

## Internet Gaming Disorder and Gambling Disorder: A Comparison of Individual Psychological Factors

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### Abstract

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In 2013, Internet gaming disorder (IGD) was added to the DSM-V under the category of disorders needing further research. IGD research is inconsistent in the definition and measure of the disorder but it has been compared to gambling disorder (GD) as the only other behavioural addiction in the DSM. The current review seeks to answer the question of how GD and IGD differ and converge on individual psychological risk factors. Six seminal studies are systematically reviewed and identify comorbid symptoms, personality and temperament traits, beliefs about illusory control, and measures of well-being. Studies presented IGD as a distinct disorder from GD but failed to clarify the psychological profile of IGD individuals. Gaining further insight into the differences between the two disorders can provide clarification in the diagnosis and treatment implementations.

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**Keywords:** Internet gaming disorder, gambling disorder, risk factors, protective factors

### 1. Introduction

The advent of the Internet has given rise to a new branch of psychology research. The first wave of research was pioneered by Young (1999) when she identified five types of behaviours associated with excessive Internet use. These are a) cybersexual addiction: compulsive use of adult websites for cybersex and cyberporn, b) cyber-relationship addiction: over-involvement in online relationships, c) net compulsions: obsessive online gambling, shopping, or day-trading, d) information overload: compulsive web surfing or database searches, and e) computer addiction: obsessive computer game playing. Though these categories were identified nearly two decades ago, contemporary research still makes use of these categories (e.g. Griffiths, 2010; Schou Andreassen & Pallesen, 2014). With increased accessibility to the Internet, it is not surprising that a class of researchers and clinicians are making efforts to include aspects of Internet overuse behaviour into the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychological Association [APA], 2013). The current review compares individual psychological risk factors of Internet gaming disorder with gambling disorder in order to understand how the disorders converge and differ in underlying features. Before continuing to a more thorough review of literature on these problematic behaviours, a brief overview of the revised DSM, gambling disorder, and substance use is necessary.

#### 1.1 DSM-V, Gambling Disorder, and Substance Use Disorder

The DSM classification system underwent some important changes in 2013 when the DSM-IV axis approach was replaced by three sections in the fifth and latest edition. Among the changes, "pathological gambling", was moved from the "Impulsivity Control Disorders Not Elsewhere Classified" and found a place in Section II under "Substance-Related and Addictive Disorders". It is currently the only behavioural disorder found in this category and has the new name of "gambling disorder" (GD). This name change is welcome as the term "pathological" holds pejorative connotations (Reilly & Smith, 2013).

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The classification change was triggered by new research that revealed that problem gamblers closely resembled substance users on external and internal factors (e.g. APA, 1994; Gerstein et al., 1999; Holden, 2010). In a recent longitudinal study by Barnes, Welte, Tidwell, and Hoffman (2015), substance abuse was found to be a salient risk factor for gambling disorder. Those with substance use or abuse, notably alcohol, were three to five times more likely to later become problematic gamblers. These results corroborate the findings of a study of Chinese youth in which Cheung (2012) also found that low self-control was a strong predictor of disordered gambling, while controlling for socioeconomic status and parental involvement. Impulsivity (e.g. Leeman, Hoff, Krishnan-Sarin, Patock-Peckham, & Potenza, 2014; Ranson, Wallace, Holub, & Hodgins, 2013), anxiety disorders (Ste-Marie, Gupta, & Derevensky, 2006), as well as personality disorders (Abdollahnejad, Delfabbro, & Denson, 2014; Lister, Milosevic, & Ledgerwood, 2015) are externally manifested risk factors shared by substance use disorder and GD patients. Internal factors have also been identified. From a neurological perspective, brain imaging studies have revealed that gambling activates the brain's reward system in the same way that drugs do (e. g. Holden, 2010) and that disordered gamblers experience cravings and highs the same way that substance users do (Potenza, Xian, Shah, Scherrer, & Eisen, 2005). On the strength of correlational information, Potenza et al. (2005) concluded that disordered gambling has a genetic component that runs in families along with other addictions.

## 1.2 Internet gaming disorder in the DSM

One can now find "Internet gaming disorder" (IGD) in Section III ("Emerging Measures and Models") of the DSM-V. This section is reserved for disorders that the DSM Task Force identified as having insufficient evidence to warrant inclusion as official disorders in Section II. It is characterised by a "persistent and recurrent use of the Internet to engage in games, often with other players, leading to clinically significant impairment or distress" (APA, 2013, p. 795). If IGD is included in the DSM, it will stand alongside GD in "Substance-Related and Addictive Disorders" as the only other behavioural addiction, i.e., there is no ingestion of substance (e.g., Rachlin, 1990; Walker, 1989). Of note, Internet gambling is not included in IGD and is considered a subtype of GD. Efforts to include IGD in the DSM have surpassed those of other behaviours that can be considered addictive such as exercise (Griffiths & Szabo, 2005), work (Andreassens, Griffiths, Hetland, & Pallesen, 2012), and shopping (Clark & Calleja, 2008). To date, IGD has no formally agreed upon set of diagnostic criteria (Ferguson, Coulson, & Barnett, 2011; King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013). However, the proposed criteria for diagnosing IGD are similar to those of GD (Young, 1999). In fact, seven of nine criteria are identical to those of GD and pertain to preoccupation with the activity, these are: showing withdrawal symptoms, building tolerance, unsuccessful attempts to stop or reduce the behaviour, attempts to coverup the behaviour, used to escape adverse moods, and risk losing relationships and opportunities. Furthermore, five of the nine criteria are identical to substance use disorder (withdrawal, tolerance, unsuccessful attempts to stop, giving up other activities, continuing despite problems) (Petry et al., 2014). Determining specific diagnostic criteria of IGD as compared to GD and/or substance use disorders can help to identify its psychopathological features and specific symptoms for the implementation of effective individual treatments.

## 1.3 Measuring and Defining Internet Gaming Disorder

Petry et al. (2014) convened with international experts from European, Asian and Australasian, and North and South American countries to discuss Internet gaming disorder as defined within the DSM-V and confirmed that there is no basis for a consensus on the diagnostic criteria of IGD. From the onset of the first studies measuring Internet behaviours, IGD has been used synonymously with "Internet use disorder", "Internet addiction", and "gaming addiction". Furthermore, there are insufficient studies examining clinical and behavioural differences in the various subtypes of Internet games (APA, 2013). Studies from the past two decades have therefore been measuring different Internet behaviours that do not necessarily distinguish between different types of games or those played on the Internet specifically (e.g. APA, 2013; Kaess et al., 2013; Müller et al., 2014; Young & Rogers, 1998). Despite this limitation, the emerging research on IGD and Internet behaviours has led to the development of several psychometric instruments, each measuring different aspects of Internet behaviour, including gaming (e. g. Charlton & Danforth, 2007; Kim & Kim, 2010; Skoric, Teo, & Neo, 2010).

These instruments come from one of two approaches that can be used complementarily, as identified in a meta-analysis of disordered video gaming (Ferguson, Coulson, & Barnett, 2011). The authors described that the first approach focuses on external symptoms of IGD that interfere with everyday activities such as missed work or school, declining grades, or feelings of distress over gaming habits.

Although there are proponents of this approach (Desai, Krishnan-Sarin, Cavallo, & Potenza, 2010; Liu & Peng, 2009; Van Rooij, Schoenmakers, Vermulst, Van den Eijnden, & Van de Mheen, 2011), this framework is criticised for lacking consistency because there is no set diagnostic framework associated with it (Ferguson et al., 2011). The second approach consists in applying a GD diagnostic model to IGD. In this case, the diagnostic criteria of GD are applied to IGD with the assumption that GD behaviours extend to IGD (Gentile et al., 2011; Lemmens, Valkenburg, & Peter, 2011). Most research to date has utilised this framework because GD and IGD both begin as entertainment activities that can become pathological. At the basic level, gambling and Internet games can trigger emotional responses (Tejeiro Salguero, Morán, & Rosa, 2002), release dopamine (Koepp et al., 1998), and create mental states where the player feels in control, loses track of time, and finds the activity intrinsically rewarding (Csikszentmihalyi, 1990). This can become harmful for some individuals when playing becomes dysfunctional, harming their psychological, social, and occupational functioning (Gentile et al., 2011). The reasons for gambling and playing games also overlap. For instance, gamblers and gamers may engage in their respective activities for relaxation, escape from daily concerns, and to feel competent (Griffiths, 2003; Ryan, Rigby, & Przybylski, 2006). Similarly, some of these reasons are also reported by substance users (Novacek, Raskin, & Hogan, 1991).

In a sample of 1178 US youths, 8.5% of gamers were classified as having a gaming disorder (Gentile, 2009). This is fairly consistent with other countries' rates; including 10.3% in China (Peng & Li, 2009), 8.0% in Australia (Porter, Starcevic, Berle, & Fenech, 2010), 11.9% in Germany (Grüsser, Thalemann, & Griffiths, 2007) and 7.5% in Taiwan (Ko, Yen, Yen, Lin, & Yang, 2007). Considering the prevalence rates of a behaviour that is not yet classified as a disorder, caution must be used when employing Internet behaviour measuring scales. It is critical not to pathologize these behaviours erroneously. For instance, some previous research focusing on diagnostic criteria of IGD has suggested that the GD adapted scales may over-identify cases of disordered gaming (Ferguson et al., 2011). Examples of these validated scales are the Internet Addiction Test (Young, 2000), Adapted DSM-IV criteria for pathological gambling (APA, 2000), Addiction-Engagement Questionnaire (revised) (Charlton & Danforth, 2007), Compulsive Internet Use Scale (Meerkerk, Van den Eijnden, Franken, & Garretsen, 2006), Korean Internet Addiction Test (Lee et al., 2007), Problematic Online Game Use Scale (Kim & Kim, 2010), and Problem Video Game Playing Scale (Tejeiro Salguero & Moran, 2002).

Almost all research to date has failed to use standardised and validated addiction criteria for IGD *per se*, but offline video games have been studied using variations of the DSM criteria for GD and substance disorders (e.g. Bioulac, Arfi, & Bouvard, 2008; Griffiths & Hunt, 1995, 1998; Tejeiro Salguero et al., 2002). Considering IGD is a burgeoning phenomenon, these scales are still deemed a reasonable starting point with an incentive to find evidence for stronger and more consistent results.

#### **1.4 Purpose of this Review of Literature**

Hussain, Griffiths, and Baguley (2012) identify some of the common limitations in the current body of research on IGD. Studies use mostly adolescent samples, only survey individuals from one country, and have a focus on massively multiplayer online role-playing games (MMORPG). Ferguson et al. (2011) identify two more caveats in the research, namely the necessity to define risk and protective factors of IGD, and understanding the pattern of comorbidity with IGD. A dearth of studies to date has focused explicitly on the latter two issues but there is a body of research addressing these in the comparison of GD and IGD.

The DSM and a peer-reviewed article search confirm that there is a substantial knowledge gap on personality traits, comorbidities, and genetic and physiological factors associated with games played on the Internet. Although these associated factors are not sufficient to establish the validity of the suggested diagnostic criteria of IGD, attempting to identify individual psychological factors may help guide decisions as to whether IGD should be grouped together with substance use and gambling disorders in the DSM.

The current review seeks to answer the question of how GD and IGD differ and converge on individual psychological risk factors. Gaining further insight into the differences between the two disorders can provide clarification in the diagnosis and treatment implementations. The different scales, frameworks, and varying terminologies of IGD will also be addressed.

## 2. Methodological Approach

### 2.1 Material and Methods

A comprehensive literature search was conducted using Lund University's *LUBsearch* search engine. For the purpose of this review, only studies that deal with both *Internet* gaming behavior or Internet addiction and gambling disorder are included as they are the only established non-substance addictive disorders found in the DSM. In an effort to staying true to the variations of terms and definitions of IGD, the terms *Internet gaming disorder*, OR *Internet addiction*, AND *gamb\** were included in each search. In order to focus on the DSM's identified caveats in IGD research, subsequent searches were conducted adding the term *personality, co(-)morbidity\**, OR *risk factor*.

**Table 1: Sample Characteristics of Studies Comparing Internet Gaming Disorder and Gambling Disorder**

Study	Country	Population	N	Age	Gender demographics
Dowling & Brown, 2010	Australia	Undergraduate students	N = 173	22.5	59 males, 114 females
King et al., 2012	Australia	Experiment 1	N = 147	Exp. 1	Exp. 1
		Social club video gamers	n = 50	21.8	48 males, 2 females
		Control group	n = 97	20.6	N/A
		Experiment 2	N = 65	Exp. 2	Exp. 2
		General Adelaide population		30.4 years	29 males, 36 females
Walther et al., 2012	Germany	Recruited from 15 participating schools	N = 2553	16.7	1289 males, 1264 females
Tonioni et al., 2014	Italy	Clinical populations:	N = 80	N/A	30 males, 1 female
		Internet addiction	n = 31		
		GD	n = 11		
		Matched control group	n = 38		10 males, 1 female
Müller et al., 2014	Germany	Clinical populations:	N = 404	22.9	Males only
		IGD	n = 115		
		IGD control group	n = 74		
		GD	n = 122		
		Healthy control	n = 93	N/A	
Choi et al., 2014	South Korea	Clinical populations:	N = 60	20.8	Males only
		IGD	n = 15		
		Gambling disorder	n = 15		
		Alcohol use disorder	n = 15		
		Healthy control	n = 15	25.3	

Note. References to Internet gaming disorder and gambling disorder include associated terms for the same phenomena. IGD = Internet gaming disorder; GD = gambling disorder; N/A = does not apply. Criteria were established to screen qualifying studies identified under the previous terms and definitions. Such studies had to overlap and differ in procedure, methodology, and results. The main features of the six studies that filled those requirements are summarised in Tables 1 and 2. Each focused on slightly different aspects of Internet gaming behaviours using features of gambling as points of comparison. The terminology and measurement of the two disorders are compared and contrasted, followed by comorbid symptoms, personality and temperament factors, illusory control, and well-being. Procedures of each study are briefly summarised when needed, along with an integrated critical appraisal of the studies.

### 3. Critical Review

#### 3.1 Terminology and Measurement of IGD and GD

The studies under review are ordered chronologically in Tables 1 and 2 in the appendix. Table 1 synthesises the attributes of each study in terms of country of origin, sample description and size, and gender demographics. Table 2 provides a summary of the specific terms used in each study, descriptively indicating which gambling and Internet behaviours are surveyed.

**Table 2: Procedural Characteristics of Studies Comparing Internet Gaming Disorder and Gambling Disorder**

Study	Terms	Measure of IGD	Measure of GD	Psychological factors	Relevant findings
Dowling & Brown, 2010	Internet dependence Problem gambling	IAT	PGSI	Depression Anxiety Loneliness Social support Student stressors	IAT ↔ PGSI: ns ↑IAT ↔ ↑depression, ↑anxiety, ↑stress, ↑loneliness ↑PGSI ↔ ↑anxiety, ↑stress, ↑loneliness Social support: ns
King et al., 2012	Video game playing Gambling involvement	Frequency scale devised by authors	PGSI	Beliefs about chance Illusory control	Video game playing time ↔ PGSI: ns Gamers' success: due to chance ↑gamblers' gaming time ↔ ↑illusion of control, ↑superstition
Walther et al., 2012	Computer and video gaming Gambling Substance use (tobacco, cannabis, alcohol)	Video Game Dependency Scale	South Oaks Gambling Screen Revised for Adolescents	Impulsivity Social anxiety ADHD Depression Sensation seeking Irritability/aggression Extraversion Loneliness General self-efficacy Social self-efficacy Life satisfaction Self-esteem	↑gaming ↔ ↑gambling ↑gaming ↔ ↑cannabis use ↑gaming ↔ ↑social anxiety, ↑ADHD, ↑irritability/aggression, ↓self-esteem. ↑gambling ↔ ↑substance use Impulsivity, social anxiety → gaming, gambling, substance use Extraversion, depression → substance use

Note. References to Internet gaming disorder and gambling disorder include associated terms for the same phenomena. IGD = Internet gaming disorder; GD = gambling disorder; IAT = Internet Addiction Test; PGSI = Problem Gambling Severity Index; ↔ = correlation; → = predictor; ns = not significant.

With "Internet gaming disorder" and its associated terms (e.g. "Internet addiction", "gaming addiction") appearing in the DSM for the first time in 2013, it is not surprising that the first three studies (Dowling & Brown, 2010; King, Ejova, & Delfabbro, 2012; Walther, Morgenstern, & Hanewinkel, 2012) used noticeably different IGD terminologies from the three studies published post 2013 (Choi et al., 2014; Müller, Beutel, Egloff, & Wölfling, 2014; Tonioni et al., 2014). This is a noteworthy difference because the official inclusion of "Internet gaming disorder" in the DSM will refer to a clinical population and it must be identified methodically in accordance with the DSM guidelines. Similarly, "pathological gambling" has been replaced with "gambling disorder" but studies dating after the 2013 publication are inconsistent in using the new term. They are used interchangeably in the current review as the name change is not associated with a modified definition or diagnostic criteria. Considering the novel IGD terms, studies published after 2013 (Choi et al., 2014; Müller et al., 2014; Tonioni et al., 2014) understandably employed the DSM terms of IGD and examined clinical populations.

Despite the more consistent use of DSM terminology after 2013, there is still no validated scale for IGD and researchers used an array of scales that measured different Internet and gaming behaviours (Table 2). Of these, the validated Internet Addiction Test ([IAT]; Young, 2000) was used in three studies, dating from before and after 2013 (Choi et al., 2014; Dowling & Brown, 2010; Tonioni et al., 2014).

The use of this scale is worth mentioning because it was found to provide the most clinically-relevant information about disordered Internet use symptoms (King et al., 2013). It is adapted from the DSM-IV's pathological gambling criteria and consists of 20 items with responses on a 5-point Likert scale. Higher scores indicate severity of the dependence (non-dependent, at risk, dependent).

**Table 2: Continued**

Study	Terms	Measure of IGD	Measure of GD	Psychological factors	Relevant findings
Tonioni et al., 2014	Internet Addiction Disorder Pathological Gambling	Interview derived from DSM-IV gambling criteria IAT	Interview based on DSM-IV criteria	Depression Anxiety Global functioning Hedonic capacity Temperament Coping Parent and peer attachment	Gamers and gamblers more similar than control in all psychological factors except hedonic capacity Gamers ≠ gamblers and control group on coping and parent and peer attachment
Müller et al., 2014	Internet Gaming Disorder Pathological Gambling	Assessment of Internet and Computer Game Addiction Scale Checklist for the Assessment of Internet and Computer Game Addiction	Self-report using the Berlin Inventory for Gambling Interview using DSM criteria	Neuroticism Conscientiousness Agreeableness Extraversion Openness	↑neuroticism → gamers, gamblers ↓conscientiousness, ↓agreeableness → gamers, gamblers ↓extraversion → gamers ↑extraversion → gamblers Openness: gaming = control group
Choi et al., 2014	Internet Gaming Disorder Gambling Disorder Alcohol Use Disorder	Interview based on DSM-V criteria IAT	Interview based on DSM-V criteria PGSI	Impulsivity Compulsivity Anxiety Depression	Compulsivity: ns ↑impulsivity overall, ↑motor impulsiveness, ↑non-planning impulsiveness → IGD, alcohol use disorder ↑cognitive impulsivity → GD Anxiety: ns IGD ↔ depression

Note. References to Internet gaming disorder and gambling disorder include associated terms for the same phenomena. IGD = Internet gaming disorder; GD = gambling disorder; IAT = Internet Addiction Test; PGSI = Problem Gambling Severity Index; ↔ = correlation; → = predictor; ns = not significant.

In order to identify their clinical samples, Tonioni et al. (2014) and Choi et al. (2014) employed this scale in conjunction with an interview derived from the DSM pathological gambling criteria. In doing so, they compromised their sample sizes but allowed for the examination of a specific pathological condition. Similarly, when selecting their GD samples, both groups of researchers employed a structured interview method based on the DSM-IV GD criteria. To remain consistent in their use of two assessment methods, Choi et al. (2014) also used the self-report Problem Gambling Severity Index ([PGSI]; Ferris & Wynne, 2001) to aid in the diagnosis of GD. Likewise, the third clinical study used the self-reported Assessment of Internet and Computer Game Addiction Scale (Wölfling, Müller, & Beutel, 2011) and the externally assessed Checklist for the Assessment of Internet and Computer Game Addiction (Wölfling, Beutel, & Müller, 2012). GD was identified with the Berlin Inventory for Gambling (Grüsser, Hesselbarth, Albrecht, & Mörsen, 2006) alongside an interview using DSM-IV criteria (Müller et al., 2014). Evidently, there is significant overlap in the measurement methods of IGD and GD in clinical populations. The use of structured interviews derived from DSM gambling criteria and the use of self-report measures is a comprehensive approach in identifying symptoms while avoiding social desirability response bias, for instance. Taken together, these studies also illustrate the preferred use of the gambling disorder diagnostic model for IGD (Gentile et al., 2011; Lemmens et al., 2011).

The measurement and identification of IGD and GD in non-clinical populations was done using exclusively self-report measures. IGD and GD were measured using the IAT (Young, 2000) and PGSI (Ferris & Wynne, 2001; Dowling et al., 2010), a frequency scale devised by the researchers (King et al., 2012) and PGSI (Ferris & Wynne, 2001), and the Video Game Dependency Scale (Rehbein, Kleimann, & Mössle, 2010) and the South Oaks Gambling Screen Revised for Adolescents (Walther et al., 2012; Winters, Stinchfield, & Fulkerson, 1993). The variety of IGD scales employed prior to 2013 exemplifies the lack of research and operationalisation in IGD. Furthermore, apart from the self-report nature of measurements, IGD and GD measures in non-clinical populations do not saliently overlap on features or frameworks. The clinical and non-clinical studies, nonetheless, share the common characteristic of being cross-sectional.

### 3.2 Comorbid Symptoms

**3.2.1 Depression.** Dowling and Brown (2010) sought to provide an understanding of how Internet dependence resembled problem gambling by examining the extent to which psychological factors present in problematic gambling are applied to Internet dependence. The authors hypothesized that problem gambling and Internet dependence would have a positive association with depression, among other factors, in a group of undergraduate students ( $N = 173$ , 59 males, 114 females;  $M_{age} = 22.5$ ). IGD and GD measures are outlined in Table 2 for all studies. The depression subscale of the Depression Anxiety Subscale (Lovibond & Lovibond, 1993) was used to measure depression levels of the students and revealed that only Internet dependence scores on the IAT were associated with depression, not gambling scores. This is inconsistent with a subsequent study utilising a similar non-clinical population. As part of a broader study, Walther et al. (2012) wanted to find the specific patterns of related personality characteristics between computer and video gaming, substance use, and gambling in a large sample of students ( $N = 2553$ , 1289 males, 1264 females;  $M_{age} = 16.7$ ). Their use of questionnaires and a depression scale adapted from Kandel and Davies (1982) showed that not only was depression not associated with computer and video gaming, but it was once again not associated with gambling. This may be due to the studies' use of student samples that did not exhibit significant problematic Internet or gambling behaviours based on their scores on IGD and GD scales. Previous studies showed that symptoms of depression and problematic gambling co-occurred in similar student populations (Kessler et al., 2008; Gupta & Derevensky, 1998), as well as depression symptoms and Internet addiction (Young & Rogers, 1998). Furthermore, the students were not asked about any clinical diagnoses of depression. The current findings may therefore be representative of significant psychological differences in samples. Though a causal link cannot be established, it is possible that depressive symptoms may lead to problematic Internet use.

When evaluating a clinical population of IGD and GD patients, only one study found the presence of depression in IGD and GD. Tonioni et al. (2014) tested whether Internet addiction patients had different psychological symptoms when compared to pathological gamblers, and a gender-matched control group. The depression scores on the Hamilton Depression Scale (Hamilton, 1960) were significantly higher for the IGD ( $n = 31$ ) and GD ( $n = 11$ ) patients when compared to the control group ( $n = 38$ ). As the only study to show depression symptoms in both groups, it is important to note that the researchers applied exclusion criteria in their selection of participants; the population had no co-morbidities with other DSM disorders. Though the sample was small, these findings suggest that clinical populations of IGD and GD patients may share depressive symptoms as a psychological risk factor. However, in the second study measuring depression in IGD and GD in male clinical populations and applying the same exclusion criteria, only the IGD group ( $n = 15$ ) had significantly higher scores of depression than a healthy control ( $n = 15$ ), as measured by the Beck Depression Inventory (Beck, Ward, Mendelson, Mock & Erbaugh, 1961; Choi et al., 2014). On the basis of these findings, there is insufficient consistent evidence to confidently identify similarities and differences in underlying depression symptoms of IGD and GD. IGD individuals exhibit more symptoms of depression than GD but the results are visibly inconsistent. The discrepancy in the results may be due to the different scales used to measure depression, the varying sample sizes and demographics, the small number of non-clinical participants exhibiting clinical symptoms of either IGD or GD, or the fact that clinical and non-clinical populations were compared.

**3.2.2 Anxiety.** The studies measuring depression symptoms in IGD and GD groups also explored anxiety symptoms in their populations. The results across the three studies were more consistent than those of depression. In the non-clinical sample of undergraduate students, Internet addiction and gambling scores were associated with anxiety using the anxiety subscale of the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1993; Dowling & Brown, 2010).

These findings were subsequently corroborated in a study of undergraduate, high school, and vocational school students. Problematic computer and video gaming and problematic gambling scores were associated with social anxiety, measured using the Social Anxiety Scale for Children – Revised (Melfsen, 1999; Walther et al., 2012). Once again, the researchers did not ask about clinical diagnoses of anxiety. This is problematic as it is possible that an undergraduate population exhibited these symptoms above the general population, consequently affecting the results.

Nevertheless, anxiety symptoms were also present in clinical samples of 15 IGD and 15 GD measured using the Hamilton Anxiety Scale (Hamilton, 1959; Tonioni et al., 2014). This was found even after applying the exclusion criteria of no diagnosis of other DSM disorders. The Beck Anxiety Inventory (Beck, Epstein, Brown, & Steer, 1988) was used to assess anxiety symptoms in IGD and GD patients in another clinical population in South Korea (Choi et al., 2014). Anxiety was not a significant predictor of either disorder. This may have been due to cultural differences in the manifestation of anxiety or the small sample size.

Taken together, these studies present preliminary evidence that symptoms of anxiety may be a salient shared feature of IGD and GD, despite the latter study's findings. The use of different scales, populations, and samples in these studies suggest that many types of persons exhibiting symptomatic Internet or gambling behaviours may present the same psychological risk factor. Though the findings were fairly consistent, the studies were all cross-sectional in nature and no inferences can be made pertaining to the direction of causality. IGD and GD may lead to anxiety symptoms, they may co-occur, or anxiety may cause individuals to retreat to computer gaming or gambling.

**3.2.3 Compulsivity and impulsivity.** Previous studies have found that impulsivity is at the core of pursuing short-term rewards and is a facilitator in the development of addictions, notably gambling (Leeman & Potenza, 2012; Verdejo-Garcia, Lawrence, & Clark, 2008). Compulsivity is a well-established feature of GD (Leeman & Potenza, 2012) but its relation to IGD has only been studied in one clinical study to date, as compared to GD and alcohol use disorder (Choi et al., 2014). The authors selected a sample of male clinical IGD ( $n = 15$ ), GD ( $n = 15$ ), and alcohol use disorder patients ( $n = 15$ ) as well as a healthy control group ( $n = 15$ ) using scales outlined in Table 2. Impulsivity and compulsivity were separately measured using the Barratt Impulsiveness Scale (Patton, Stanford, & Barratt, 1995) and the Trail Making Test (Seo et al., 2006), respectively, and neurocognitive tests from the Cambridge Neuropsychological Test Automated Battery (Robbins et al., 1998). On both the self-report and neurocognitive tests, compulsivity was not significantly associated with either disorder. However, the two impulsivity tests showed that IGD and alcohol use disorder patients scored significantly higher on impulsivity overall when compared to the GD and control groups. More specifically, GD patients scored higher on cognitive impulsivity (making quick decisions) but IGD and alcohol use disorder patients showed more motor impulsiveness (acting without thinking), and non-planning impulsiveness (lack of foresight), suggesting that there are specific patterns of impulsivity demarcating GD and IGD. A second study of non-clinical students comparing computer and video gamers, gamblers, and substance use found that computer gamers and gamblers were the groups most associated with impulsivity as measured on the Inventory of impulsivity, risk behaviour and empathy (Walter et al., 2012). This study differs considerably from Choi et al. (2014) in that the sample is much larger, non-clinical, and measures impulsivity using one self-report scale. Nevertheless, both studies converge on the findings that impulsivity is an underlying feature of IGD, more so than compulsivity. Together they suggest that there may be differences among behavioural addictions, such as in GD and IGD, in terms of different types of impulsivities.

### 3.3 Personality and Temperament Traits in IGD and GD

Müller, Beutel, Egloff, and Wölfling (2014) investigated the predisposing personality factors for IGD ( $n = 115$ ), GD ( $n = 122$ ), a matched IGD group that did not meet IGD diagnostic criteria ( $n = 74$ ), and a healthy control ( $n = 93$ ) in an all-male German sample. Among others, conscientiousness, extraversion, agreeableness, and neuroticism were assessed using the NEO Five-Factor Inventory (Costa & McCrae, 1992). The IGD and GD groups scored the lowest on conscientiousness and agreeableness but scored the highest on neuroticism. IGD patients scored even lower than GD on conscientiousness. Additionally, IGD and GD groups differed in extraversion; extraversion was the lowest for the IGD group and the highest for the GD group. This finding on extraversion is corroborated in another study. Walther et al. (2012) measured extraversion in a population of non-clinical German students ( $N = 2553$ ) and found that the computer gaming group had lower scores of extraversion than the gambling group.

These authors also measured other personality and temperament variables, such as ADHD, sensation seeking, and irritability/aggression. Problematic gamers scored higher than gamblers and substance users on ADHD and irritability/aggression, suggesting that certain symptoms associated with these traits may be underlying risk factors of IGD. Conversely, Tonioni and colleagues (2014) did not find such distinct differences between their clinical GD and IGD groups. The authors found that the IGD and GD had similar scores on the Temperament and Character Inventory – Revised (Fossati et al., 2007). Both groups of patients exhibited lower reward dependence, self-directedness, and higher self-transcendence. However, IGD patients scored significantly lower on the cooperation scale than both the GD and control groups.

Though the above studies tested different personality and temperamental traits, individuals with problematic Internet or gaming behaviours seem to share some underlying personality and temperamental traits with gamblers, while being distinct on others. Low extraversion represented a systematic difference between computer gamers and gamblers. For other personality and temperamental traits, the pattern for each disorder is unclear because of the small number of studies under review and the variability in samples and measures.

### **3.4 Illusory Control in IGD and GD**

King, Ejova, and Delfabbro (2012) adopted a comprehensive approach in studying differences in video game players and gamblers. They combined survey and laboratory methods in two experiments to contribute more empirical data on illusory control and beliefs about chance in video gamers and gamblers. The procedure for the two experiments followed the same multi-stage process. Participants first filled out demographic questionnaires and reported on their gambling and gaming habits. They then participated in a computerised soccer playing task that emulated a gambling task, and filled out a questionnaire accounting for their scored goals. In the soccer game, participants had to score goals on a computer-programmed goalie by selecting the direction of their kicks (either corner of the goal). They had the option to bet on the chances of scoring on the next attempt, or could bet on a riskier multi-shot option. What the participants did not know was that the game was programmed so that one in six goals were successful.

Participants accounted for their successful goals by later answering questions that asked if success was due to chance, primary control (skill), or secondary control (fate, superstition) on the Drake's Beliefs About Chance Inventory (Wood & Clapham, 2005) and Account for Wins (Ejova, Delfabbro, & Navarro, 2010). The use of a computerised soccer game instead of a regular gambling game was a measure intended to minimise the confounding influence of previous gambling experience, such as using a game that gamblers would have been exposed to due to their general gambling habits. Participant information for both experiments is outlined in Table 1. In order to assess the video game players' perceptions of the task, the researchers compared them to an equivalent non-gaming control group from a previous study (Ejova et al., 2010). When accounting for their successful goals, video gamers correctly reported higher agreement with the "chance" option and lower agreement with primary and secondary control items. Therefore, gamers were less likely than non-gamers to attribute their wins to the belief that they were able to exercise direct control over the game, or that superstitious factors helped to produce the wins. Conversely, video game playing experience in gamblers was not related to chance or secondary control but it was significantly positively related to primary control. This indicated that gamblers who played video games felt that they had more direct control over their successful goals than those who did not have as much video gaming experience.

The two experiments suggest that video game playing is not directly related to gambling. However, playing video games can influence some gambling cognitions among those who both gamble and play video games. Considering that illusory control (primary control) was present in gamblers who played video games, it would have been valuable to know which types of games the gamblers played that elicited this type of cognition. IGD was not measured directly in this study but the findings suggest that illusory control could be a psychological risk factor associated with certain types of video gamers, those who also gamble.

### **3.5 Well-being in IGD and GD**

No studies directly measured well-being but aspects of it are present across select studies. These include co-occurring behaviours, loneliness, self-esteem, and social support. The three studies utilising clinical samples ensured that there were no co-morbidities in their selection of participants and therefore did not measure co-occurring behaviours.

The non-clinical and cross-sectional nature of the remaining studies allowed for the measurement of several behaviours at once. Researchers employed self-report questionnaires and used correlational methods in their analyses. The first study utilising a student sample found that there was no overlap between participants reporting problem gambling and Internet dependence (Dowling & Brown, 2010). Indeed, the majority of the participants were non-dependent Internet users and non-problematic gamers (79.3%,  $n = 137$ ). The other non-clinical student sample yielded contrary results (Walther et al., 2012). There was a positive association between problematic gambling and problematic gaming. It is important to note that the researchers dichotomised the original gambling and video gaming scales.

Participants were no longer grouped as “non-gambler”, “non-problem gamer”, “at-risk gambler”, “problem gambler”, or “probable pathological gambler”. Rather, students with scores in the latter three categories were grouped into one, “problematic gambler”. The same categorisation applied for gamers. In doing so, problematic gamblers and problematic gamers were effectively overidentified. Walther and her colleagues (2012) also measured substance use (tobacco, cannabis, alcohol) in all participants using a dichotomous “non-user” and “current user” scale. They found that Internet dependence was only associated with cannabis use and that gambling was associated with all three substances. There is no information on the number of students classified as “current users” in multiple categories so the co-occurrence in this instance cannot be confidently established. In their multiple study design, King et al. (2012) selected gaming participants and gambling participants from different populations. Effectively, there was no association between each group’s time spent gambling and time spent gaming. The overarching trend in these studies points to a low co-occurrence of gambling and gaming. Furthermore, these two groups differed in their use of substances, with cannabis as the only substance associated with both. Substance use in gambling and gaming populations will be further elaborated in the discussion.

Other well-being variables were explored in the literature but since they were not the focus of the studies, only abbreviated scales and measures were used (Dowling & Brown, 2010; Walther et al., 2012; Tonioni et al., 2014). Possibly due to this limitation, associated well-being measures for IGD and GD vary. For instance, loneliness was associated with both student gamblers and gamers (Dowling & Brown, 2010) but was only present for gamers in another student population (Walther et al., 2012). Similarly, some findings revealed that there was no association between perceived social support in GD and IGD populations (Dowling & Brown, 2010) whereas others revealed that there were associations. For example, both IGD and GD participants made less use of emotional social support, had less trust towards parents, and experienced higher alienation with peers (Tonioni et al., 2014). The gaming population had more negative experiences with social support than GD groups; they had less trust towards peers, less communication with parents and peers, and experienced alienation with their parents (Tonioni et al., 2014). Furthermore, IGD populations differed from GD by experiencing lower self-esteem, less social self-efficacy (Walther et al., 2012), higher denial, and higher mental and behavioural disengagement (Tonioni et al., 2014). Student stressors such as financial difficulties, friendships, and academic pressure were also associated with IGD and GD student populations (Dowling & Brown, 2010). The varying results surrounding the well-being of gamblers and Internet gamers suggest that these individuals may have more in common in external factors, such as compromised social support. The co-occurrence of other addictive behaviours is inconsistent across studies and warrant more in-depth research. Not all studies overlapped in the types of well-being measures they used or in the populations involved; however when taken together and separately, IGD and GD populations generally have poorer well-being.

#### **4. Discussion**

The aim of the current review was to identify how gambling disorder and Internet gaming disorder differed and converged on individual psychological risk factors. With the proposed inclusion of Internet gaming disorder next to gambling disorder in the DSM’s “Substance-Related and Addictive Disorders”, it is important to identify the ways in which these behavioural addictions manifest themselves. The terminologies and methodologies of the clinical and non-clinical studies were evaluated and the comorbid symptoms, personality and temperament traits, illusory control, and well-being of IGD and GD patients were compared across six studies (Choi et al., 2014; Dowling & Brown, 2010; King et al., 2012; Müller et al., 2014; Tonioni et al., 2014; Walther et al., 2012). The findings added to the body of literature that attempts to identify the underlying psychological characteristics of IGD as compared to GD.

IGD and GD participants showed differences in personality and other individual traits, especially regarding lower extraversion and conscientiousness (Müller et al., 2014; Walther et al., 2012), more symptoms of ADHD and irritability/aggression (Walther et al., 2012), and illusion of control (King et al., 2012). Extraversion was the lowest for the IGD group and the highest for the GD group (Müller et al., 2014; Walther et al., 2012). This indicates that introverted gamers may want to be a part of a social network but lack the social skills or opportunities. Collaborative online games, such as massively multiplayer online role-playing games (MMORPG), might offer these opportunities. Evaluating IGD and GD individuals on specific facets of extraversion, such as friendliness and gregariousness, could provide more insight into the particular underlying differences of GD and IGD patients. IGD was also associated with significantly less conscientiousness than the GD group (Müller et al., 2014).

Since low conscientiousness scores have been found to be characteristic of less persistent and less disciplined individuals (Settles et al., 2012), low conscientiousness in non-disordered gamers may be a risk factor in the development of IGD; gamers may get lost in virtual environments and lose sight of their real-world responsibilities. Additionally, problematic gamers scored higher than gamblers on ADHD and irritability/aggression (Walther et al., 2012). ADHD is a disorder that manifests itself before the age of seven (APA, 2000) and can be associated with getting bored easily, having difficulty relaxing, or having a quick temper (Martel, Schimmack, Nikolas, & Nigg, 2015). By design, online games are stimulating and may be appealing to gamers with some ADHD symptomatology. Given its early onset, ADHD symptoms are likely a risk factor for IGD rather than a side effect. Similarly, irritability and aggression may be secondary effects of playing video games (Hollingdale & Greitemeyer, 2014) or alternatively, problematic gamers may feel irritable when they are away from online games. Video gamers and gamblers also differed in illusory control in a pre-set computerised soccer playing task (King et al., 2012). The video gamers correctly attributed their successful goals to chance whereas gamblers more often reported that they had direct control over the task. This is indicative that illusion of control may be a problem for a very specific population: gamblers who also play video games. Previous research on this population is very sparse. It has been found that players of video games may find gambling machines appealing due to their structural similarity (Griffiths, 1991) and that young video gamers can develop false beliefs about the amount of control they have in video games (Gupta & Derevensky, 1996). This increased illusory control through childhood may render this gaming population vulnerable to developing disordered gambling if it persists in adulthood.

IGD and GD overlapped on their associations with lower levels of agreeableness and increased levels of neuroticism (Müller et al., 2014). Previous research shows that low agreeableness is associated with low cooperation (e. g. Hilbig, Leist, Zettler, & Heydasch, 2013; Koole, Jager, Van den Berg, & Vlek, 2001) yet some popular Internet games, such as MMORPG, require cooperation. Decreased agreeableness may be a consequence of video gamers' and gamblers' lack of social skills for healthy interactions in the non-digital and non-gambling worlds. This effect may be further amplified by low extraversion in disordered gamers. Moreover, high neuroticism, also found in both clinical populations, is predictive of smoking (Soldz & Vaillant, 1999) and associated with elevated stress (Ormel et al., 2013) and mental disorders such as major depressive disorder, generalised anxiety disorder, social phobia, obsessive compulsive disorder, and substance use disorder (e.g. Kotov, Gamez, Schmidt, & Watson, 2010; Hettema, Neale, Myers, Prescott, & Kendler, 2006). High neuroticism not only represents an important general health risk factor, but may also contribute to gamblers' and video gamers' escape from the "real world" to alleviate negative symptoms of possible mental disorders. The associations of neuroticism with other comorbidities cannot be ignored; within the context of the current review, individuals with GD or IGD who also presented symptomatology of depression or anxiety may have had elevated levels of neuroticism as an underlying risk factor for multiple disorders.

The findings on comorbid symptoms of impulsivity, anxiety, and depression, varied across the reviewed studies. IGD and GD were associated with high impulsivity with IGD having the highest levels (Choi et al., 2014; Walther et al., 2012). This is consistent with a previous study that found that IGD was associated with diminished impulse control in a clinical population (Cao, Su, Liu, & Gao, 2007). Interestingly, IGD and alcohol use disorder patients scored significantly higher on impulsivity overall when compared to the GD group (Walther et al., 2012). The shared impulsivity traits of IGD and alcohol use disorder are an important aspect to consider as it proposes that IGD may share features of other addictive disorders in the "Substance-Related and Addictive Disorders" section of the DSM.

Anxiety symptoms were present in three different populations of IGD and GD (Dowling & Brown, 2010; Tonioni et al. 2014; Walther et al., 2012) and absent from a clinical sample (Choi et al., 2014). Anxiety has been found to be associated with both disorders (e. g. Gentile et al., 2011; Shead, Derevensky, & Gupta, 2010) suggesting that IGD and GD patients likely share this underlying psychological factor. Due to the cross-sectional nature of the studies, it is not possible to establish if anxiety symptoms are risk factors for or outcomes of the disordered behaviours. A previous study has found that children with social anxiety prefer online social interactions (Lemmens et al., 2011) which may explain why the current review revealed that IGD was associated with anxiety in most instances. Dowling and Brown (2010) also found that IGD and GD participants experienced elevated levels of student stressors, such as financial or relationship issues, which may be factors in the levels of anxiety found across the populations.

Lastly, anxiety symptoms in IGD may pose health and well-being risks. In their study, Walther et al. (2012) found that gamers were more often users of cannabis than gamblers, suggesting that cannabis use may be a means of relieving symptoms of anxiety.

The most surprising findings pertained to depression. In two populations, IGD was associated with depression symptoms (Choi et al., 2014; Dowling & Brown, 2010) whereas two other studies either found depressive symptoms in both IGD and GD (Tonioni et al., 2014) or no symptoms at all (Walther et al., 2012). This is inconsistent with some previous studies that showed that symptoms of depression and problematic gambling co-occurred in student populations (Kessler et al., 2008; Gupta & Derevensky, 1998), as well as in Internet addiction (Young & Rogers, 1998). Though no conclusions can be drawn from the current review's findings, it is possible that depression symptoms are linked to the personality, temperament, and overall well-being measures of the populations reviewed. For instance, loneliness was associated to both IGD and GD samples in one study (Dowling & Brown, 2010), and only to IGD in another (Walther et al., 2012). Similarly, low self-esteem was more associated with IGD than GD (Dowling & Brown, 2010; Walther et al., 2012). Loneliness and self-esteem are feelings that are themselves associated with depressive symptoms (e. g. Acun-Kapikiran, Körükcü, & Kapikiran, 2014; Rieger, Göllner, Trautwein, & Roberts, 2015; Sum, Maliheh, & Robab, 2015). Combined with the prevalence of neuroticism in the populations reviewed, it is conceivable that the measured symptoms of depression appear as shared symptoms of loneliness and low self-esteem. In relation to gaming, MMORPG and other online games often make use of avatars, characters that represent the gamer in the game. It is possible that the measured depression, anxiety, loneliness, and low self-esteem may be related to the gamers' dissatisfaction with the difference between their online selves (avatars) and the person they are in real life. This can only remain a speculation in the current review due to the lack of information about the preferred types of games of IGD populations.

External variables may be at play in the manifestation of comorbid symptoms. Various measures of social support revealed that there were no differences in perceived social support between IGD and GD (Dowling & Brown, 2010) and that both IGD and GD participants made less use of emotional social support, had less trust towards parents, and experienced higher alienation with peers. Overall, the gaming population had more negative experiences with social support than GD groups (Tonioni et al., 2014). Once more, it is not possible to infer if social support issues arise due to the disordered behaviours or if they are risk factors for them. In the initial stages of IGD manifestation, it would be important for close friends, family members, or educators to make themselves available to the individual if they show needs of support. While the direct relation of social support to IGD is uncertain, the importance of social support in the management of possible comorbid symptoms of anxiety and depression is undeniable (e. g. Corrigan, Kwasky, & Groh, 2015; Rapee, Peters, Carpenter, & Gaston, 2015). Social support can benefit individuals dealing with IGD or GD regardless of their psychological profiles.

The treatment options for IGD were not discussed in the reviewed studies but some treatment options for disordered Internet use using a GD framework exist. Practically, it is nearly impossible to use an abstinence approach in treating IGD in the same way that it is sometimes used in GD. For instance, offline gamblers can remove themselves from gambling establishments, such as casinos. Internet gamers will make use of the Internet for other activities so it is vital to find a treatment approach that differs from GD in this respect. Young (2007) has found that cognitive behavior interventions have been successful in treating Internet addiction suggesting that this may be an effective treatment option for the general addictive behaviour associated with IGD. Establishing systematic diagnostic criteria for IGD will aid in the development of specific treatment options for the disorder.

Gaining a further understanding of the psychological factors associated with IGD will influence the treatment options and subsequently their effectiveness.

#### **4.1 Umbrella Observations, Limitations and Future Research**

As a whole, the studies presented common limitations. It was not possible to deduce any causality or temporal precedence in the identified psychological factors due to the cross-sectional nature of the research designs. This is an important aspect to consider when measuring well-being and the possible clinical symptoms of depression, anxiety, and impulsivity in IGD and GD; the evaluation of these symptoms can only infer that they are present or absent at the time of the study, not whether they are the predictors or result of disordered behaviours. There needs to be a much better understanding of the types of individuals who are drawn to cyber activities to begin establishing causality.

Some of the studies examined had homogenous populations of students (Dowling & Brown, 2010; Walther et al., 2014), and others had an overwhelming male population (Choi et al., 2014; King et al., 2012; Müller et al., 2014; Tonioni et al., 2014), affecting the generalisability of the results to different countries, age groups, and to females. Moreover, the studies were only conducted in one country at a time, with an emphasis on Western populations. The findings from a European population may not extend to those of different countries where personality and measures of well-being may differ, as in Asian populations for instance. More studies are needed on specific ethnic communities since they seem to fall victims of targeted predatory practices by gambling establishments. A case in point is Asian-Americans of Chinese, Vietnamese and Korean descent (Skolnik, 2011). Their rates of gambling are much higher than for any other Americans of ethnic backgrounds. Considerations for future research should include a comparison of populations from different countries as well as different ethnic communities within a country as this could yield cross-culturally relevant information on the prevalence of IGD and GD and their underlying psychological factors. Given the inconsistency of findings on comorbid symptoms, personality, individual traits, and well-being overall, longitudinal studies that include more women, greater age ranges, a diversity of environments, and family trees are necessary to begin recognising the psychological profiles of at-risk individuals across the lifespan.

In order to demarcate the different types of gamers, it is imperative that future studies examine the different types of games that their samples engage in (e. g. MMORPG, single player, multiplayer). A precise account of which game types are most associated with the proposed IGD criteria combined with longitudinal data can help the DSM Task Force come to a consensus on a systematic definition of "Internet gaming disorder", its measurement, its psychological risk factors, and effective preventive and treatment options. Clinicians indicate that a high percentage of their patients addicted to video games and obsessive gambling have a preexisting condition of comorbidity such as Asperger's syndrome, ADHD, bipolar disorder, and clinical depression (Roberts, 2010). Given that approximately one-third of individuals with ADHD will eventually develop substance abuse problems, it is not surprising that many will end up with cyber addictions. More synergy and sharing of behaviour modification strategies need to occur among specialists studying various pathological conditions to recognise the early warning signs of problematic cyber use before they escalate into full-scale addiction.

For many adults, addiction will manifest itself through financial disaster, divorce, unemployment, loss of their network of family and friends, illnesses, and ultimately, suicide. For youth, it may be failing classes, getting involved with petty crime, being kicked out of the house, or moving onto other progressive diseases. More rigorous and independent studies need to examine the social costs and impacts of obsessive IGD and GD on families, communities, and societies at large. By contrast to the tobacco industry which denied for years the negative effects of their products, the gambling industry started from the premise that problem gamblers had addictive personalities and were predisposed to abuse alcohol, sex, drugs, pornography, video games, or Internet, etc. They were already positioning themselves to litigate any legal challenges in that they were not responsible for creating problem gamblers. The lack of research independence of studies funded by the gambling and gaming industries are not to be ignored. The implications are huge in that it is often difficult to differentiate self-serving research from truly scientific one. Future research must not take for granted that all published IGD and GD research is sound and can be a springboard to take a leap forward.

#### **4.2 Conclusions**

In sum, the current review sought to identify how gambling disorder and Internet gaming disorder differed and converged on individual psychological risk factors.

There was insufficient empirical evidence to draw categorical conclusions about the roles of personality, temperament, other individual traits, comorbid symptoms, and well-being in IGD and GD. However, the review provided preliminary evidence that IGD and GD are separate behavioural disorders and that IGD shows more distinctive personality characteristics when compared to GD. Once systematically defined and identified, IGD will merit a place in the DSM as behavioural disorder and research on preventive and treatment measures of the disorder can move forward across different parts of the world. Digital technology is ubiquitous. It has the potential of transforming our lives in positive ways when used appropriately or being a force of destruction when it becomes cyber obsessions. There is a world of addictive temptations being offered online at every moment, be it poker games, video games, pornography, or marathon chatting.

High-risk individuals become powerless to harness their feelings, and their desires morph into absolute needs. Digital technology has erupted so suddenly that research is struggling to feed addiction professionals with the leading-edge knowledge necessary to cope with this new phenomenon. IGD and GD exemplify this situation.

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