleagues [40] found that the "online game addiction" group in their study showed higher neuroticism scores than the other participants who were not addicted

Table 2 Empirical studies examining the relationship between personality and Internet gaming disorder

First author	Sample *N*	Sample characteristics	Mean age	Country	Personality variables	IGD measure	Personality measure	Relationships between IGD and personality variables (main findings)
Billieux (2011) [30]	54	Regular player of MMORPGs (100% males)	23.43 (SD = 5.08)	Switzerland	Impulsivity	IAT	UPPS-P	Associations. High urgency was the only facet of impulsivity that significantly predicted problematic engagement in MMORPGs ($\beta = .45$, $p < .01$).
Billieux (2015) [8]	1057	Online gamers (87.7% males, 12.3% females)	26.01 (SD = 7.96)	France, Switzerland, Belgium (2.46% other countries)	Impulsivity Sensation seeking	IAT	UPPS-P	Differences between groups. Differences among problematic gamers found. Unregulated escapers: high impulsivity and low sensation seeking; Unregulated achievers: high on all impulsivity facets; Hardcore gamers: high levels of sensation seeking and the urgency dimension of impulsivity, but also high perseverance and high premeditation.
Blinka (2016) [31]	1463	Online gamers (90.8% males, 9.2% females)	24.40 (SD = 6.48)	Czech Republic and Slovak	Impulsivity	AEQ	DII	Associations. Dysfunctional impulsivity positively predicted IGD scores ($\beta = .25$).
Braun (2016) [32]	2891	Adults (83.7% males, 16.3% females) (78% gamers,16% gaming addicts, 6% non-gamers)	23.20 (SD = 5.99)	Online survey	Neuroticism Extraversion Conscientiousness Agreeableness	AICA-S gaming	BFI-S	Associations. IGD scores positively correlated with neuroticism ($r = .12$), and negatively correlated with extraversion ($r = -.14$) and conscientiousness ($r = -.25$). Differences between group. Higher neuroticism and lower extraversion in gaming addicts. Higher neuroticism in gaming addicts and non-gamers. No significant differences between non-gamers, regular gamers, and gaming addicts for agreeableness.
Choi (2014) [33]	60	Patients and controls 25% Internet gaming disorder, 25% gambling disorder, 25% alcohol use disorder, 25% healthy controls	20.80 (SD = 5.09)	South Korea	Impulsivity	IAT	BIS-11	Differences between groups. Total impulsivity scores higher in IGD and alcohol use disorder groups than in other groups. Cognitive impulsivity lower in the IGD group than that in the gambling disorder group, but motor and non-planning impulsivity higher in the IGD and alcohol use disorder groups than in the gambling disorder group.
Cole (2013) [21]	163	Adult online gamers (56.4% males, 40% females, 3.6% unreported)	27.3 (SD = 9.1)	Online survey	Neuroticism Extraversion Conscientiousness	GPIUS	NEO-PI-R	Differences between groups. MMO gamers showed more neuroticism and less extraversion and conscientiousness than other participants in the study.
Collins (2012) [22]	225	Adults (57.3% males, 42.7% females) 10% problematic MMORPG player, 19% non-problematic MMORPG players, 71% non-players	26.55 (SD = 9.48)	UK	Agreeableness Aggression Impulsivity Self-regulation	PVP	IPIP GME BPAS DII-S	Differences between groups. Self-regulation, dysfunctional impulsivity, and agreeableness decreased in problematic MMORPG players compared to non-problematic gamers. Physical and verbal aggression increased in problematic MMORPGs players, while impulsivity, functional impulsivity, and agreeableness scores were lower in the same problematic players compared to non-players.

Table 2 (continued)

First author	Sample *N*	Sample characteristics	Mean age	Country	Personality variables	IGD measure	Personality measure	Relationships between IGD and personality variables (main findings)
Collins (2013) [34]	416	Adults (62.5% males, 37.5% females) 65% non-problematic video game players, 18% problematic video game players, 17% non-gamers	27.3 years (SD = 8.48)	UK, USA, Australia, Spain (17.9% other countries)	Extraversion	GAS	EPQ-R-S	Differences between groups. No significant differences across groups (non-problematic video game players, problematic video game players, and non-gamers) in extraversion.
Festl (2012) [35]	4382	Online gamers (13% adolescents, 43% young adults, 44% adults)	37.8 (SD = 9.80)	Germany	Sociability Aggression	GAS	GSE AQ	Differences between groups. Sociability decreased and aggressive tendencies increased among adolescents with problematic game use.
Gentile (2011) [2]	2998	Children and adolescent students (72.7% males, 27.3% females) 48% in primary schools, 52% in secondary schools	11.2 (SD = 2.06)	Singapore	Impulsivity	PVG	BIS-11	Associations. A longitudinal growth model showed that increased impulsivity fostered the development, maintenance, and worsening of pathological gaming among participants.
Jiménez-Murcia (2014) [36]	193	Gambling disorder patients (86.5% males, 13.5% females): 62.69% non-video game users; 22.27% video game users; 15.04% video game addicts	42.4 (SD = 13.4)	Spain	Self-directedness	VDT	TCI	Differences between groups. Self-directedness decreased among video game users and video game addicts. Associations. Lower self-directedness scores uniquely predicted IGD scores ($\beta = -.97$, $p < .01$).
Khazaal (2016) [23•]	5983	Young adults (55.5% French-speaking, 44.5% German-speaking)	20.0 (SD = 1.2)	Switzerland	Neuroticism Sociability Aggression Sensation seeking	GAS	ZKPQ-50-cc BSSS	Associations. IGD scores were positively associated with neuroticism ($r = .24$) and negatively associated with sociability ($r = -.20$) in the French-speaking community. In the German-speaking community, IGD scores were positively associated with neuroticism ($r = .23$) and aggression ($r = .15$) and negatively associated with sociability ($r = -.10$). No significant associations were found between sensation seeking and IGD scores.
Kim (2008) [37]	1471	Online gamers (82.7% males,17.3% females)	21.30 (SD = 4.96)	South Korea	Narcissism Aggressiveness	GAS	NPDS	Associations. Narcissistic personality traits ($\beta = .19$, $p < .001$) and aggressiveness ($\beta = .16$, $p < .001$) positively predicted IGD scores.
Lehenbauer-Baum (2014) [38]	577	Online gamers (77.1% males, 22.9% females)	24.38 (SD = 1.89)	Germany, Austria, Switzerland	Agreeableness Conscientiousness	WoW questionnaire	BFI-10	Differences between groups. Significant differences between addicted and engaged players, with addicted players reporting higher scores on agreeableness and conscientiousness.
Lehenbauer-Baum (2015) [39]	682	Online gamers (84.9% males, 15.1% females)	23.26 (SD = 5.98)	Germany, Austria, Switzerland	Neuroticism Agreeableness Conscientiousness	GAS WoW questionnaire	BFI-10	Differences between groups. Addicted gamers reported lower scores than engaged gamers on agreeableness, conscientiousness, and neuroticism.
Li (2016) [40]	654	Students (45.6% males, 54.4% females) 4.8% addict gamers, 95.2% non-addict gamers	20.29 (SD = 1.39)	China	Neuroticism	OGCAS CIAS	EPQ-RS	Differences between groups. The IGD group scored higher on neuroticism than other participants.

Table 2 (continued)

First author	Sample *N*	Sample characteristics	Mean age	Country	Personality variables	IGD measure	Personality measure	Relationships between IGD and personality variables (main findings)
Martín-Fernández (2016) [41••]	59	Patients (96.6% males, 3.4% females)	14.83 (SD = 1.45)	Spain	Cluster C personality	Clinical interview	Kiddie-sads	Descriptive. 11% of those with a diagnosis of Internet gaming disorder showed Cluster C personality disorders in comorbidity.
Mehroof (2010) [19]	123	Students (58.5% males, 41.5% females)	21.95 (SD = 4.1)	UK	Neuroticism Sensation seeking Aggression	GAS	SCS BPAQ AISS EPQ-R-S	Associations. Sensation seeking (β = 1.04, $p < .001$), neuroticism (β = 2.04 $p < .01$), and aggression (β = .21; $p < .01$) positively predicted IGD scores.
Montag (2011) [20••]	610	Online gamers—students (97% males, 3% females)	19.32 (SD = 4.40)	Germany	Neuroticism Extraversion Openness to experience Agreeableness Conscientiousness Cooperativeness Aggression Self-directedness	IAT	NEO-FFI TCI ANPS	Associations. IGD scores were positively correlated with neuroticism (r = .33) and aggression (r = .30) and were negatively correlated with extraversion (r = −.15), openness to experience (r = −.12), agreeableness (r = −.27), conscientiousness (r = −.35), self-directedness (r = −.48), and cooperativeness (r = −.30, $p < .01$). Participants with IGD showed higher self-directedness (β = − .32; $p < .01$) and lower consciousness (β = − 12; $p < .01$) than the other participants.
Müller (2014) [42]	404	Adolescent and young adult men (Internet gaming disorder group 28.46%; clinical control group 18.31%; pathological gambling group 30.19%; non-clinical control group 23.04%)	22.90 (SD = 6.13)	Germany	Neuroticism Extraversion Conscientiousness Openness to experiences	AICA-S	NEO-FFI	Differences between groups. The IGD group showed higher neuroticism and openness to experiences, and lower conscientiousness and extraversion than the other groups. Associations. Neuroticism (β = .25, $p < .001$) and conscientiousness (β = −.39; $p < .001$) predicted IGD scores.
Müller (2016) [43•]	699	Adults (97.9% males, 2.1% females) (Internet addiction group 32.49%; gambling disorder group 33.33%; control group 20.35%; specific control group for Internet addiction 13.83%)	26.0 (SD = 8.69)	Germany	Sensation seeking	AICA-C AICA-S	SSS-V	Differences between groups. Addicted gamers and gamblers reported lower scores in sensation seeking.
Nuyens (2016) [44]	36	Online gamers (84% males, 16% females)	21.35 (SD = 1.89)	Belgium	Impulsivity	POGQ	UPPS-P BIS-11	Associations. Cognitive impulsivity (and no other impulsivity dimensions) was associated with IGD preoccupation (r = .41) and immersion scores (r = .33).
Peters (2008) [45]	196	Online gamers (88.3% males, 11.7% females)	24.34 (SD = 5.36)	USA	Agreeableness Neuroticism Extraversion Conscientiousness	WoW AEQ	NEO-PI-R	Associations. IGD scores were negatively correlated with agreeableness (r = −.30), positively correlated with neuroticism (r = .38), and low negatively correlated with extraversion (r = −.24) and with conscientiousness (N = 145, r = −.289, $p < .001$).
Škarupovà (2016) [46••]	6730	Online gamers (93.5% males, 6.5% females)	20.81 (SD = 5.95)	Czech Republic and Slovak	Interpersonal dependency	AEQ	RPT	Associations. Destructive overdependence (β = .17, $p < .01$) and dysfunctional detachment (β = .17, $p < .01$) positively predicted IGD scores, while

Table 2 (continued)

First author	Sample *N*	Sample characteristics	Mean age	Country	Personality variables	IGD measure	Personality measure	Relationships between IGD and personality variables (main findings)
								healthy-dependency personality ($\beta = -.13$, $p < .01$) negatively predicted IGD scores.
Vollmer (2014) [47]	741	Adolescents (60.2% males, 39.8% females)	12.89 (SD = 1.05)	Turkey	Agreeableness Neuroticism	CGA	BFI-10	Associations. Extraversion ($\beta = -.10$, $p < .005$) and agreeableness ($\beta = -15$, $p < .001$) negatively predicted IGD scores.
Walther (2012) [48]	2553	Adolescents and young adults (50.7% males, 49.3% females)	Not reported (age between 12 and 25 years old)	Germany	Impulsivity Aggression	KFN-CSAS-II	IVE SBB-SSV	Associations. Problematic computer gaming was associated with higher irritability/aggression (OR = 1.64) and higher impulsivity (OR 1.79).
Wang (2015) [49]	920	Students (36.6% males, 63.4% females)	15.5 (SD = 1.5)	China	Openness Conscientiousness	IAT GAS	BFI-10	Associations. Conscientiousness ($\beta = -.09$, $p < .01$) and openness to experiences ($\beta = -.06$, $p < .05$) negatively predicted Internet gaming disorder scores. No significant associations found between neuroticism and IGD scores.

Personality measure

AISS Arnett Inventory of Sensation Seeking, *ANPS* Affective Neuroscience Personality Questionnaire, *AQ* Aggression Questionnaire, *BFI-10* Big Five Inventory with 10 items, *BFI-S* Big Five Inventory-Socio Economic Panel, *BIS-11* Barratt Impulsiveness Scale, *BPAQ* Buss-Perry Aggression Questionnaire, *BPAS* Buss-Perry Aggression Scale, *BSSS* Brief Sensation Seeking Scale, *DII* Dickman's Impulsivity Inventory, *DII-S* Dickman's Impulsivity Inventory Short, *EPQ-R-S* Eysenck Personality Questionnaire Revised Short Scale, *GME* Grossarth-Maticek and Eysenck's, *GSE* General Self-Efficacy Expectations Scale, *IPIP* International Personality Item Pool Big Five Factor Markers questionnaire, *IVE* Inventory of Impulsivity, Risk Behaviour and Empathy, *Kiddie-sad* Kiddie-sad present and life time interview, *NEO-FFI* NEO Five-Factor Inventory, *NEO-PI-R* Revised NEO Personality Inventory, *NPDS* Narcissistic Personality Disorder Scale, *RPT* Relationship Profile Test, *SBB-SSV* Rating Scale for Oppositional Defiant/Conduct Disorders, *SCS* Self-Control Scale, *SRS* Self-Regulation Scale, *SSS-V* Sensation Seeking Scale-FormV, *TCI* Temperament and Character Inventory, *TCIR* Temperament and Character Inventory-Revised, *UPPS-P* Urgency, Premeditation, Perseverance, Sensation Seeking, Positive Urgency, *ZKPQ-50-cc* Zuckerman-Kulhman Personality Questionnaire-50-CC

IGD measure

AEQ Addiction-Engagement Questionnaire, *AICA-C* Checklist for the Assessment of Internet and Computer Game Addiction, *AICA-S gaming* Scale for the Assessment of Internet and Computer Game Addiction, *AICA-S* Scale for the Assessment of Pathological Computer Gaming, *CGA* Computer Game Addiction, *GAS* Game Addiction Scale, *GPIUS* Generalized Pathological Internet Use Scale, *CIAS* Chinese Internet Addiction Scale, *IAT* Internet Addiction Test, *KFN-CSAS-II* Video Game Dependency Scale, *OGCAS* Online Game Cognitive Addiction Scale, *POGQ* Problematic Online Game Questionnaire, *PVG* Pathological Video Game Use, *PVP* Problem Video Game Playing Scale, *VDT* Test de Dependencia de Videojuegos

to online gaming. In contrast to the majority of the studies, in which neuroticism was a positive predictor of IGD, two other major studies reported small or even non-significant associations between IGD scores and neuroticism. Braun and colleagues [32] examined the personality characteristics and IGD symptoms of gaming addicts, regular gamers, and non-gamers. They found a positive but weak association between IGD scores and neuroticism, and an analysis of variance surprisingly showed that non-gamers and gaming addicts had the highest scores for neuroticism compared to regular gamers. Wang and colleagues [49] found that neuroticism was not significantly associated with gaming addiction in a study examining addictive behaviors in relation to different online activities among adolescents.

The findings on the relationships between the other Big Five domains and IGD symptoms were mixed. In their already mentioned study, Montag and colleagues [20••] found that IGD scores were negatively associated with extraversion, openness to experience, agreeableness, and conscientiousness, with low conscientiousness emerging in regression models as a significant predictor of Internet addiction scores among gamers. In the study by Wang and colleagues [49], low conscientiousness and low openness to experiences were significantly associated with gaming addiction. Müller and colleagues [42] found instead that participants displaying IGD showed lower extraversion and conscientiousness but higher openness to experience compared to the pathological gambling group. However, in Müller and colleagues' study, only low conscientiousness and high neuroticism predicted the scores for Internet and gaming addiction. Braun and colleagues' study [32] suggested that gender differences may help understand these conflicting results: they found in a German adult sample that openness to experiences statistically interacted with gender, so that male gamers showed lower openness to experience than non-gamers, whereas female gamers showed significantly higher scores for openness to experience than non-gamers. Also, in their study, excessive gamers reported significantly lower scores on extraversion and conscientiousness than non-gamers and regular gamers, while they did not find significant differences between non-gamers, regular gamers, and excessive gamers for agreeableness. Yet, Collins and colleagues [22] found that agreeableness decreased in problematic MMORPG players with respect to both non-problematic MMORPG players and non-players, and Vollmer and colleagues [47] found that agreeableness, together with extraversion, negatively predicted online gaming addiction scores in a sample of adolescents. Also, Peters and Malesky [45] found in a sample of players of World of Warcraft low to moderate negative correlations between online gaming addiction scores and agreeableness, conscientiousness, and extraversion, and Lehenbauer-Baum and colleagues [39] found that addicted gamers reported lower scores in comparison to healthy-engaged gamers [50] in the dimensions of agreeableness and conscientiousness. However, a year before this, Lehenbauer-Baum and Fohringer [38] published another study in which an opposite pattern of associations emerged, with addicted players showing higher rather than lower scores in the dimensions of agreeableness and conscientiousness. In this context, two other studies are relevant: Cole and Hooley [21] found that gamers with higher IGD symptoms scored lower on conscientiousness and extraversion than their counterparts, who did not show significant IGD symptoms. Conversely, Collins and colleagues [34] did not find significant differences among three groups of adolescents (non-problematic video game players, problematic video game players, and non-gamers) with respect to extraversion.

Sociability, Self-Directedness, and Cooperativeness

Several personality features have been explored in relation to IGD. Some of these personality features can be conceived as specific traits within the Big Five model of personality, and among these are sociability, cooperativeness, and self-directedness.

In the study by Montag and colleagues [21], Internet addiction scores among gamers were negatively correlated with both self-directedness and cooperativeness, with low self-directedness explaining most of the variance in Internet addiction scores. Festl and colleagues [35] found among German adolescent gamers that social competence and social integration were negatively related to game addiction scores, with low sociability specifically linked to problematic gaming. Likewise, Khazaal and colleagues [23•] found a negative association between sociability and gaming problems. Finally, Jiménez-Murcia and colleagues [36] found in a group of video game users and video game abusers that low levels of self-directedness uniquely predicted IGD scores.

Impulsivity and Sensation Seeking

Several studies [8, 22, 27, 31, 33] showed that there are significant overlaps between personality dimensions and impulsivity components. For example, the urgency component and the inability to delay gratification are related to neuroticism; lack of premeditation, lack of perseverance, and dysfunctional impulsivity are related to low consciousness; moreover, sensation seeking and dysfunctional impulsivity are also connected with extraversion. The findings on the relationship between impulsivity and IGD suggest that specific facets of impulsivity may be linked with IGD.

Among the few findings against this assertion, the problematic group of MMORPG players in Collins and colleagues' [22] study scored significantly lower in dysfunctional impulsivity than non-problematic MMORPG players and even non-players. Conversely, Blinka and colleagues [31]

found a moderate and positive association between dysfunctional impulsivity and online gaming addiction scores in a large sample of MMO gamers. In their study, regression analyses showed that dysfunctional impulsivity was a significant predictor of gaming addiction. Similarly, in a previous study examining the psychological predictors of problematic involvement in MMORPGs, Billieux and colleagues [30] found that high urgency was a significant predictor of problematic engagement in the game. Moreover, in another study, Billieux and colleagues [8] examined a large sample of online gamers, and found that impulsivity was related to problematic gaming. They identified through cluster analysis three subtypes of problematic online gamers: unregulated escapers were characterized by high impulsive traits but low levels of sensation seeking; unregulated achievers were high on all impulsivity facets (urgency, lack of premeditation, lack of perseverance, sensation seeking); hardcore gamers showed a contrasting but interesting profile characterized by high levels of sensation seeking and urgency and at the same time high levels of premeditation and perseverance. Nuyens and colleagues [44] explored impulsivity in multiplayer online battle arena (MOBA) gamers and found that cognitive impulsivity was associated with problematic online gaming. Previously, Choi and colleagues [33] examined differences in impulsivity among individuals diagnosed with IGD, gambling disorder (GD), alcohol use disorder (AUD), and controls. The IGD and AUD groups scored significantly higher on total impulsivity than the other groups, with increased scores in motor and non-planning impulsivity among Internet gamers further explaining the differences between patients with IGD and pathological gamblers. Also, Walther and colleagues [48] found in a large sample of students that high levels of impulsivity consistently predicted IGD. However, stronger evidence for the relationship between impulsivity and IGD is a 2-year prospective study by Gentile and colleagues [2••], who showed through a 2-year longitudinal study that high impulsivity is a risk factor for becoming a pathological gamer among children and adolescent students.

Sensation seeking is a personality feature that has been clearly linked with impulsivity [27], but it is often studied as a stand-alone construct in research. In Mehroof and Griffiths' [19] study, sensation seeking showed a predictive association with online gaming addiction scores among students. In contrast, Muller and colleagues [43•] compared patients with gambling disorder, patients with IGD, and healthy controls, and they found that sensation seeking was surprisingly lower in addicted gamers and pathological gamblers than in controls. Moreover, the study by Khazaal and colleagues [23•] did not show significant associations between gaming addiction scores and sensation seeking. However, with respect to these latter studies, it may be useful to observe that the measures used to assess sensation seeking may not be particularly appropriate for IGD research, as the used scales were developed to address the more action-based component of sensation seeking (e.g., through extreme sports) rather than the component of psychological and sensory excitement, which may be more relevant to Internet gamers.

Self-Regulation and Aggressiveness

As already mentioned, personality dimensions and traits may be closely related and sometimes overlap [51]. As such, impulsivity and sensation seeking show positive relationships with aggressiveness and low capacities for self-regulation [52]. In fact, people who are highly impulsive often fail to regulate painful or otherwise negative feelings, and some of them are also prone to a host of high-risk behaviors characterized by poor self-control and by elements of aggressiveness [53].

Collins and colleagues [22] found that aggressiveness correlated positively with scores on problematic video gaming. Moreover, in their study, the problematic group of gamers showed significantly lower scores in self-regulation than the non-problematic group and scored significantly higher in physical aggression and verbal aggression than non-players. Also, Mehroof and Griffiths [19] showed that aggressiveness was a good predictor of online video game addiction. Similarly, the study of Kim and colleagues [37] on online game users suggested that IGD could be predicted on the basis of higher aggressiveness scores. Walther and colleagues [48] also found that high levels of aggressiveness predicted IGD, and Montag and colleagues [21] found positive associations between Internet addiction scores and aggressiveness among first-person shooter video game players. Moreover, Festl and colleagues [35] found among German gamers that problematic game use was associated with aggressive tendencies (whether physical or anger-related), and Khazaal and colleagues [23•] found a significant, albeit weaker, association between gaming addiction scores and aggressiveness.

Other Personality-Related Constructs

The results obtained from systematic review showed that other personality-related constructs, such as interpersonal dependency, narcissism, and personality disorders, may play a pivotal role in the acquisition, development, and maintenance of IGD.

Škarupová and Blinka [46••] showed in relation a large sample of online gamers that IGD scores were negatively associated with healthy dependency, whereas the associations between IGD and the negative dimensions of interpersonal dependency—destructive overdependence and dysfunctional detachment—were positive.

A study by Kim and colleagues [37] explored the relationship between online game addiction and narcissistic personality traits in a sample of MMORPG players. In this study,

higher narcissistic personality traits predicted the severity of online game addiction.

Finally, we found only one article that examined the relationship between IGD and diagnosed personality disorders. Martin-Fernandez and colleagues [41••] described the profiles of 59 Spanish patients from a hospital unit. Of these patients, 11% presented comorbidity with cluster C (including avoidant, dependent, and obsessive) personality disorders.

Discussion

This systematic review illustrated the associations between personality features and IGD. The relationship between IGD symptoms and the Big Five model of personality has been extensively investigated, and this model has been considered of particular relevance for the understanding of the online game addiction process [37]. Regarding neuroticism, the findings are quite consistent and mirror results of research on problematic Internet use, suggesting that a high level of neuroticism is involved in a maladaptive use of the Internet [19, 20••, 40, 49]. For people who are high in this personality trait, it is possible to conceptualize problematic online gaming as a maladaptive coping strategy that may serve to reduce tension (i.e., as a mood modifier) [43•, 51] and/or to overcome negative life events [54–59].

With respect to the other Big Five domains, low agreeableness seems to also play a relevant role in IGD. This finding is consistent with considerations reported by many scholars [10, 20••, 36, 42] that decreased agreeableness indicates a higher tendency toward competition than toward cooperation. Computer games often demand high competitiveness to achieve game success, which might reinforce the gaming behavior. However, in some games such as MMORPGs, it is also crucial to cooperate with others. Thus, findings of the studies linking agreeableness to IGD should be observed in relation to their related results on extraversion. In fact, the effects of decreased agreeableness might be regarded in the same light as decreased extraversion for the development of problematic Internet gaming. Perhaps, as a consequence of impaired social participation in the real world, some gamers might become aware of other people creating distance. Lacking close social boundaries could motivate the gamer to search for social contacts in virtual environments. Moreover, less extroverted people may compensate for loneliness through activities such as playing computer games, but they may also use games to express themselves and their feelings better in a controlled virtual context that allows them to maintain the desired distance from other people. Thus, despite the fact that several studies [19, 20••, 42] have hypothesized that introverted people usually have a poorer social network and experience more rejection by peers, there are studies [22, 34] in which no significant differences in extraversion emerged between players and non-players.

Likewise, several studies [21, 42, 45, 49] discussed how people scoring low on conscientiousness are less persistent in pursuing personal aims and often show difficulties organizing their activities. If gamers with these characteristics find the environments of computer games particularly attractive, they might be at greater risk of developing IGD-related problems, as they do not pay much attention to the duties of everyday life. Other studies underline that addictive use of gaming may be influenced by low openness to experience. It might be that gamers with low openness to experience tend to stick to their gaming behavior instead of exploring new activities, thus making low openness to experience even more important for the maintenance of IGD than for the onset of IGD [20••, 49].

All these considerations may explain results concerning lower levels of sociability, self-directedness, and cooperativeness in IGD, which can also result in lower expectations of self-efficacy, lower life satisfaction, less perceived social support, and increased feelings of anger as potential consequences [20••, 23•, 35, 36].

In this respect, understanding the role of impulsivity in online gaming may be an important contribution to the conceptualization of IGD. Literature focusing on addictive behaviors suggest that addiction is strictly related to high impulsivity [59], and the examined studies showed that both impulsivity and sensation seeking are related to problematic gaming in some samples [2••, 8, 31, 33, 36, 44]. The most important study in this field is that of Gentile and colleagues [2••], who showed with longitudinal data that impulsivity combined with other significant risk factors (such as high amount of gaming, depression, anxiety, and low social competence) increased the risk of pathological gaming, but also that, in a vicious circle, pathological gaming increased impulsivity across time. However, despite most of the studies [31, 33, 44] showing that higher impulsivity increases the risk of developing symptoms of IGD, impulsivity is a broad construct, so it is likely that specific components of impulsivity, such as high urgency [8], are more relevant for understanding IGD. In fact, Collins' study [22] found decreased dysfunctional impulsivity among gamers; Billieux et al. [8, 30] showed that specific components of impulsivity may be linked at different levels to different profiles of problematic gaming. Moreover, findings on sensation seeking are highly inconsistent, suggesting that problematic gaming may be related to both high [19] and low [43•] levels of sensation seeking, or may even be unrelated to such a construct [23•]. A possible explanation of these conflicting findings is that people who display problematic gaming have diverse psychological profiles, also with respect to impulsivity facets [8]. For example, impulsive people are very unlikely to excel at some games such as MMORPGs, and in fact, impulsivity may limit their enjoyment as it may be detrimental to achievement in the game;

however, other players high in impulsiveness may find it enjoyable to excessively play in order to overcome their boredom and/or to feel psychologically or physiologically stimulated [60]. In sum, research findings highlight that impulsivity and its facets are probably involved with IGD, but their specific contributions need further research.

A difficulty with self-regulation could be a general trait that increases the risk of developing an IGD [61]. Limited self-regulation abilities often foster compensatory strategies that allow the individual to cope (albeit dysfunctionally) with negative affect [55]; in fact, some researchers have proposed that excessive gaming might be a coping strategy to deal with temporary or persistent emotional distress [54, 56, 57, 61].

Aggressive tendencies (whether physical or anger-related) seem also to be linked to IGD. In this respect, there is a quite high degree of agreement among the studies [19, 20••, 22, 35, 37, 47, 62]. In fact, research has shown a link between excessive gaming and a liking for game violence [63–65]. However, the directionality and origins of aggression are not revealed in the examined study. Also, considering the fact that low agreeableness, low self-directedness, and low self-regulation seem also to be involved in IGD, it is possible that more aggressive players can engage in specific online games (e.g., first-person shooter games) to express, in the safe context of a virtual world, their aggressive impulses without harming anyone.

A unique finding has emerged from Škarupová and Blinka's study [46••], in which the authors suggested that the negative traits of destructive overdependence and dysfunctional detachment may predispose some individuals toward developing addictive use of video games. This finding expands the literature on IGD and on interpersonal dependency as a trait [66, 67]. The concept of interpersonal dependency is to some extent similar to the concept of attachment [68], an inborn motivational system that steers an individual's attitude toward a desire for close relationships. Attachment styles have indeed shown significant associations with problematic Internet use [59]. In the case of IGD, it is possible that individuals with problematic interpersonal dependency seek an escape toward a more detached social environment (dysfunctional detachment), or, on the contrary, they may constantly seek the social support and recognition of fellow gamers (destructive overdependence).

Finally, it is no surprise that the few people with both personality disorders and IGD observed in Martin-Fernandez and colleagues' [41••] study displayed mainly Cluster C personality disorders (avoidant, dependent, or obsessive-compulsive personality disorders), as Cluster C disorders reflect many personality traits already discussed, e.g., low extraversion is a characteristic of avoidant personality, overdependence is a characteristic of dependent personality, and low openness to experience is a characteristic of obsessive-compulsive personality. Furthermore, narcissistic personality traits showed positive associations with IGD [37]. This finding seems to be inconsistent with a previous report by Niemz and colleagues [69], who found that low self-esteem and a negative evaluation of the self were good predictors of generalized problematic Internet use and the amount of time spent online. Moreover, the unique characteristics of MMORPGs may explain Kim and colleagues' [53] findings of a positive relationship between narcissistic traits and IGD. In MMORPGs, leveling-up and getting items, recognition, and admiration from other players could be major attractions for many players [70]. Thus, for some people with increased narcissistic personality traits, playing MMORPGs can be reinforcing because it may bolster self-esteem and provide status and respect.

Limitations of Current Studies and Future Directions

The results of this review should be considered in light of limitations of the examined studies. The first limitation relates to the paucity of studies on IGD as a specific construct, which did not allow us to disentangle the different conceptualizations of IGD and the differences in the measurement of both IGD and personality traits in the various studies. The second limitation is that most of the studies described in this review are correlational and/or did not control for multiple comparisons, which strongly limit the possibility of establishing causal links between specific personality traits and IGD. A third problem arises when considering the age of participants and the composition of the samples. Many studies focused on male adolescents and young adults, and often no controls for age, were applied in the study, which limits the generalizability of our review to adult people and patients suffering from IGD. A fourth limitation is that there are clear discrepancies between the types of gamers in the different studies (e.g., MMORPG gamers, MOBA gamers, first-person shooter gamers), and these discrepancies may account for different findings, as different games may attract different types of people with different personality characteristics. Finally, although research into online gaming has steadily increased over the last decade, as yet, there are few longitudinal studies and studies specifically examining the relationship between IGD and personality disorders.

It is also important to note here that our review may be limited in the following aspects. First, we decided to review empirical articles published after 2006. This decision likely allowed us to collect and discuss contemporary research in a more reliable and valid fashion, but it might also have caused us to dismiss previous relevant findings, even though we considered the literature before 2007 in writing our article. Second, even though we conducted both an electronic and a manual search to identify relevant articles, it is possible that other relevant articles have been missed because they were not

indexed with the selected keywords in the searched database and were not identified in the manual search.

However, regardless of the limitations of our review and others' studies, it is evident that further research is needed to extend and clarify the findings of the examined studies and to disentangle the role of personality factors in the development and maintenance of problematic Internet gaming.

Conclusions

IGD is included as a condition for further study in the DSM-5. It is a relatively novel topic, in relation to which the research base is constantly developing. Therefore, it is difficult to draw any definitive conclusion from this review. The findings of the studies highlight that IGD is linked to a wide range of personality features, and it emerged that each of these personality dimensions and traits, alone or more frequently in combination, may play a pivotal role in the acquisition, development, and maintenance of IGD. In this respect, future research will be critical for understanding whether the concept of IGD reflects a specific and consistent diagnostic entity [5•], and if so, which pattern (or patterns) of personality traits may predispose to it.

Compliance with Ethical Standards This systematic review is in compliance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines for the search, systematization, and reporting of systematic reviews [25].

Conflict of Interest Dr. Alessia Maria Gervasi, Dr. Luana La Marca, Antonino Costanzo, Dr. Ugo Pace, Dr. Fanny Guglielmucci, and Dr. Adriano Schimmenti declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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