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REVIEW ARTICLE

Conduct problems and depressive symptoms in association with problem gambling and gaming: A systematic review

JÉRÉMIE RICHARD[1,2*], ÉMILIE FLETCHER[1,2], STEPHANIE BOUTIN[1,2], JEFFREY DEREVENSKY[1,2] and CAROLINE TEMCHEFF[1,2]

[1] International Centre for Youth Gambling Problems and High-Risk Behaviors, McGill University, Montreal, QC, Canada

[2] Department of Educational and Counselling Psychology, Faculty of Education, McGill University, Montreal, QC, Canada

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ABSTRACT

Background and aims: Behavioral addictions such as gambling and gaming disorder are significant public health issues that are of increasing importance to policy makers and health care providers. Problem gambling and gaming behaviors have been identified as being associated with externalizing and internalizing problems, with theoretical models suggesting that both conduct problems and depressive symptoms may be significant risk factors in the development of problem gambling and gaming. As such, the purpose of this systematic review is to provide an overview of research identifying the relationship between conduct problems, depressive symptoms and problem gambling and gaming among adolescents and young adults. *Methods:* Systematic literature searches in accordance with PRISMA guidelines found 71 eligible studies that met the inclusion criteria, 47 for problem gambling, 23 for problem gaming and one for both problem behaviors. *Results:* Based on cross-sectional evidence, both problem gambling and gaming are consistently concurrently associated with conduct problems and depressive symptoms. Longitudinal evidence appears to be clearer for conduct problems as a risk factor for problem gambling, and depressive symptoms as a risk factor for problem gaming. However, both risk factors appear to increase the risk for these problem behaviors. *Discussion and Conclusions:* Results from the literature review suggest that problem gambling and gaming are associated with the presence of conduct problems and depressive symptoms, with the potential of sharing common etiological factors. Additional research is necessary to confirm these longitudinal relationships with an emphasis on investigating the interaction of both early conduct problems and depressive symptoms.

KEYWORDS

adolescents & young adults, conduct problems, depressive symptoms, problem gambling, problem gaming, systematic review

INTRODUCTION

Gambling and gaming behaviors are generally described as being on a continuum ranging from occasional or recreational participation, through to problematic, excessive and disordered engagement (Griffiths, Kuss, Lopez-Fernandez, & Pontes, 2017; Shaffer & Korn, 2002). In the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association [APA], 2013), gambling disorder was reclassified as a non-substance-related disorder and Internet gaming disorder was included in Section III as a condition requiring further research (APA, 2013). Moreover, as of May 2019, the World Health Organization (WHO) officially included gaming disorder in the *International*

*Corresponding author.
E-mail: jeremie.richard@mail.mcgill.ca

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Classification of Diseases – Eleventh Edition (ICD-11; WHO, 2019) alongside gambling disorder as the two formally recognized disorders due to addictive behaviors (WHO, 2019). According to the DSM-5 (APA, 2013), both disorders are defined as the persistent and recurrent engagement in the behavior (gambling or video gaming), leading to clinically significant impairment or distress. Recent research has identified that rates of problematic participation in both gambling and gaming are higher among adolescents and young adults, with 0.2–12.3% reporting problem gambling (PG; Calado, Alexandre, & Griffiths, 2017) and 5–10% reporting problem video gaming (PVG; Fam, 2018; Paulus, Ohmann, von Gontard, & Popow, 2018; Turner et al., 2012).

Gambling and gaming have been found to share a number of similarities with both activities holding the potential for convergence (Griffiths, 2008b; King, Delfabbro, & Griffiths, 2010). Indeed, multiple similarities have been noted at the structural (e.g., variable reinforcement schedules), esthetic (e.g., exciting and stimulating sounds and light effects) and motivational (e.g., escapism, socializing) levels (Hilgard, Engelhardt, & Bartholow, 2013; King, Gainsbury, Delfabbro, Hing, & Arabanel, 2015). The distinction between gambling and gaming has been muddled even further with the integration of microtransactions and "loot boxes" in many mobile and console games, allowing gamers to spend money for a chance at acquiring random virtual items of differing value or benefit (Griffiths, 2018; Li, Mills, & Nower, 2019; Richard, 2018; Zendle, Meyer, & Over, 2019). However, some differences between both behaviors are also present. For one, video games do not have any formally legislated age restrictions, whereas gambling is legally restricted to adults in most jurisdictions. Additionally, video games are most often played for points and/or status, with skill determining one's performance, whereas gambling can be engaged in for money with the outcome being predominantly random (Griffiths, 2005). Lastly, although variable reinforcement schedules in gambling and gaming can make these activities more addictive, some video games do not utilize immediate reinforcement, with more delayed rewards being presented to the player after long periods of strategic and goal-directed engagement (James & Tunney, 2017).

Various psychosocial risk factors for the development of problematic engagement in both gambling and gaming have been identified. However, a significantly greater amount of research has investigated PG as the growth of studies investigating PVG largely begun in the 2000s with the rise of online gaming (Griffiths, Kuss, & King, 2012). Recent literature reviews have indicated that males (Brezing, Derevensky, & Potenza, 2010; Dowling et al., 2017) and younger individuals (Derevensky, 2019; Johansson, Grant, Kim, Odlaug, & Gotestam, 2009) are at an increased risk of PG and PVG. Moreover, high sensation seeking (Dowling et al., 2017; Shead, Derevensky, & Gupta, 2010), emotion-focused coping styles (i.e., suppressive and reactive; Johansson et al., 2009; Kuss & Griffiths, 2012), depressive symptoms (Johansson et al., 2009; Kuss & Griffiths, 2012), attention problems (Shead et al., 2010; Sugaya, Shirasaka, Takahashi, & Kanda, 2019), delinquency (Johansson et al., 2009; Shead et al., 2010), and conduct problems (Dowling et al., 2017; Sugaya et al., 2019) have been identified as risk factors for both PG and PVG. As numerous risk factors have been identified, there is a serious need to understand which of these are of critical importance when investigating the development and maintenance of these problem behaviors.

Theoretical models for the development of substance use disorders and non-substance addictive behaviors can provide a rationale to specify which risk factors are predominant in the development of PG and PVG. The potential generalizability of these models is based on research demonstrating that there are etiological, neurobiological, clinical, and phenomenological similarities between substance and non-substance addictions (Brezing, Derevensky, & Potenza, 2010; Potenza, 2014; Yakovenko & Hodgins, 2018). Based on a developmental psychopathology framework, various pathways have been suggested to explain the development of substance use disorders (SUDs) including the externalizing pathway, internalizing pathway, and combined pathway. The externalizing pathway suggests that early externalizing problems (e.g., conduct problems) and behavioral disinhibition predict later SUDs (Zucker, 1994; Zucker, Heitzeg, & Nigg, 2011). The internalizing pathway proposes that early inhibited temperament, internalizing symptoms (e.g., depression) and difficulties with emotional coping predict later SUDs (Hussong, Jones, Stein, Baucom, & Boeding, 2011; Trucco, Villafuerte, Hussong, Burmeister, & Zucker, 2018). Lastly, the combined pathway proposes that a combination or interaction of externalizing and internalizing problems leads to the development of SUDs (Englund & Siebenbruner, 2012; Maslowsky, Schulenberg, & Zucker, 2014), which may be explained by the presence of shared mechanisms underlying psychopathology (Angold, Costello, & Erkanli, 1999; Caspi & Moffitt, 2018).

Recently, two of these pathways have been indirectly adapted to explain the development of gaming disorder. Based on case reports, Benarous et al. (2019) identified an "internalized pathway" (involving depressive symptoms during adolescence) and an "externalized pathway" (involving conduct problems during adolescence) towards the development of gaming disorder in young adulthood. Indeed, subtypes of problem gamers have been identified depicting greater aggressive and/or depressive symptoms (Lemmens, Valkenburg, & Gentile, 2015; Myrseth & Notelaers, 2018; Sanders & Williams, 2019; Yu & Cho, 2016), with longitudinal studies identifying the predictive role of greater internalizing and externalizing symptoms for problem gaming (Krossbakken et al., 2018; Liu et al., 2018).

Although these specific developmental pathways have not been empirically or theoretically investigated with regards to PG, Yakovenko and Hodgins (2018) discuss the potential for the SUD literature to act as a model for future research related to gambling disorder. Linking these pathways to what has been theoretically established for PG, these appear to parallel the two subgroups of problem gamblers identified within the *Pathways Model* (Blaszczynski & Nower, 2002), namely, the antisocial impulsivist (Pathway 3) and emotionally vulnerable (Pathway 2) problem gamblers.

Importantly, the presence of these subgroups of problem gamblers has been empirically validated using cross-sectional community (Gupta et al., 2013; Nower, Martins, Lin, & Blanco, 2013), clinical (Moon, Lister, Milosevic, & Ledgerwood, 2017; Valleur et al., 2016), and longitudinal data (Allami et al., 2017; Dowd, Keough, Jakobson, Bolton, & Edgerton, 2018; Mader, Christensen, & Williams, 2019). Lastly, as a combined pathway has been identified within the SUD literature, it is possible that comorbid externalizing and internalizing problems may also be related to the development of behavioral addictions. This combined pathway would be consistent with the subgroup of adolescent problem gamblers identified by Gupta et al. (2013) reporting higher levels of both externalizing and internalizing symptoms. This combined pathway presently remains unexplored with regards to PVG.

Based on this theoretical rationale, conduct problems (CP) and depressive symptoms (DS) appear to be critical risk factors in the development of PG and PVG. CP typically include symptoms and problem behaviors associated with conduct disorder such as aggression, rule-breaking, antisocial behaviors and violent or delinquent (e.g., theft, vandalism) acts (APA, 2013; Fonagy & Luyten, 2018; Hawkins et al., 2002). As for DS, these typically include symptoms associated with major depressive disorder such as low mood, anhedonia, and feelings of worthlessness (APA, 2013; Dean & Keshavan, 2017; Rapee et al., 2019). Empirically, both CP and DS have been associated with PG (Giralt et al., 2018; Richard & Derevensky, 2017; Sagoe et al., 2017) and PVG (Müller et al., 2015; Myrseth & Notelaers, 2018), with the presence of both CP and DS rendering youth at an even greater risk of addiction later in life (Giralt et al., 2018; Jessor & Jessor, 1977; Khoddam, Jackson, & Leventhal, 2016; Strittmatter et al., 2015; Wiesner, Kim, & Capaldi, 2005).

Given the theoretical and empirical associations between CP, DS and behavioral addictions, a review of the literature investigating the role of these problems in the development of PG and PVG is deemed necessary. Previous reviews have broadly examined the role of various risk and protective factors for PG (Dowling et al., 2017; Johansson et al., 2009; Lorains, Cowlishaw, & Thomas, 2011; Yakovenko & Hodgins, 2018) and PVG (Burleigh, Griffiths, Sumich, Stavropoulos, & Kuss, 2019; Cheng, Cheung, & Wang, 2018; González-Bueso et al., 2018; Mihara & Higuchi, 2017). However, these reviews have not investigated both PG and PVG together, with an emphasis on DS and CP. With the inclusion of gaming disorder as the second formally recognized behavioral addiction (WHO, 2019), reviews investigating both PG and PVG are necessary to assess for similarities and differences in the risk factors and mechanisms underlying the development of each problem behavior (Marchica, Mills, Derevensky, & Montreuil, 2019). Furthermore, as adolescents and young adults present with a higher risk for the development of these problem behaviors, a review targeting this demographic is of primary interest. Several reviews have limited their sample to adolescents and young adults, yet these are limited in their broad examination of factors associated with PG (Calado, Alexandre, & Griffiths, 2017) or PVG (Paulus et al., 2018; Sugaya et al., 2019), with no focus on CP and DS. As such, the purpose of the present systematic review is to provide an overview of research identifying the relationship between CP, DS and both PG and PVG among adolescents and young adults.

METHODS

Study selection

The methodology employed in this review is compliant with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA; Moher, Liberati, Tetzlaff, & Altman, 2009). Electronic databases including PsychINFO, Medline, Social Work Abstracts, Scopus and Web of Science were searched. Searches in all databases utilized a combination of Medical Subject Headings (MeSH) and multipurpose terms where applicable, searching for the keywords in the title, abstract, keywords, headings and subject headings of articles. The search terms used a combination of keywords and Boolean terms relating to gambling, gaming, CP and DS. Keywords for the searches are presented in Table 1. The search was restricted to articles published from January 1994 to October 2019, to coincide with the publication of the DSM-IV (APA, 1994) which introduced a scientific and empirically-based understanding of pathological gambling (National Research Council, 1999, p. 18). The search strategy was peer-reviewed by a university librarian with experience conducting systematic reviews. The search parameters yielded the following number of results in each database: PsychINFO (296), MEDLINE (945), Social Work Abstracts (22), Scopus (1,623), and Web of Science (915).

Inclusion criteria were developed for the title/abstract screening stage and full text screening stage. Studies were considered eligible at the title/abstract stage if they were: (1) original peer-reviewed publications in English or French; (2) providing an estimate of the presence of CP (i.e., physical or verbal aggression, delinquency, antisocial behavior, externalizing problems) or DS (i.e., low mood, negative affect, anhedonia, internalizing symptoms) in association with either PG or PVG; (3) observational and descriptive studies (e.g., cross-sectional, case–control, longitudinal); (4) reviews if they included the calculation of new data (i.e., meta-analysis). Studies were not eligible at the title/abstract screening stage if they were: (1) validating the development of a psychometric measure/scale; or (2) investigating the impact of a treatment intervention.

Studies were included at the full-text screening stage if: (1) participants were between the ages of 12 and 25 years; (2) the study included a measure specific to problem/disordered gambling or problem/disordered gaming as the dependent variable; and (3) the study included a measure specific to CP or DS as the independent variable. Studies were excluded at the full-text screening stage if they: (1) only included a

Table 1. Keywords for database searches

Grouping terms	Keywords
Gambling or gaming	(gambl* OR gambling OR "problem gambling" OR "disordered gambling" OR "gambling disorder" OR "pathological gambling" OR "video game" OR videogame OR games OR gamer OR "problem* use of video games" OR "Internet gaming disorder" OR "gaming disorder") AND
Conduct problems or depressive symptoms	(conduct* OR "conduct problems" OR "conduct disorder" OR delinquency OR aggression OR externaliz* OR "externalizing problems" OR "externalizing symptoms" OR "oppositional defiant disorder" OR "antisocial personality disorder" OR "antisocial behavio*r" OR depression OR "major depression" OR "major depressive disorder" OR "major depressive episode" OR dysthymia OR "mood disorder" OR internaliz* OR "internalizing problems" OR "internalizing symptoms")

measure for impulsive behavior, sensation seeking or substance use (and not CP more specifically); (2) only included a measure of emotional problems based on a composite of both anxious and depressive symptoms without isolating the effect of DS; or (3) investigated Internet addiction/problems without isolating the effect of PVG.

Study assessment

A PRISMA flow diagram of the search results is displayed in Fig. 1. A total of 2,549 articles were identified after duplicate records were removed. Rayyan QCRI (Ouzzani, Hammady, Fedorowicz, & Elmagarmid, 2016) was utilized to perform the blind screening of identified articles. To ensure reliable title and abstract screening, approximately 20% (n = 527) of the titles and abstracts were randomly selected and reviewed by JR and EF. The inter-rater agreement across the reviewers was 95.64%. After the title/abstract screening, 571 full-text articles were deemed potentially eligible and were retrieved for review. To ensure reliable full-text screening, approximately 20% (n = 114) of the full-texts were randomly selected and reviewed by JR and EF. The inter-rater agreement across the reviewers was 94.74%. Discrepancies were resolved through group discussion with a third reviewer (CT) as arbiter and inclusion/exclusion criteria were specified or adjusted as necessary. After the full-text screening, 71 articles met the inclusion criteria for the study.

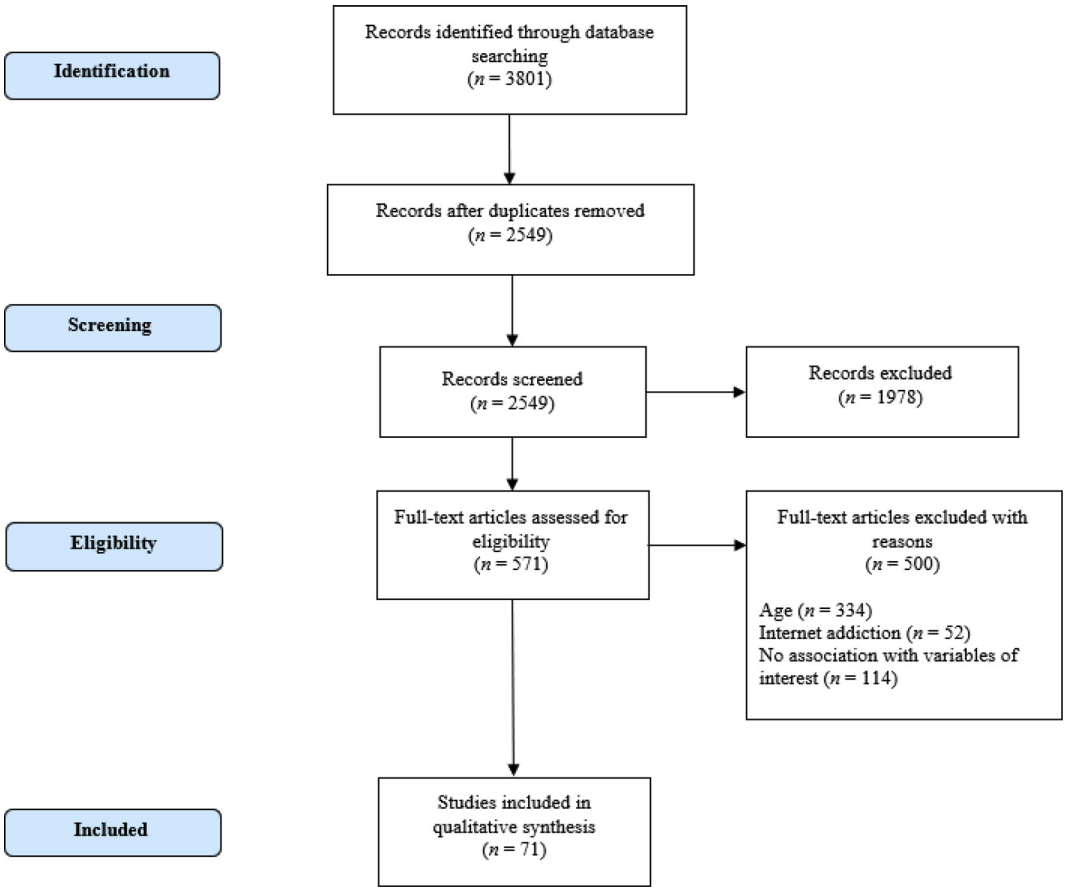

Fig. 1. Flow diagram of paper selection process for the systematic review

Data extraction

JR and EF extracted data from the included studies. The following data were extracted from each of the included studies: (1) type of study (and study duration/number of time-points if longitudinal); (2) independent/predictor, dependent/outcome and control variables; (3) population source; (4) number of participants; (5) age and sex/gender of participants; (6) participant inclusion and exclusion criteria; (7) statistical analyses; and (8) main findings.

RESULTS

Sample characteristics

Sample characteristics of selected studies are presented in Tables 2–4. Approximately 59% of the studies were published within the past five years (2014–2019), with the majority of the studies being carried out in Canada (n = 22), Europe (n = 22), and the United States (n = 16). Forty-seven studies examined PG (33 cross-sectional and 14 longitudinal), 23 studies examined PVG (18 cross-sectional and five longitudinal) and one cross-sectional study investigated both PG and PVG. A majority of the studies utilized convenience sampling methods (n = 49), with others applying random, stratified, or cluster sampling methods. As for the gender of individuals in study samples, 15 studies reported samples that were more than 60% male and seven studies reported samples that were more than 60% female. The most commonly sampled populations included high-school students (n = 23), adolescents/young adults (n = 14), and university students (n = 11).

Measures

Problem gambling (PG) and problem video gaming (PVG). Commonly used measures for PG include: adolescent and adult versions of the South Oaks Gambling Scale (SOGS; Lesieur & Blume, 1987; Winters, Stinchfield, & Fulkerson, 1993) (n = 20), Diagnostic and Statistical Manual of Mental Disorders-Fourth edition-Multiple Response-Juvenile for pathological gambling (DSM-IV-MR-J; Fisher, 2000) (n = 12), Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001) (n = 9), and Massachusetts Gambling Screen DSM-IV subscale (MAGS; Shaffer, LaBrie, Scanlan, & Cummings, 1994) (n = 5). For PVG, the most commonly used measures include: Game Addiction Scale (GAS; Lemmens, Valkenburg, & Peter, 2009) (n = 5), Internet Gaming Disorder Scale (IGDS; Lemmens et al., 2015) (n = 3), DSM-5 criteria for Internet Gaming Disorder (APA, 2013) (n = 2), and pathological gaming based on the DSM-IV-R criteria for pathological gambling (APA, 2000) (n = 2). Compared to PG, there appeared to be a greater variation in the instruments used to assess PVG, with multiple studies using scales developed specifically for the study in question.

Depressive symptoms and conduct problems. Of the included studies, 20 measured CP, 28 measured DS, and 23 measured both CP and DS. The most commonly used measures for CP include: youth, young adult, and parent versions of the Child Behavior Checklist (CBCL; Achenbach 1997; Achenbach & Edelbrock, 1987; Achenbach, Howell, Quay, Conners, & Bates, 1991) (n = 6), Buss-Perry Aggression Questionnaire (BPAQ; Buss & Perry, 1992; Diamond & Magaletta, 2006) (n = 6), Diagnostic Interview Schedule for Children for Conduct Disorder (DISC-C; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000) (n = 6), and the Reynolds Adolescent Adjustment Screening Inventory (RAASI; Reynolds, 2001) (n = 2). As for DS, commonly used measures include: Composite International Diagnostic Interview-Short Form (CIDI-SF; Kessler, Andrews, Mroczek, Ustun, & Wittchen, 1998) (n = 5), Hospital Anxiety and Depression Scale (HADS, Zigmond & Snaith, 1983) (n = 5), Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1996) (n = 4), Beck Depression Inventory I & II (BDI; BDI-II; Beck & Beck, 1972; Beck, Steer, Ball, & Ranieri, 1996) (n = 4), Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1997) (n = 3), and Reynolds Adolescent Depression Scale (RADS; Reynolds, 1987) (n = 2).

Conduct problems

Problem gambling (PG). A total of 15 studies (11 cross-sectional and four longitudinal) were included investigating the relationship between CP and PG (Table 2). Seven cross-sectional studies indicated that problem gamblers experienced greater CP compared to those with no gambling problems, with relative risk or odds ratios ranging from 1.01 to 19.6 (Barnes et al., 2011; Brunelle, Leclerc, Cousineau, Dufour, & Gendron, 2012a; Cheung, 2014; Cook et al., 2015; Hayatbakhsh et al., 2013; Welte et al., 2009; Willoughby et al., 2004). Additionally, Brunelle and colleagues (2012b) reported that CP were related to an increased severity of PG in both Internet and non-Internet gamblers. Terrone et al. (2018) investigated the relationship between CP and PG while measuring the moderating role of attachment style. The authors reported that although CP were associated with PG among those with a dismissing-detached attachment style, this was not the case among those with a fearful-avoidant attachment style. The remaining two studies reported non-significant associations between CP and PG (Pace et al., 2013; Widinghoff et al., 2019).

Evidence from cross-sectional studies indicate strong evidence for a positive association between CP and PG. The two cross-sectional studies that did not report significant associations between CP and PG were similar in that they included a relatively small sample size of males. In their study, Pace and colleagues (2013) report that at-risk (M = 1.09, SD = 0.54) or pathological gamblers (M = 1.19, SD = 0.68), did not differ from non-gamblers (M = 1.11, SD = 0.55) with regards to CP. However, CP did differentiate between at-risk and pathological gamblers. Given the study's

Table 2. Summary of research articles investigating the association between conduct problems and problem gambling and gaming

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP measure	Findings
Problem gambling							
Barnes, Welte, Hoffman, and Tidwell (2011)	United States	Cross-sectional survey Randomly selected telephone sample from a sampling frame of all working telephone blocks in the United States	Representative household sample of adolescents and young adults	N = 2,274 Gender NR M_{age} = NR, range 14–21	SOGS-RA	DISC-C	CP were correlated with PG (r = 0.31, P < 0.001). Youth who endorsed 3 or more symptoms of conduct disorder (CD) were 4 times more likely to report PG compared to those not meeting the criteria for CD (31% vs. 8%). Logistic regression results controlling for gender, age, socioeconomic status, and race/ethnicity indicated that CD increased the odds of being a problem gambler by 4.4 times (P < 0.001). When alcohol, tobacco and marijuana problems were added to the model, CD remained significant, increasing the odds of being a problem gambler by 2.9 times (P < 0.001).
Brunelle et al. (2012a)	Canada (Quebec)	Cross-sectional survey Convenience sampling	High-school students	N = 1,870 54.1% female M_{age} = 15.43 (SD = 0.97, range 14–18)	DSM-IV-MR-J (French version)	MASPAQ	Male and female problem gamblers had higher average scores in all domains of CP including severe delinquency, fraud and theft, and vandalism and interpersonal violence compared to non-gamblers and non-problem gamblers (all significant at P < 0.001).
Brunelle et al. (2012b)	Canada (Quebec)	Cross-sectional survey Convenience sampling	High-school students	N = 1,870 54.1% female M_{age} = 15.43 (SD = 0.97, range 14–18)	DSM-IV-MR-J (French version)	MASPAQ	In both Internet and non-Internet gamblers, CP were associated with a greater severity of PG (β = 0.29, P < 0.05; β = 0.15, P < 0.001, respectively).
Cheung (2014)	China	Cross-sectional survey Stratified random sampling	High-school students	N = 4,734 50.7% male M_{age} = 16.39 (SD = 1.73, range 12–23)	DSM-IV-MR-J	Delinquency scale	Correlations between delinquency and gambling variables (problems, frequency, permissiveness) ranged from r = 0.22 to r = 0.28 (P < 0.001). Logistic regression predicting PG indicated that delinquency predicted PG (AOR = 1.20 95% CI [1.17, 1.23]) while controlling for age, gender, SES, familial status. Delinquency remained significant in the model that also included tobacco and alcohol use (AOR = 1.11 95% CI [1.08, 1.15]).

(continued)

Table 2. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP measure	Findings
Cook et al. (2015)	Canada (Ontario)	Cross-sectional survey	High-school students	N = 4,851	SOGS-RA	Delinquency scale (violent and non-violent acts)	Correlation between delinquency and PG was significant (r = 0.24, P < 0.001). Violent and non-violent delinquent behaviors were more common in PG than non-PG, with ORs ranging from 3.4 to 19.6 depending on the delinquent act. Overall delinquency scores indicated 11.35 times (P < 0.001) higher likelihood of PG. A multivariate logistic regression indicated that higher overall delinquency resulted in youth being 5.9 times (P < 0.001) more likely to meet the criteria for PG compared to less delinquent youth when controlling for hazardous drinking, cannabis dependency, suicide attempt(s) and psychological distress.
		Stratified (region and school type), two-stage (school, class) cluster sampling		53% female M_{age} = 14.6 (SD = NR, range NR)			
Hayatbakhsh, Clavarino, Williams, Bor, and Najman (2013)	Australia	Cross-sectional study	Young adults	N = 3,512	PGSI	CBCL Young Adult Self-Report	Individuals in the top 10% of externalizing problems had a greater likelihood of being categorized as at-risk for problem gambling compared to being categorized as non-gamblers (OR = 5.4, 95% CI [3.1, 9.4]).
		Convenience sampling		47% male M_{age} = 20.6 (SD = 0.8), range 18–23)			
Martins et al., (2013)	United States	14-year longitudinal study	Urban males from predominantly low SES neighborhoods	N = 310	Age 17, 19, & 20: SOGS-RA	Grade 1–3: Childhood aggressive behaviors (Teacher Observation of Classroom Adaptation-Revised)	General growth mixture modeling based on the longitudinal development of CP indicated that those who had chronically high CP throughout childhood were 2.6 times more likely (95% CI [1.06, 6.38]) to meet the criteria for at-risk or PG.
		Convenience sampling		100% male M_{age} = NR (range 6–20)		Grade 6–10: Adolescent aggressive behaviors (Teacher Report of Classroom Behavior-Checklist Form)	Those with chronically high CP throughout adolescence were 3.19 times more likely (95% CI [1.18, 8.64]) to meet the criteria for at-risk or PG.

(continued)

Table 2. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP measure	Findings
Martins et al. (2014)	United States	17-year longitudinal study Convenience sampling	Urban youth from predominantly low SES neighborhood	N = 617 53% male M_{age} = NR (range 6–23)	Age 17, 19, & 20: SOGS-RA	Age 13–17: DISC-C Age 17–23: Arrest history	A greater proportion of problem gamblers (65%) were arrested before the age of 23 compared to social (38%) and non-gamblers (24%). PG was significantly associated with the hazard of first arrest by age 23 in both the unadjusted (HR = 3.6, $P < 0.001$) and adjusted (covarying for gambling status, race, household structure, lunch status, intervention status, theft/property damage, illegal drug use; AHR = 1.6, $P = 0.05$) models
Pace, Schimmenti, Zappulla, and Maggio (2013)	Italy	Cross-sectional study Convenience sampling	High-school students	N = 268 100% male M_{age} = 16.23 (SD = 0.39, range 15–17)	SOGS	CBCL Youth Self-Report	The group of at-risk and pathological gamblers compared to non-gamblers did not endorse higher levels of CP ($P > 0.05$). In the discriminant function analysis, higher CP was one of the variables that best differentiated at-risk gamblers from pathological gamblers (pathological gamblers having slightly more CP) but did not differentiate between non-gamblers and at-risk gamblers.
Terrone et al. (2018)	Italy	Cross-sectional study Convenience sampling	High-school students	N = 94 65.96% male M_{age} = 17.51 (SD = 0.82, range 16–20)	SOGS	CBCL Youth Self-Report	Utilizing attachment style as a moderator, there was a significant positive association between CP and PG only among the dismissing-detached group ($P = 0.04$), but not among the fearful-avoidant group.
Vitaro, Brendgen, Ladouceur, and Tremblay (2001)	Canada (Quebec)	5-year longitudinal study (2 year period reporting CP and PG) Convenience sampling	Adolescent boys from disadvantaged neighborhoods	N = 717 100% male M_{age} = NR (range 13–17)	Age 16–17: SOGS-RA	Age 16–17: Self-Reported Delinquency Scale	Delinquency at age 16 was positively correlated with PG at age 16 ($r = 0.29$, $P < 0.001$) and this association remained significant at age 17 ($r = 0.31$, $P < 0.001$). The path model accounting for gambling frequency, PG and drug/alcohol use at age 16 and 17, indicated that delinquency at age 16 did not significantly predict PG one year later.
Wanner, Vitaro, Carbonneau, and Tremblay (2009)	Canada (Quebec)	7-year longitudinal study Convenience sampling	Sample 1: Low SES youth Sample 2: Community youth	Sample 1: N = 502 100% male Time 1:	SOGS-RA	Sample 1: Self-Report Delinquency Questionnaire Sample 2: DISC-C (delinquency)	In both samples, there were significant correlations ($P < 0.05$) between CP and PG at age 16 ($r = 0.22$–0.25), age 23 ($r = 0.21$–0.31), and age 16 and 23 ($r = 0.07$(ns)-0.13). Investigating the cross-lagged models, CP at age 16 were not prospectively linked to PG at age 23, when accounting for gambling participation, PG, and substance use at age 16.

(continued)

Table 2. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP measure	Findings
				M_{age} = 16.2 (SD = 0.6, range NR) Time 2: M_{age} = 22.8 (SD = 0.6, range NR) Sample 2: N = 663 100% male Time 1: M_{age} = 16.2 (SD = 0.5, range NR) Time 2: M_{age} = 22.5 (SD = 0.5, range NR)			
Welte, Barnes, Tidwell, and Hoffman (2009)	United States	Cross-sectional study Stratified sample by county and telephone block within county across the United States	United States residents	N = 2,258 Gender NR M_{age} = NR (range 14–21)	SOGS-RA	DISC-C	Those who had current CP had a 6.1% rate of current PG (vs. 1.7% in non-CP) and a 22.9% rate of current at-risk/PG (vs. 5.2% in non-CP). In the logistic regression, with each additional DISC-C symptom, odds of at-risk/PG increased (OR = 1.4 (95% CI [1.3, 1.6]). This effect was most striking for those aged 14–15, with an odds ratio of 1.8 (95% CI [1.3, 2.2]). By age 20–21, this relationship was no longer significant (P > 0.05). In the multinomial logistic regression predicting at-risk/PG age of onset, each additional DISC-C symptom increased the odds that one would have a gambling problem before age 14 (OR = 1.6, 95% CI [1.4, 1.8]), and age 15 and later (OR = 1.2, 95% CI [1.0, 1.4]).
Widinghoff et al. (2019)	Sweden	Cross-sectional study Convenience sampling	Violent offenders in prison	N = 264 100% male M_{age} = 22.3 (SD = NR, range 18–25)	SCID DSM-IV	SCID Conduct Disorder	Rates of gambling disorder were not higher among those with a conduct disorder (P = 0.15).

(continued)

Table 2. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP measure	Findings
Willoughby, Chalmers, and Busseri (2004)	Canada (Ontario)	Cross-sectional study Convenience sampling	High-school students	N = 7,290 47.7% male M_{age} = 15.58 (SD = 1.33, range 13–18)	SOGS-RA	Delinquency (minor and major) and aggression (direct and indirect)	Correlations between CP and PG were significant ranging from r = 0.16–0.18 (P < 0.001). Results from the confirmatory factor analysis indicated a three-factor model with a delinquency factor including major delinquency (β = 0.50, P < 0.001), minor delinquency (β = 0.57, P < 0.001), and gambling (β = 0.30, P < 0.001). This factor was significantly correlated with the aggression factor (r = 0.63). Lastly, there was a consistent co-occurrence of CP and PG across levels of severity (risk ratios ranging between 1.01 and 3.45, all P < 0.001).
Problem video gaming							
Kim et al. (2018)	South Korea	Cross-sectional study Convenience sampling	First year middle-school students	N = 402 55.5% male M_{age} = 13.0 (SD = 0.40, range NR)	IGUESS	BPAQ	Correlation analyses indicated a positive correlation between CP and PVG (r = 0.32, P < 0.001). A mediation model was created with father-adolescent communication as a mediating variable between CP and PVG. CP were directly related to PVG (β = 0.29, P < 0.001), with a significant partial indirect effect through poorer father-adolescent communication (β = 0.19, P < 0.001). The total effect of the model was significant (β = 0.42, P < 0.001).
Ong, Peh, and Guo (2016)	Singapore	Cross-sectional study Convenience sampling	Adolescents presenting at an addiction treatment center (for substance or behavioral addictions)	N = 260 81.2% male M_{age} = 15.48 (SD = 1.93, range NR-19)	Pathological gaming based on DSM-IV-R-PG; PIUQ; GAS	Delinquent behavior based on violent and non-violent crimes	Adolescents with a history of delinquency were less likely to report PVG compared to adolescents without a history of delinquency (P = 0.001).
Tejeiro, Gómez-Vallecillo, Pelegrina, Wallace, and Emberley (2012)	Spain	Cross-sectional study Convenience sampling	High-school students	N = 737 52% male M_{age} = 14 (SD = 1.12, range 12–17)	PVP	Anti-Social Illegal Behaviors Questionnaire	The cluster analysis indicated three clusters in the data; 1) comorbid-PVG, 2) social-PVG and 3) non-PVG. The comorbid-PVG cluster, had significantly higher levels of CP compared to the non-PVG group (P < 0.001).
Wartberg et al. (2017)	Germany	Cross-sectional study	Family dyads (adolescent and related caregiver). 98.8% of	N = 1,095 50.8% male	IGDS	RAASI subscale for antisocial behavior	Two regression models were conducted (linear and logistic) controlling for gender, anger control problems, self-esteem problems, hyperactivity/inattention, parental depression and anxiety.

(continued)

Table 2. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP measure	Findings
		Convenience sampling	caregivers were biological parents (85% mothers)	M_{age} = 12.99 (SD = 0.82, range 12–14)			In the linear regression model, CP predicted PVG (β = 0.14, P < 0.001), and CP also predicted PVG in the logistic regression model (OR = 1.11, 95% CI [1.00, 1.22], P < 0.05).
Wartberg, Kriston, Zieglmeier, Lincoln, and Kammerl (2019)	Germany	1-year longitudinal study Convenience sampling	Family dyads (adolescent and related caregiver). 98.8% of caregivers were biological parents (85% mothers)	N = 985 50.7% male Time 1: M_{age} = 12.99 (SD = 0.82, range 12–14) Time 2: M_{age} = 13.89 (SD = 0.89, range NR)	IGDS	RAASI subscale for antisocial behavior	CP and PVG were correlated at Time 1 (r = 0.44, P < 0.01), Time 2 (r = 0.46, P < 0.01) and between Time 1 and Time 2 (r = 0.28–0.30, P < 0.01). In the cross-lagged panel design (controlling for anger control problems, emotional distress, self-esteem, hyperactivity/inattention, parental depression and anxiety), CP at Time 1 did not predict PVG at Time 2 (P > 0.05).

Note. BPAQ = Buss-Perry Aggression Questionnaire, CBCL = Child Behavior Checklist, DISC-C = Diagnostic Interview Schedule for Children for Conduct Disorder, DSM-IV-R-PG = Diagnostic and Statistical Manual-IV-Revised-Pathological Gambling, CP = conduct problems, GAS = Game Addiction Scale, IGDS = Internet Gaming Disorder Scale, IGUESS = Internet Game Use-Elicited Symptom Screen, MASPAQ = Mesure de l'adaptation sociale et personnelle pour adolescents Quebecois, PIUQ = Problematic Internet Use Questionnaire, PG = problem gambling, PGSI = Problem Gambling Severity Index, PVG = problem video gaming, PVP = Problem Video Game Playing, RAASI = Reynolds Adolescent Adjustment Screening Inventory, SCID = Structured Clinical Interview for DSM-IV, SOGS = South Oaks Gambling Screen, SOGS-RA = South Oaks Gambling Screen – Revised Adolescent.

Table 3. Summary of research articles investigating the association between depressive symptoms and problem gambling and gaming

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	DS measure	Findings
Problem gambling							
Afifi, Nicholson, Martins, and Sareen (2016)	Canada (Manitoba)	5-year longitudinal survey Random sampling, snowball recruitment, and convenience sampling	Representative sample of young adults	Time 1: N = 679 51.8% female M_{age} = 18.9 (SD = NR, range 18–20) Time 4: N = 517	PGSI	CIDI-SF	Cross-sectional analyses indicated that at-risk or PG was associated with an increased risk of major depressive disorder (AOR = 2.33, 95% CI [1.47, 3.68]) Longitudinal findings indicated that at-risk or PG at T1 was associated with increased odds of major depressive disorder at Time 2 through 4 (AOR = 1.98, 95% CI [1.14, 3.44]). Major depressive disorder at T1 was not significantly associated with increased odds of at-risk or PG at Time 2 through 4 (P = 0.56).
Bilevicius et al. (2018)	Canada (Manitoba)	1-month longitudinal survey Convenience sampling through an online participant pool of psychology students	University students	Time 1: N = 497 Gender NR M_{age} = NR Time 2: N = 210 76% female M_{age} = 19.71 (SD = 3.83, range NR)	PGSI	DASS depression subscale	DS were correlated with PG symptoms at both T1 (r = 0.14, P < 0.05) and T2 (r = 0.21, P < 0.01). Mediation analyses indicated that after controlling for baseline PG, there was a significant positive indirect relationship between DS and PG which was partially mediated by high levels of shame (β = 0.021, 95% CI [0.006, 0.046]).
Chinneck, Mackinnon, and Stewart (2016)	Canada (Manitoba)	4-year longitudinal survey Random sampling, snowball recruitment, and convenience sampling	Representative sample of young adults	Time 1: N = 679 51.8% female M_{age} = 18.92 (SD = 0.79, range 18–20) Time 4: N = 530 M_{age} = 22.23 (SD = NR, range 22–24)	PGSI	CIDI-SF	At T1, DS and PG were positively correlated (r = NR). However, DS at T1 were unrelated to changes in PG over time. Further, PG at T1 was unrelated to changes in DS over time.
Cosenza, Ciccarelli, and Nigro (2019)	Italy	Cross-sectional survey Convenience sampling	High-school students	N = 425 45.5% male	SOGS-RA	DASS depression subscale	DS was correlated with PG (r = 0.23, P < 0.001).

(continued)

Table 3. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	DS measure	Findings
				M_{age} = 17.12 (SD = 1.42, range 14–19)			Those with PG had higher levels of DS compared to the non-PG group. In the regression model, DS predicted PG (β = 0.015, P < 0.001).
Delfabbro and Grabosky (2006)	Australia	Cross-sectional survey	High-school students	N = 926	DSM-IV-MR-J	Negative Mood Checklist	Those reporting PG had greater negative mood (d = 0.49, P < 0.01) compared to those who did not report PG.
		Convenience sampling		51% male M_{age} = 14.5 (SD = 1.64, range 11–19)			In the regression model, DS was non-significant in predicting PG when accounting for other psychosocial predictors including self-esteem, health, social alienation, and relative deprivation. Only social alienation was significant.
Dowd et al. (2018)	Canada (Manitoba)	Cross-sectional survey	Representative sample of young adults	N = 566	PGSI	CIDI-SF	Results from the latent class analysis indicated that 27.4% of sample were the emotionally vulnerable type of problem gambler, with higher levels of DS. This was compared to a larger class of non-problem gamblers (59.90%) and impulsive problem gamblers (12.72%).
		Random sampling, snowball recruitment, and convenience sampling		47.8% male M_{age} = 19.97 (SD = 0.82, range 18–22)			
Dussault et al. (2016)	Canada (Quebec)	9-year longitudinal survey (PG and DS measured over a 6-year period)	Boys living in economically disadvantaged areas	N = 1,004	Age 17: SOGS-RA	Age 17: CDI	Correlations between DS and PG at age 17 and 23 were of r = 0.14 (P < 0.01). DS and PG at age 23 were correlated at r = 0.15 (P < 0.01).
		Convenience sampling		100% male Time 1: M_{age} = NR, (range 14–17)	Age 23: SOGS	Age 23: DISC-D	Longitudinal associations indicated that PG at age 17 predicted increases in DS at age 23 (β = 0.151, P < 0.001). DS at age 17 predicted increases in PG at age 23 (β = 0.131, P < 0.001). PG and DS at age 17 (P < 0.38) and age 23 (P < 0.66) were not concurrently associated.
Edgerton, Melnky, and Roberts (2015)	Canada (Manitoba)	4-year longitudinal survey	Representative sample of young adults	Time 1:	PGSI	CIDI-SF	The increased probability of DS were associated with increased initial PG severity scores at Time 1 (β = 0.134, P < 0.05). However, this had no effect on the rate of change in PG severity.
		Random sampling, snowball recruitment, and convenience sampling		N = 679 51.8% female M_{age} = NR (range 18–20)			

(continued)

Table 3. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	DS measure	Findings
Edgerton, Keough, and Roberts (2018)	Canada (Manitoba)	4-year longitudinal survey Random sampling, snowball recruitment, and convenience sampling	Representative sample of young adults	Time 1: N = 679 51.8% female M_{age} = NR (range 18–20)	PGSI	CIDI-SF	Correlations between DS and PG from Time 1 to 4 ranged from r = 0.001 (P > 0.05) to r = 0.09 (P < 0.05), the latter being between DS at T1 and PG at T4. Five classes were identified, with only one class indicating PG: moderate and stable PG with no DS (2.06%). Overall, there was no evidence of reciprocal growth in PG and DS in any of the classes.
Ellenbogen, Derevensky, and Gupta (2007)	Canada (Ontario & Quebec)	Cross-sectional survey Convenience sampling	High-school or junior college students	N = 5,313 51.8% male M_{age} = 14.77 (SD = NR, range 12–18)	DSM-IV-MR-J	RADS	Non-PG, females were more likely to report DS. However, among those with PG, both males and females reported higher rates of DS. Rates of DS among PG were approximately 2–4 times higher than for social gamblers.
Martin, Usdan, Cremeens, and Vail-Smith (2014)	United States	Cross-sectional study Convenience sampling	University students	N = 1,430 64.4% female M_{age} = NR (first- or second-year university students)	DSM-IV-MR-J	PHQ-9	Correlations for DS and PG were significant (r = 0.105, P < 0.01). When compared to non-PG, PG had higher rates of DS (40.0%, OR = 3.3, 95% CI [1.9, 5.6]).
Molde, Pallesen, Bartone, Hystad, and Johnsen (2009)	Western Norway	Cross-sectional study Random sampling from total population of high-school students	High-school students (11^{th}-13^{th} grade)	N = 2,055 52.9% male M_{age} = 17.3 (SD = 0.8, range 16–19)	MAGS	HADS depression subscale	In the univariate logistic regression, DS predicted PG (OR = 14.4, P < 0.001). In the multivariate logistic regression, significant predictors of PG included gender, depression (OR = 9.23, P < 0.001), alcohol abuse and self-forgetting when gambling. DS had the largest odds ratio.
Nigro, Cosenza, and Ciccarelli (2017)	Italy	Cross-sectional study Convenience sampling	Middle- and high-school students	N = 1,010 47.5% male M_{age} = 15.37 (SD = 2.05, range 12–19) N = 3,941	SOGS-RA	DASS depression subscale RADS	Significant correlations were reported between DS and PG (r = 0.279, P < 0.01). Problem gamblers also endorsed a greater mean score of DS compared to non-gamblers, non-problem gamblers, and at-risk gamblers (P = NR). In the linear regression, DS predicted severity of PG while controlling for gender, age, impulsivity, anxiety, and future/immediate implications of behavior (β = 0.129, P < 0.001).

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Table 3. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	DS measure	Findings
Nower, Gupta, Blaszczynski, and Derevensky (2004)	Canada (Quebec & Ontario)	Cross-sectional study Convenience sampling	Three combined samples of high-school students (two in Quebec, one in Ontario)	49.15% male M_{age} = NR (range 12–18)	Sample 1 & 2 (S1 & 2): DSM-IV-MR-J Sample 3 (S3): DSM-IV-MR-J &		In all three samples, those with PG reported significantly higher DS compared to non-gamblers and social gamblers ($P < 0.01$; S1 = 23.1%; S2 = 24.5%; S3 = 20.4% clinically depressed).
Pascual-Leone, Gomes, Orr, Kaploun, and Abeare (2011)	Canada (Ontario)	Cross-sectional study Convenience sampling	University students	N = 200 88.5% female M_{age} = 21.41 (SD = 3.53, range NR)	SOGS	BDI-II	Descriptive statistics indicated that 7.5% (n = 15) of the sample were at-risk or problem gamblers. Correlations indicate that DS were not significantly correlated with PG scores (r = 0.117, $P > 0.05$). DS were not included in the regression analysis.
Sanscartier, Edgerton, and Roberts (2018)	Canada (Manitoba)	Cross-sectional study Convenience sampling	University students	N = 496 43.1% male M_{age} = 20.22 (SD = 1.77, range 18–25)	PGSI	CES-D	Latent class analysis results yielded a four-class solution: 1) casual gamblers; 2) skill-interactive gamblers; 3) chance-passive gamblers; and 4) extensive gamblers. Extensive gamblers and chance-passive classes had higher rates of PG compared to the casual and skill-based gamblers. Chance-passive gamblers had greater DS compared to casual gamblers ($P < 0.05$, η^2 = 0.14). Chance-passive gamblers and extensive gamblers did not differ in DS.
Stuhldreher, Stuhldreher, and Forrest (2007)	United States	Cross-sectional study Convenience sampling	University students	N = 1,079 58% female M_{age} = 19.9 (SD = 1.6, range NR)	Four criteria for PG: gambling-related harms and help-seeking behaviors	BDI	Comparisons for DS were conducted for each of the four criteria for PG. Results indicate that for all four criteria there was a greater proportion of individuals with a positive score for DS.
Wohl, Matheson, Young, and Anisman (2008)	Canada	Cross-sectional study Convenience sampling	First-year university students reporting gambling in the past year	N = 125 58.4% male M_{age} = 20 (SD = 0.75, range NR)	DSM-IV-MR-J	BDI	DS scores varied between gamblers, where pathological gamblers endorsed significantly more DS (M = 14.87, SD = 5.70) than problem (M = 8.40, SD = 7.80) or recreational (M = 6.60, SD = 5.71) gamblers. This was the case for both males and females.
Problem video gaming							
Bonnaire and Baptista (2019)	France	Cross-sectional study Convenience sampling	Online forums	N = 429 71.3% male	GAS Short Version	HADS depression subscale	Compared to non-PVG, PVG had higher DS (M = 15.4 vs M = 12.2, $P < 0.001$). This was significant for both males and females. In the logistic regression analysis, DS significantly predicted PVG (OR = 1.2, 95% CI [1.1–1.3], $P <$

(continued)

Table 3. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	DS measure	Findings
				M_{age} = 20.7 (SD = 2.6, range 18–25)			0.001) while controlling for sex, anxiety and alexithymia.
Dang, Zhang, Leong, and Wu (2019)	China	1-year longitudinal study Convenience sampling	University students with gaming experience	N = 282 39.4% male Time 1: M_{age} = 20.47 (SD = 1.15, range NR)	DSM-5 criteria for IGD	DASS depression subscale	DS and PVG were significantly correlated at both time points (r = 0.26–0.42, P < 0.001). In the path analysis, DS were identified as a mediator in the relationship between trait emotional intelligence (TEI) and PVG. In the cross-sectional model, DS mediated the relationship between TEI and PVG, while also mediating the relationship between coping flexibility and PVG. Consistent findings are reported in the prospective model. The models indicated that DS were a significant concurrent mediator at both T1 and T2 (direct effects; T1: (β = 0.37, P < 0.001; T2: β = 0.29, P < 0.001).
Givron, Berrewaerts, Houbeau, and Desseilles (2018)	Belgium	Cross-sectional study Convenience sampling	First-year university medical students	N = 210 29.5% male M_{age} = 18.5 (SD = 1.0, range 17–25)	PVP	MADRS-S	As the severity of DS increased (none, minor, moderate), the average PVG score increased from M = 1.9, M = 2.4, to M = 3.9, respectively. This change was significant (P = 0.001).
Guillot et al. (2016)	United States	1-year longitudinal study (9–18-month range) Convenience sampling	Emerging adults, former attendees of alternative high-schools, and prior participants in a school-based substance abuse prevention program	N = 503 47.7% male M_{age} = NR (range 19–24)	Video Game Addiction (1 item)	Snaith-Hamilton Pleasure Scale	Anhedonia predicted greater levels of PVG one year later (OR = 1.33, 95% CI [1.11, 1.60], P = 0.003), while controlling for gender and high-school graduation.
Kircaburun, Griffiths, and Billieux (2019)	Turkey	Cross-sectional study Convenience sampling	High-school students	N = 470 40.4% male M_{age} = 16.29 (SD = 1.17, range 14–18)	IGDT-10	SDHS	DS were positively correlated with PVG (r = 0.13, P < 0.001). A multiple mediation model was tested to examine the mediating role of DS (in addition to mindfulness and rumination) on the relationship between emotional intelligence (EI) and PVG. Results indicated that although the other mediators were significant, DS did not mediate the relationship between EI and PVG.

(continued)

Table 3. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	DS measure	Findings
Li, Liau, and Khoo (2011)	Singapore	Cross-sectional study Convenience sampling	Adolescents with massively multiplayer online gaming experience	N = 161 49.1% male M_{age} = 14.04 (SD = 0.73, range 13–15)	Pathological gaming based on DSM-IV-R-PG	Asian adolescent depression scale	DS and PVG were positively correlated (r = 0.31, P < 0.01). Results of the path model, indicated that escapism mediated the relationship between DS and PVG (indirect effect [β = 0.09, P < 0.05]; direct effect from DS to escapism [β = 0.45, P < 0.01]), while DS mediated the relationship between actual-ideal self-discrepancies (AISD) and escapism (indirect effect [β = 0.09, P < 0.05]; direct effect from AISD to DS [β = 0.20, P < 0.01]), with escapism being directly related to PVG (β = 0.34, P < 0.01). The direct relationship between DS and PVG was non-significant (β = 0.13, P > 0.05).
Liu et al. (2018)	China	Study 1: 4-year longitudinal study Convenience sampling	Study 1: University students with experience playing online games, spending on average 20% of their daily time gaming	Study 1: N = 563 78% male Time 1: M_{age} = 18.31 (SD = 0.89, range 16–21)	Chinese Internet Addiction Scale	SCL-90 depressive symptoms	Across the four time points, higher DS at T1 were associated with greater PVG severity from Time 2 to 4 (r = 0.25–0.30, P < 0.01). Higher PVG at T1 was associated with greater DS at Time 2 to 4 (r = 0.19–0.27, P < 0.01). Results from the cross-lagged path models indicated that although there is a temporal interrelationship between DS and PVG, the impact of DS on PVG (β = 0.118, 0.126, 0.127; P < 0.001) is greater than the impact of PVG on DS (β = 0.070, 0.066, 0.070; P < 0.05).
Männikkö, Billieux, and Kääriäinen (2015)	Finland	Cross-sectional study Random sampling stratified for age and gender	Adolescents and young adults	N = 293 51% male M_{age} = 18.7 (SD = 3.4, range 13–24)	GAS	Depression (frequency of feeling depressed)	DS and PVG were positively correlated (r = 0.17, P < 0.01). Those with PVG endorsed greater DS than those with no-PVG (22.6% vs 6.5%, P < 0.001). In the linear regression model, DS were a significant predictor of PVG (β = 0.18, P < 0.01) when controlling for occupation, education level, age, gaming frequency, health, exercise, life satisfaction, and preference for online interaction.
Vadlin Åslund, Hellström, and Nilsson (2016)	Sweden	Cross-sectional study Sample 1: Total population sampling Sample 2: Consecutive sampling at child and adolescent psychiatric clinics	Sample 1: Community sample of adolescents Sample 2: Clinical sample of adolescents in psychiatric clinics	Sample 1: N = 1,868 55.4% female M_{age} = 13.9 (SD = NR, range 12–16) Sample 2: N = 242 69.8% female	GAIT	DSRS-A	In the multivariable logistic regression analysis adjusting for sex, age, school bullying, and family maltreatment, attention problems, and anxiety, adolescents with DS were 2.47 times more likely to be PVG (95% CI [1.44, 4.25], P < 0.001).

(continued)

Table 3. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	DS measure	Findings
				M_{age} = 15.39 (*SD* = NR, range 12–18)			
Van Rooij et al. (2014)	Netherlands	Cross-sectional study Stratified sampling of schools based on region, urbanization and education level	High-school students	*N* = 8,478 49% male M_{age} = 14.2 (*SD* = 1.1, range NR)	VAT	Depressive Mood List (Dutch translation)	Analyses were conducted separately by gender. In males, DS were associated with an increase in PVG (d = 0.91, P < 0.001). In females, DS associated with an increase in PVG (d = 1.23, P < 0.001).

Note. BDI = Beck Depression Inventory, CDI = Child Depression Inventory, CES-D = Center for Epidemiologic Studies Depression Scale, CIDI-SF = Composite International Diagnostic Interview-Short Form, DASS = Depression Anxiety Stress Scale, DISC-D = Diagnostic Interview Schedule for Children for Depressive Symptoms, DS = depressive symptoms, DSM-IV-R-PG = Diagnostic and Statistical Manual - IV - Revised - Pathological Gambling, DSRS-A = Depression Self-Rating Scale Adolescent Version, GAIT = Gaming Addiction Identification Test, GAS = Game Addiction Scale, HADS = Hospital Anxiety and Depression Scale, IGD = Internet Gaming Disorder, IGDT-10 = Internet Gaming Disorder Test, MADRS-S = Montgomery and Asberg Depression Rating Scale, MAGS = Massachusetts Gambling Screen DSM-IV subscale, PG = problem gambling, PGSI = Problem Gambling Severity Index, PHQ-9 = Patient Health Questionnaire-9, PVG = problem video gaming, PVP = Problem Video Game Playing, RADS = Reynolds Adolescent Depression Scale, SCL-90 = Symptom Checklist, SDHS = Short Depression Happiness Scale, SOGS = South Oaks Gambling Screen, SOGS-RA = South Oaks Gambling Screen – Revised Adolescent, VAT = Video Game Addiction Test.

Table 4. Summary of research articles investigating the association between both conduct problems, depressive symptoms and problem gambling and gaming

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP and DS measure	Findings
Problem gambling							
Allami et al. (2017)	Canada (Quebec)	11-year longitudinal survey	Sample 1: Low SES francophone adolescents	Sample 1:	Age 16: SOGS-RA	CP: Age 12: Teacher report (antisocial & aggressive behavior)	Latent profile analysis results indicated 4 classes, with two classes having higher CP and DS respectively: a biologically vulnerable (BV) class and an emotionally vulnerable (EV) class
		Sample 1: Convenience sampling (high-risk)	Sample 2: Representative francophone school students	Time 1:	Age 23: SOGS	DS: Age 12: Teacher report (DS)	Longitudinal findings indicated that being in either the BV or EV subgroup at age 12 was a risk for PG at age 23, but not age 16. This relationship was strongest for the BV class, reporting significantly more PG than behaviorally conditioned gamblers and significantly more PG than EV gamblers. By age 23, the proportion of BV gamblers increased from what it was at age 16. For EV gamblers, class proportions were stable.
		Sample 2: Convenience sampling (partly probabilistic)		N = 1,033 Time 4: N = 899 100% male M_{age} = NR, range 12–23 Sample 2: Time 1: N = 6,397 Time 4: N = 3,017 58% male M_{age} = NR, range 12–23			
Allami et al. (2018)	Canada (Quebec)	11-year longitudinal survey	Sample 1: Low SES francophone adolescents	Sample 1:	Age 16: SOGS-RA	CP: Age 12: Teacher report (antisocial & aggressive behavior)	Correlation analyses indicated significant correlations between CP and PG (r = 0.08–0.16, P < 0.01) and DS and PG at 16 and 23 years (r = 0.07–0.09, P < 0.01).
		Sample 1: Convenience sampling (high-risk group)	Sample 2: Representative francophone school students	Time 1:	Age 23: SOGS	DS: Age 12: Teacher report (DS)	Latent profile analysis results identified an externalizing (high CP), an internalizing (high DS) and a comorbid class (high CP and DS).
		Sample 2: Convenience sampling (partly probabilistic)		N = 1,033 Time 4: N = 939 100% male M_{age} = NR, range 12–23 Sample 2:			At age 16 and 23, both externalizing and comorbid classes had greater PG symptoms compared to the well-adjusted class. The internalizing class did not report greater PG compared to the well-adjusted class.

(continued)

Table 4. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP and DS measure	Findings
				Time 1: N = 6,397 Time 4: N = 3,142 58% male M_{age} = NR, range 12–23			
Giralt et al. (2018)	Germany	Cross-sectional study Two samples based on random probability sampling with a stratification by school type and regional population density	Adolescents	N = 9,309 49.4% male M_{age} = 15.3 (SD = 1.71, range 12–18)	DSM-IV-MR-J	CP & DS: Strengths and Difficulties Questionnaire	When covarying for age, DS (boys $P < 0.001$, $\eta^2 = 0.037$; girls; $P < 0.001$, $\eta^2 = 0.012$) and CP (boys $P < 0.001$, $\eta^2 = 0.111$; girls $P < 0.001$, $\eta^2 = 0.043$) were greater in those with at-risk/PG compared to those with no PG.
Gupta et al. (2013)	Canada (Quebec & Ontario)	Cross-sectional study Convenience sampling	High-school students reporting problem gambling	N = 109 72% male M_{age} = 15.6 (SD = 1.10, range 14–18)	DSM-IV-MR-J	CP & DS: Millon Adolescent Clinical Inventory	Results from the latent class analyses identified 5 classes. These classes support the groups identified within the *Pathways Model* (Blaszczynski & Nower, 2002), in addition to a DS only class (27%) and a combined (DS/CP) (10%) class.
Hardoon, Gupta, and Derevensky (2004)	Canada (Ontario)	Cross-sectional study	High-school students	N = 2,336	DSM-IV-MR-J	CP & DS: Conners-Wells Adolescent Self-Report Scale	CP were the largest clinical problem for probable PG, with 55% of the latter reporting clinical levels of CP, which was greater than the CP reported by non-gamblers and social gamblers ($P < 0.001$). Similar findings were reported for DS, with 27.4% of probable PG reporting such problems and this being greater than the DS reported by non-gamblers and social gamblers ($P < 0.001$).
		Convenience sampling		42% male M_{age} = 14.76 (SD = 1.91, range 12–19)			In the regression model controlling for family problems, anger control problems, hyperactivity, and inattention, CP was significant in predicting at-risk/probable PG (β = 0.083, Exp(β) = 1.087, $P < 0.001$). However, DS was non-significant.
Kaminer, Burleson, and	United States	Cross-sectional study	Adolescents diagnosed with psychoactive	N = 97	MAGS	CP & DS: DISC-C & SCID	In the sample, 34% never gambled, 57% were social/non-problem gamblers, 8% (n = 8) were at-risk and 1% (n = 1) met the criteria for pathological gambling.

(continued)

Table 4. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP and DS measure	Findings
Jadamec (2002)		Convenience sampling	substance use disorders (DSM-III-R)	66% male M_{age} = NR (range 13–18)			Bivariate analyses indicated that there was no correlation between DS and PG (r = -0.09, $P < 0.05$) and between CP and PG (r = 0.09–0.18, $P < 0.05$).
Kong et al. (2014)	United States	Cross-sectional study Latent class analysis results indicated that compared to the low-risk gambling class, all three other classes (including the at-risk chasing gambling, at-risk negative consequences gambling, and problem gambling) were more likely to experience CP ($P < 0.001$).	High-school students	N = 3,901	MAGS	CP: Aggression (2 items; weapon carrying or serious fights)	
M_{age} = NR (range 14–21)		Non-random, yet all schools in Connecticut were invited to participate.		48.5% male	DS: Depression (1 item; feeling sad or hopeless almost every day for 2 or more weeks)		For DS, only the at-risk negative consequences and problem gambling classes were more likely to experience DS compared to the low-risk gambling group ($P < 0.001$).
Langhinrichsen-Rohling, Rohde, Seeley, and Rohling (2004)	United States	Cross-sectional study	High-school students	N = 1,735	SOGS-RA	CP: 2 items (getting in trouble more than others your age; more trouble in school than others your age)	Five groups were identified from the discriminant function analyses: 1) non-gambler; 2) non-problem gambler; 3) at-risk gambler; 4) problem gambler and; 5) pathological gamblers. CP were a significant predictor in the linear progression from least to most PG, DS were not a significant predictor.
		Convenience sample		Gender NR		DS: CES-D	Pathological gamblers reported significantly more CP (M = 1.36) and more DS (M = 0.88) than did individuals in the

(continued)

Table 4. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP and DS measure	Findings
				M_{age} = NR (range 14–19)			other four groups. At-risk gamblers reported more CP (M = 0.67) but not more DS (M = 0.21) compared to non-gambles and non-problem gamblers.
Petry and Tawfik (2001)	United States	Cross-sectional study Convenience sampling	Adolescents entering treatment for marijuana abuse	N = 255 83.92% male M_{age} = 15.8 (SD = 1.2, range 12–18)	GAIN & DSM-IV-MR-J	CP & DS: GAIN	In the multivariate model examining differences between PG and non-PG (controlling for race, age and gender), PG were more likely (P < 0.05) to endorse CP. There was no difference in DS between the PG and non-PG groups (P > 0.05).
Potenza et al. (2011)	United States	Cross-sectional study	High-school students	N = 2,006	MAGS	CP: Aggression (2 items; weapon carrying or serious fights)	Comparing at-risk PG and PG to low risk gamblers, at-risk PG were more likely to report DS among both Internet (29% vs 20%, P = 0.05) and non-Internet (28% vs 22%, P = 0.01) gamblers. Similar findings for Internet and non-Internet gamblers are noted for those reporting CP (P < 0.001) including serious fights (13.55–30% vs. 5.94–13.75%) and carrying a weapon (38.8–53% vs. 20.15–33%).
		Convenience sampling		59.92% male M_{age} = NR (range 14–18)		DS: Depression (1 item; feeling sad or hopeless almost every day for 2 or more weeks)	
Sagoe et al. (2017)	Norway	2-year longitudinal study	Late adolescents/ young adults	N = 1,277	PGSI	CP: BPAQ-SF	Latent class analyses indicated a three-class solution provided the best fit for patterns of gambling from age 17 to 19: 1) consistent non-gambling (71%); 2) consistent non-risk gambling (23.8%); 3) risk-and-problem gambling (5.1%).
		Random sampling based on national population registry.		67.1% female M_{age} = NR (range 17–19)		DS: HADS depression subscale	Correlates of the risk-and-problem gambling class at age 17 include greater CP (physical aggression, OR = 1.58, P = 0.01; verbal aggression, OR = 1.54, P = 0.03) and greater DS (OR = 1.14, P = 0.03). At age 19, the risk-and-problem gambling class had the highest levels of DS (d = 0.53) and CP (physical, d = 0.91; verbal, d = 0.57).
Tackett et al. (2017)	United States	Cross-sectional study	University students	N = 4,751	SOGS	CP: Zuckerberg-Kuhlman Personality Questionnaire: Aggression/ Hostility & BSI	After accounting for the shared variance between PG and alcohol problems, personality correlates of PG among men included CP (aggression/hostility; r = 0.31, P = 0.001). This was non-significant among women.
		Convenience sampling		55.1% male		DS: BSI	For the mental health correlates, among men, DS were non-significant yet CP (hostility; r = 0.23, P < 0.001) were

(continued)

Table 4. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP and DS measure	Findings
				M_{age} = 20.34 (SD = 3.31, range NR)			significant. For women, both DS (r = 0.27, P < 0.01) and CP (hostility; r = 0.46, P < 0.001) were significant.
Yip et al. (2011)	United States	Cross-sectional study	High-school students	N = 2,484	MAGS	CP: Aggression (2 items; weapon carrying or serious fights)	Individuals with PG were more likely to report past year DS in comparison to low-risk (OR = 4.15, P < 0.001) and at-risk gamblers (OR = 3.95, P < 0.001). Individuals with PG were also more likely to report serious fights (OR = 6.48, P < 0.001; OR = 6.45, P < 0.001) and carrying a weapon to school (OR = 3.40, P < 0.001; OR = 2.89, P < 0.001) compared to low- and at-risk gamblers.
		Convenience sampling		55.84% male M_{age} = NR (range 13–19)		DS: Depression (1 item; feeling sad or hopeless almost every day for 2 or more weeks)	
Yücel et al. (2015)	Australia	6-year longitudinal study	Adolescents	N = 156	SOGS-RA	CP: CBCL Parent Report	There were no significant differences across gambling risk categories with regards to DS (P = 0.62–0.96) and CP (P = 0.41–0.59) across all time points. However, females with risky gambling reported greater CP than no-risk gamblers at T1 (P = 0.03). This difference was no longer significant at T2 (P =0.18).
		Convenience sampling		51.3% male Time 1: M_{age} = 12.5 (SD = 0.4, range NR) Time 2: M_{age} = 16.7 (SD = 0.4, range NR) Time 3: M_{age} = 18.8 (SD = 0.5, range NR)		DS: CES-D	Longitudinal change scores in DS and CP did not predict at-risk gambling in the entire sample or in the sample separated by sex. In the model investigating interaction effects by sex, higher aggression predicted PG in females and lower aggression predicted PG in males (β = 0.36, P = 0.018, OR = 1.43, 95% CI [1.06, 1.92]).
Problem video gaming							
Desai, Krishnan-Sarin, Cavallo, and Potenza (2010)	United States	Cross-sectional study	High-school students	N = 4,028 45.8% male	Problem video gaming (3 items: unsuccessful attempts to cut back; irresistible urges to play;	CP: Aggression (2 items; weapon carrying or getting into serious fights) DS:	Among boys, PVG was associated with DS (11.37% vs. 4.3%, P < 0.001), and CP (serious fights, 13.95% vs. 4.69%, P < 0.001; carrying a weapon, 7.66% vs. 4.55%, P = 0.02). Among girls, PVG was also associated with DS (7.48% vs. 1.01%, P < 0.001) and CP (serious fights, 9.76% vs. 2.67%, P = 0.01), but not carrying a weapon (P = 0.37). In the

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Table 4. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP and DS measure	Findings
		Convenience sampling		M_{age} = NR (range 14–18)	tension only relieved by gaming.	Depression (1 item; feeling sad or hopeless almost every day for 2 or more weeks)	logistic regression, DS (OR = 3.62, $P < 0.001$) and CP (OR = 2.97, $P < 0.001$) were associated with PVG when controlling for grades, extracurriculars, smoking, marijuana, alcohol, drug, and caffeine use.
Krossbakken et al. (2018)	Norway	3-year longitudinal study Random sampling	Adolescents and young adults	N = 1,277 61.7% female Time 1: M_{age} = 17.5 (SD = NR, range NR) Time 2: M_{age} = 18.5 (SD = NR, range NR) Time 3: M_{age} = 19.5 (SD = NR, range NR)	GAS	CP: BPAQ-SF DS: HADS depression subscale	In the unrestricted path model, DS were reciprocally related to PVG (as both an antecedent [β = 0.11–0.12, $P < 0.01$]; and a consequence [β = 0.12–0.13, $P < 0.01$]). However, physical aggression was only an antecedent to PVG (β = 0.08, $P < 0.05$). Based on a typology of gamers (engaged, problem, addicted), physical (OR = 1.10–1.19, $P < 0.01$) and verbal aggression (OR = 1.11, $P < 0.01$) and DS (OR = 1.11, $P < 0.01$) were antecedents of PVG over a 1-year, but not a 2-year interval.
Müller et al. (2015)	Europe (7 countries)	Cross-sectional study Random probability clustered sample	High-school students	N = 12,938 52.9% male M_{age} = NR (range 14–17)	Assessment of Internet and Computer Game Addiction-Gaming Module	CP: CBCL Youth Self-Report DS: CBCL Youth Self-Report	Correlations indicate a positive relationship between PVG and CP (r = 0.30, $P < 0.01$). Adolescents in the PVG group reported significantly greater levels of CP (males, M = 24.5; females, M = 25.9) compared to non-problematic and non-gamers (M scores for males and females range between 10.9 and 11.5; η^2 = 0.033, $P < 0.001$). Large effect sizes were identified within the specific domains of rule-breaking behavior (M = 10.47 vs. M = 4.43, η^2 = 0.06, $P < 0.001$) and aggressive behavior (M = 14.29 vs. M = 6.71, η^2 = 0.05, $P < 0.001$) when comparing the PVG group to the non-PVG group. For DS, a significant albeit smaller effect was noted (M = 5.95 vs. M = 2.90, η^2 = 0.03, $P < 0.001$).
Myrseth and Notelaers (2018)	Norway	Cross-sectional study Random sampling	Adolescents and young adults	N = 2,055 52.9% male	GAS-A	CP: BPAQ-SF	Latent class analyses identified 5 classes: 1) no symptoms of PVG (46%); 2) rare symptoms of PVG (22%); 3) occasional symptoms of PVG (23%); 4) often symptoms of PVG (7%); 5) very often symptoms of PVG (1.2%). Differences in DS

(continued)

Table 4. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP and DS measure	Findings
				M_{age} = 17.5 (*SD* = NR, range NR)		DS: HADS depression subscale	were reported between the classes (η^2 = 0.04, P < 0.001), where class 5 endorsed a greater number of DS compared to all other classes. Similar findings are noted for physical (η^2 = 0.05, P < 0.001) and verbal aggression (η^2 = 0.024, P < 0.001).
Stockdale and Coyne (2018)	United States	Cross-sectional study Convenience sampling	University students (87 game addicts and 87 matched healthy controls)	N = 174 48.85% male M_{age} = 20.23 (*SD* = 4.17, range NR)	IGDS	CP: BPAQ-SF DS: PROMIS Emotional Distress-Depression-Short Form 8a.	Comparing the group with PVG to the non-PVG group, the PVG group reported greater DS (M = 17.58, SD = 7.0 vs. M = 12.76, SD = 5.26; η^2 = 0.15, P < 0.001) and greater CP (M = 3.22, SD = 0.82 vs. M = 2.7, SD = 0.82; η^2 = 0.08, P < 0.001).
Strittmatter et al. (2015)	European (5 countries)	Cross-sectional study	High-school students	N = 8,807	Young Internet Addiction Test	CP: DISC-C	The PVG group reported greater CP (M = 1.40, SD = 1.60 vs. M = 0.63, SD = 1.06; d = 0.71, P < 0.001) and DS (M = 11.27, SD = 9.96 vs. M = 6.90, SD = 7.37; d = 0.58, P < 0.001) than the non-PVG group.
		Random sampling stratified by school		45.5% male M_{age} = 15 (SD = 1.3, range NR)		DS: BDI-II	In a multinomial logistic regression, DS (RR = 1.25, 95% CI [1.10, 1.43], P = 0.001) and CP (RR = 1.24, 95% CI [1.14, 1.36], P < 0.001) were significantly associated with PVG when controlling for gender, emotional symptoms, hyperactivity, peer problems, well-being, suicidal behavior and self-injurious behavior.
Torres-Rodrígez, Griffiths, Carbonell, and Oberst (2018)	Spain	Cross-sectional study Convenience sampling	Adolescents with a diagnosis of Internet Gaming Disorder seeking mental health treatment	N = 31 100% male M_{age} = 14.97 (*SD* = 1.74, range 12–18)	DSM-5 criteria for IGD & IGD-20	CP: CBCL Youth Self-Report DS: SCL-90 depressive symptoms & CBCL Youth Self-Report	Within the sample of problem video gamers, 64.5% were in the clinical range for DS and 6.4% were in the borderline range (SCL-90). Based on the CBCL, there were correlations between DS and PVG (r = 0.522, P < 0.001), and CP and PVG (r = 0.665–0.692, P < 0.001). Those with PVG had an average score denoting a clinical status in externalizing problems (M = 61.77, SD = 8.32).
Yu and Cho (2016)	South Korea	Cross-sectional study	Middle-school students	N = 2,024	IGDS (Modified Korean adaptation)	CP: BPAQ	Analyses indicated that the PVG group reported a significantly higher mean score of DS (M = 14.21) compared to the non-gamer (NG; M = 12.0), at-risk gamers (M = 11.76), and regular gamer (RG; M = 11.06) groups. Based on the cut-off score for DS, 15.1% of PVG had DS, compared to 5.1% of NG, 2.5% of at-risk gamers and 2.8% of RG. Further, analyses indicated that the PVG group reported the highest mean score in CP (M = 16.18),

(continued)

Table 4. Continued

Authors	Country	Design and sampling method	Sample population	Sample characteristics	PG and PVG measure	CP and DS measure	Findings
							followed by the at-risk gamers (M = 14.02), NG (M = 13.59), and RG (M = 12.53) groups.
		Multiple-stage cluster sampling with stratification by region, grade level and sex. Three or more schools from each of the 15 districts were randomly selected, then, one 8th and one 9th grade from each selected middle school was randomly selected.		50.6% male M_{age} = 14.5 (SD = 0.50, range 13–15)		DS: Short Version of Online Psychological Tests	Significant correlations are reported between DS and PVG (r = 0.21, P < 0.01) and CP and PVG (r = 0.26, P < 0.01).
Problem gambling and gaming							
Walther, Morgenstern, and Hanewinkel (2012)	Germany	Cross-sectional survey	Secondary and vocational school students	N = 2,553	PG: SOGS-RA	CP: Rating Scale of Oppositional Defiant/ Conduct Disorders	Univariate analyses indicate that both PG (P < 0.01) and PVG (P < 0.001) reported more CP, but not more DS compared to non-problem gamblers (P = 0.71) and non-problem gamers (P = 0.10). Multivariate analyses indicate that PVG reported more CP (OR = 1.65, 95% CI [1.01–2.69]) but not more DS than non-problem gamers. PG reported no significant differences in either CP or DS.
		Random sample of 15 public schools		50.7% male M_{age} = 16.7 (SD = 3.04, range = 12–25)	PVG: Video Game Dependency Scale	DS: Depression scale adapted from Kandel & Davies (1982)	

Note. BPAQ-SF = Buss-Perry Aggression Questionnaire - Short Form, BSI = Brief Symptoms Inventory, CBCL = Child Behavior Checklist, CES-D = Center for Epidemiologic Studies Depression Scale, CP = conduct problems, DS = depressive symptoms, HADS = Hospital Anxiety and Depression Scale, IGDS = Internet Gaming Disorder Scale, IGD = Internet Gaming Disorder, IGD-20 = Internet Gaming Disorder Test, GAIN = Global Assessment of Individual Needs, GAS-A = Gaming Addiction Scale-Adolescents, MAGS = Massachusetts Gambling Screen DSM-IV subscale, PG = problem gambling, PGSI = Problem Gambling Severity Index, PVG = problem video gaming, SCID = Structured Clinical Interview for DSM-IV, SCL-90 = Symptom Checklist, SOGS = South Oaks Gambling Screen, SOGS-RA = South Oaks Gambling Screen – Revised Adolescent.

small sample size, it is possible that the non-significant difference was related to the lack of statistical power within the analyses. As for Widinghoff et al. (2019), they investigated violent offenders in prison where rates of conduct disorder in the overall sample was of 79.2%. Due to the elevated rates of conduct disorder in the non-PG (77.4%) and PG (88.4%) groups, it is possible that there was a ceiling effect associated with abnormally elevated levels of CP.

Two out of the four longitudinal studies reported significant relationships between CP and PG. Martins et al. (2013) reported that boys with chronically high CP throughout adolescence were more likely to be at-risk or problem gamblers by early adulthood. Martins et al. (2014) expanded on these findings by noting that problem gamblers in early adulthood were more likely to have been arrested before the age of 23 compared to social or non-gamblers. In contrast to these results, two studies of a duration of 2- and 7-years, respectively, reported that CP at age 16 did not predict PG at age 17 (Vitaro et al., 2001) or 23 (Wanner et al., 2009). All four studies sampled predominantly male youth from disadvantaged neighborhoods, with some overlap in the included samples (i.e., Vitaro et al., 2001; Wanner et al., 2009). As there were differences in the times at which CP was measured between the studies and differences in the types of CP measured, it is possible that the presence of CP (primarily aggression) in early adolescence (Martins et al., 2013), as opposed to CP (primarily delinquency) in later adolescence (Vitaro et al., 2001; Wanner et al., 2009), is of greater importance when predicting PG in young adulthood.

Problem video gaming (PVG). A total of five studies (four cross-sectional and one longitudinal) investigated the relationship between CP and PVG (Table 2). All four cross-sectional studies reported significant associations, with three studies finding a positive association between CP and PVG (Kim et al., 2018; Tejeiro et al., 2012; Wartberg et al., 2017), and one study finding that those with a history of CP were less likely to be problem gamers (Ong et al., 2016). Differing results may have been reported in the study by Ong and colleagues (2016) because they investigated a relatively small sample of adolescents presenting at an addiction treatment center in Singapore. Moreover, the authors measured CP dichotomously which does not account for the severity of the behaviors when compared to the other three studies that measured CP continuously.

Only one longitudinal study investigated the prospective relationship between CP and PVG. This study was an extension of Wartberg and colleagues (2017) and they reported that CP at baseline did not predict PVG one year later when accounting for other psychosocial predictors (Wartberg et al., 2019). Overall, there is a paucity of research investigating the association between CP and PVG. Although cross-sectional results are encouraging, longitudinal findings do not confirm the presence of a prospective relationship between CP and PVG.

Depressive symptoms

Problem gambling (PG). A total of 18 studies (12 cross-sectional and six longitudinal) investigated the relationship between DS and PG (Table 3). Ten cross-sectional studies reported significant positive associations between DS and PG. Notably, greater DS were reported among problem gamblers compared to non-problem gamblers (Dowd et al. 2018; Ellenbogen et al., 2007; Martin et al., 2014; Nower et al. 2004; Sanscartier et al., 2018; Stuhldreher et al., 2007; Wohl et al., 2008). Moreover, in linear and logistic regression analyses, DS were associated with greater PG severity after controlling for various psychosocial and demographic variables (Cosenza et al., 2019; Molde et al., 2009; Nigro et al., 2017).

The remaining two cross-sectional studies reported non-significant associations between DS and PG (Delfabbro and Grabosky, 2006; Pascual-Leone et al., 2011). Pascual-Leone and colleagues (2011) reported a non-significant correlation in their sample which may have been a result of the study's small sample size ($N = 200$) of university students, with low overall levels of PG (15 reported at-risk or probable pathological gamblers) and DS (23 reported moderate to severe depression). Further, although Delfabbro & Grabosky (2006) reported a moderate effect size of DS on the presence of PG ($d = 0.49$), this effect became non-significant when controlling for other psychosocial factors including self-esteem and social alienation (correlation coefficients not reported in the study). Overall, based on the cross-sectional studies, there appears to be good evidence for a positive association between DS and PG.

In the six longitudinal studies, two report significant relationships whereby DS predicted PG one-month (Bilevicius et al., 2018), and six-years later (Dussault et al., 2016). Although the remaining four studies indicated cross-sectional associations between DS and PG (Afifi et al., 2016; Chinneck et al., 2016; Edgerton et al., 2015, 2018), these relationships were non-significant in the prospective analyses. It is important to note that all four of these studies utilized the same cohort (Manitoba Longitudinal Study of Young Adults) over time periods ranging from one to five years. Furthermore, Bilevicius and colleagues (2018) only had a one-month period between both time points which brings into question whether these results would be maintained over longer periods of time. Lastly, as Dussault and colleagues (2016) focused solely on males living in economically disadvantaged areas, it is possible that these individuals present with different psychosocial developmental trajectories compared to young adults in the general population. Overall, longitudinal evidence for the relationship between DS and PG is mixed, with a trend towards DS being a poor predictor of PG.

Problem video gaming (PVG). A total of 10 studies (seven cross-sectional and three longitudinal) investigated the relationship between DS and PVG (Table 3). To begin, two studies reported that problem gamers endorsed greater DS

compared to non-problem gamers (Givron et al., 2018; Van Rooij et al., 2014). Additionally, three studies indicated significant positive associations between DS and PVG when controlling for demographic characteristics and other psychosocial factors (Bonnaire & Baptista, 2019; Männikkö et al., 2015; Vadlin et al., 2016). As for structural equation models, Li and colleagues (2011) report that although the direct path between DS and PVG was non-significant, an indirect path existed via escapism and actual-ideal self-discrepancies. However, Kircaburun and colleagues (2019) identified that DS were a non-significant mediator in the relationship between emotional intelligence and PVG.

All three longitudinal studies reported significant relationships between DS and PVG. Investigating the cross-sectional associations between DS and PVG at each time point, Dang and colleagues (2019) report these associations were significant at baseline and one-year later. As for the prospective results, Guillot and colleagues (2016) report that anhedonia predicted greater levels of PVG one year later (OR = 1.33). Similarly, Liu et al. (2018) report that greater DS at baseline were associated with greater PVG one, two, three and four years later. Given these consistent positive associations in both the cross-sectional and longitudinal research, there appear to be good evidence for the concurrent and temporal associations between DS and PVG.

Conduct problems and depressive symptoms

Problem gambling (PG). A total of 14 studies (10 cross-sectional and four longitudinal) investigated the relationship between both CP, DS, and PG (Table 4). Three cross-sectional studies reported that at-risk and problem gamblers endorsed greater DS and CP compared to low and no risk gamblers (Giralt et al., 2018; Potenza et al., 2011; Yip et al., 2011). Furthermore, in the two studies utilizing latent class analyses, problem gamblers could be separated based on the presence of greater CP or greater DS (Gupta et al., 2013; Kong et al., 2014). Moreover, Gupta et al. (2013) also identified a class of problem gamblers with higher levels of both CP and DS.

Alternatively, three cross-sectional studies reported that although the association between CP and PG was significant, the association between DS and PG was not. Although Hardoon et al. (2004) reported that problem gamblers endorsed greater levels of CP and DS, only CP were significantly associated with at-risk/probable PG. In the other two studies, problem gamblers were more likely to endorse greater severity of CP but not DS compared to non-problem gamblers (Langhinrichsen-Rohling et al., 2004; Petry & Tawfik, 2001).

As for the remaining studies, Tackett et al. (2017) investigated these relationships by gender and reported that although both DS and CP were correlated with PG among women, only CP were significant for men. Finally, Kaminer et al. (2002) reported no significant association between either DS and PG, and CP and PG. It is important to note that the study included a small number (N = 97) of adolescents diagnosed with psychoactive substance use disorders, where only nine individuals were identified as being at-risk/pathological gamblers. Overall, results from the cross-sectional studies indicated that both CP and DS were generally positively associated with PG, with other studies indicating that only CP were associated with PG. None of the cross-sectional studies indicated that DS were solely associated with PG.

In the four longitudinal studies, two studies reported significant relationships between both DS, CP, and PG. Allami et al. (2017) identified two classes of problem gamblers with higher levels of CP and DS, respectively, and that membership within these classes at age 12 was a significant predictor of PG at age 23. Additionally, Sagoe et al. (2017) report that at-risk and PG classes had greater concurrent levels of CP and DS from age 17 to 19. In contrast to these findings, although Allami, Vitaro, Brendgen, Carbonneau, and Tremblay (2018) utilized the same samples reported in their 2017 study, they identified a third comorbid (high CP and DS) class of adolescents. However, only the high CP and comorbid classes had greater levels of PG at age 16 and 23. Finally, in a 6-year longitudinal study, no significant overall differences in DS and CP were noted across different levels of gambling risk across time. However, sex-dependent effects were identified whereby greater levels of parental-reported CP predicted PG among females, and lower levels of parental-reported CP predicted PG among males (Yücel et al., 2015). Overall, longitudinal findings appear to have established a greater consistency regarding the predictive role of both CP and DS for later PG, followed by CP.

Problem video gaming (PVG). A total of eight studies (seven cross-sectional and one longitudinal) investigated the relationship between both CP, DS, and PVG (Table 4). Generally, problem gamers reported greater CP (η^2 = 0.03–0.08; d = 0.71) and DS (η^2 = 0.03–0.15; d = 0.58) than non-problem gamers (Müller et al., 2015; Myrseth & Notelaers, 2018; Stockdale & Coyne, 2018; Torres-Rodrígez et al., 2018; Yu & Cho, 2016). Furthermore, two studies reported that after controlling for psychosocial variables, DS (OR = 3.62; RR = 1.25) and CP (OR = 2.97; RR = 1.24) were significantly associated with PVG (Desai et al., 2010; Strittmatter et al., 2015).

One longitudinal study investigated the predictive role of both CP and DS on later PVG. In this study, Krossbakken et al. (2018) reported that both DS (β = 0.11–0.12) and CP (β = 0.08) predicted PVG. Moreover, both CP (OR = 1.10–1.11) and DS (OR = 1.11) predicted membership to the group of problem gamers one year, but not two years later. Overall, all seven cross-sectional studies and the one longitudinal study reported significant associations between both DS, CP and PVG. Although there is strong cross-sectional evidence, with results indicating that the association may be stronger for DS compared to CP, the paucity of longitudinal research limits the extent to which conclusions can be drawn regarding the predictive role of CP and DS on PVG.

Problem gambling (PG) and problem video gaming (PVG). One cross-sectional study measured both PG and PVG, in addition to CP and DS (Table 4). In a sample of German students (Walther et al., 2012), multivariate analyses controlling for demographic characteristics and parental monitoring indicated that problem gamers reported greater CP, but not greater DS compared to non-problem gamers. However, problem gamblers did not report greater CP or DS in the multivariate models, even if those with PG reported greater CP in the univariate model. It is noteworthy that in this study, only a small proportion of individuals were identified as problem or probable pathological gamblers (1.3%).

DISCUSSION

The aim of this systematic review was to provide an overview of research identifying the relationship between CP, DS and both PG and PVG among adolescents and young adults. Overall, the results from these studies indicate important distinctions in the role of CP and DS as risk factors for PG and PVG. Present findings are consistent with the wider literature identifying both CP and DS as significantly associated with PG (Dowling et al., 2017; Johansson et al., 2009; Shead et al., 2010) and PVG (Brezing et al., 2010; Kuss & Griffiths, 2012; Sugaya et al., 2019). What is novel in the present review is the identification of the extent to which these claims can be made among adolescents and young adults, with an emphasis on the quantity and methodological quality of studies and the differences between the concurrent and prospective associations. Based on theoretical models for the development of addictive behaviors, there appears to be greater evidence for a combined pathway (Englund & Siebenbruner, 2012; Maslowsky et al., 2014) for the development of both PG and PVG, an externalizing pathway (Zucker, 1994; Zucker et al., 2011) for the development of PG, and an internalizing pathway (Hussong et al., 2011; Trucco et al., 2018) for the development of PVG. These results suggest that although both CP and DS are generally associated with PG and PVG, they may exert different effects on the development of these problem behaviors.

The difference in the extent to which CP and DS are related to PG and PVG warrants further discussion. To begin, CP were identified as a greater risk factor for PG when compared to PVG. In the broader literature, CP have been frequently associated with PG under a general pattern of co-occurring problem behaviors as a result of shared etiological factors (Blaszczynski & Nower, 2002; Jessor & Jessor, 1977; Welte, Barnes, & Hoffman, 2004; Willoughby, Chalmers, and Busseri, 2004). For instance, risk factors for antisocial behaviors and conduct problems include impulsivity and behavioral disinhibition, which may explain why these individuals are at a greater risk for later PG. As impulsivity has been identified as increasing the risk for both adolescent PG (Secades-Villa, Martínez-Loredo, Grande-Gosende, & Fernández-Hermida, 2016) and conduct problems (Ahmad & Hinshaw, 2017; Olson, Schilling, & Bates, 1999), it may be an important factor in the etiology of both behaviors. Overall, these predispositions would be consistent with what has been identified for the externalizing pathway (Zucker, 1994; Zucker et al., 2011).

As for gaming, PVG has not typically been associated with CP, nor included under the classic umbrella of the problem behaviors (Welte, Barnes, & Hoffman, 2004; Willoughby, Chalmers, and Busseri 2004). Indeed, there are noteworthy differences between gambling and gaming which may differentiate the two including the legality of the activity for adolescents and the close connection of youth gambling with other delinquent acts (Burleigh et al., 2019; Welte, Barnes, & Hoffman, 2004; Willoughby, Chalmers, & Busseri, 2004). An important point of distinction here may be that video game playing in youth is not as strongly associated with delinquency when compared to gambling. Additionally, all five included studies investigating PVG and CP were comprised primarily of samples of youth in early adolescence, with aggressive behaviors being more prominent in childhood and early adolescence and delinquent behaviors typically peaking in late adolescence (Fonagy & Luyten, 2018; Hawkins et al., 2002). As such, the age of the samples could potentially explain why evidence for the association between delinquency and PVG is mixed. Nevertheless, it is possible that specific conduct problems such as aggression and rule-breaking pose a higher risk for PVG compared to others including violent or delinquent behaviors. A potential common factor underlying aggression, rule-breaking and problem gaming could be impulsivity (specifically, impulsive decision making and urgency), which has been found to be more prominent among problem gamers (Billieux et al., 2015, 2011; Tian et al., 2018). Given the paucity of research in this domain, further research is necessary to elucidate the differences between specific conduct problems and their predictive value for PVG.

DS appear to be more consistently associated with PVG in both cross-sectional and longitudinal studies. For one, it is possible that the difficulties with emotional coping and emotional dysregulation experienced by those with elevated DS is related to the development of PVG. As the included studies investigating DS and PVG were comprised of samples ranging from early adolescence to young adulthood, it would appear as though these associations are present across these developmental periods. These predispositions and risk factors would be consistent with the internalizing pathway (Hussong et al., 2011; Trucco et al., 2018). Moreover, symptoms of PVG as outlined in the DSM-5 (APA, 2013) and ICD-11 (WHO, 2019) include a loss of interest in previous hobbies/activities, negative emotions (e.g., irritability, sadness) when gaming it taken away, and the use of games to relieve a negative mood (e.g., guilt). These symptoms have important overlaps with those of depression, which include anhedonia, depressed mood, and feelings of worthlessness or inappropriate guilt (APA, 2013). As such, it is possible that these two disorders share symptomatology in a manner that creates a downward spiral of DS and PVG,

leading to a significant deterioration of psychological well-being over time. However, evidence for these temporal relationships are limited to samples of university students and emerging adults, with additional research being necessary to establish these links in early adolescents. Although similar claims could be made for PG and DS, temporal interrelationships remain inconclusive with stronger evidence for their concurrent associations. Given that gambling is an age-restricted activity in most jurisdictions, it is possible that these prospective associations become clearer later in adulthood.

Based on the included studies, the presence of both CP and DS appear to increase the risk for the development of PG and PVG. Although CP and DS are etiologically heterogeneous (Angold et al., 1999), this would be consistent with the combined pathway (Englund & Siebenbruner, 2012; Maslowsky et al., 2014). A potential hypothesized mechanism underlying this comorbid association could be the role of poor impulse control and emotion dysregulation (Angold et al., 1999; Caspi & Moffitt, 2018). Of note, poor impulse control and emotion dysregulation could explain the shared variance of internalizing (e.g., depression) and externalizing (e.g., conduct) problems, their continuity over time, and the later emergence of addictive behaviors due to poor behavioral inhibition and continued engagement in the behavior as a maladaptive learned coping strategy. Moreover, it is also possible that the predisposition towards poor impulse control or emotion dysregulation is related to gender, with Tackett et al. (2017) reporting that PG among young adult males could be related to risk-taking and impulsivity (as represented by CP) and PG among young adult females being related to affective dysregulation (as represented by DS). However, heightened CP among females may also be indicative of maladjustment (Crick, 1997), which is consistent with the findings by Yücel et al. (2015) identifying that higher levels of aggressive behavior in early adolescent females predicted PG in late adolescence. Overall, further research investigating the effect of CP and DS at different time-points across adolescence and young adulthood, while isolating the effects for males and females will be essential to understand whether the presence of these symptoms at different times represents a greater or lesser risk for the development of PG and PVG.

A major limitation of the included research studies is the shortage of longitudinal research investigating PG and PVG. Although 14 studies were included investigating the predictive role of CP and/or DS on later PG, only five studies were included with regards to PVG. As such, additional studies are necessary to draw clear conclusions regarding the predictive role of both of these risk factors for later PVG. Furthermore, there is a pressing need for greater consistency in the instruments used to measure PVG in order to ensure that different researchers are measuring the same latent construct. Additionally, there is a need to investigate the interaction of these two variables in the way they predict PG or PVG. Understanding the interaction of CP and DS in predicting PG and PVG will lead to important insights regarding the complexity of these symptoms with the potential of identifying youth at the highest risk for these problem behaviors and more concrete evidence for the combined pathway. Moreover, only one study investigated both PG and PVG among adolescents and young adults (Walther et al., 2012). Further research is necessary to clarify the developmental pathways of behavioral addictions and whether youth who report problems with one behavior are at a greater risk of experiencing problems with another at the same or a later time. Although gambling and gaming disorder are the only two formally recognized behavioral addictions (APA, 2013; WHO, 2019), other potential behavioral addictions such as problematic use of the Internet, sex, shopping, tanning, and exercising (Grant, Potenza, Weinstein, & Gorelick, 2010; Petry, Zajac, & Ginley, 2018) could be considered in relation to the risk factors examined in this review in addition to their potential co-occurrence with PG and PVG.

Limitations

Although the present review identified and clarified the role of CP and DS on the development of PG and PVG, it is subject to a number of limitations. First, it is possible that some articles were missed in the systematic search due to relevant terms (i.e., keywords for CP and DS) not being included in the areas searched by the MeSH and multipurpose terms. Although the present study sought to identify articles with CP and DS as independent variables, it is possible that some published articles did not mention these terms in the title, abstract, keywords, headings and/or subject headings, although they were included in the study. As such, certain articles may have been omitted although they could have reported on the associations between the variables of interest. Second, the methodology used in the present review was primarily descriptive with the aim of investigating a breadth of literature. As such, no statistical conclusions can be drawn from the results. Third, the review was limited to English and French peer-reviewed journal publications identified on the five selected databases. Given these criteria, the authors may have omitted studies from other countries that were unavailable through the selected databases. Fourth, although clear inclusion and exclusion criteria and a high inter-rater reliability was established, the review, screening, and selection process is subjective and prone to certain biases. Fifth, a diversity of instruments measuring the constructs of interest (i.e., CP, DS, PG and PVG) were utilized which may have resulted in the measurement of slightly different constructs between studies. Finally, this review focused on adolescents and young adults and did not include children or older adults. Future reviews should aim to investigate the relative role of CP and DS in predicting PG and PVG across the lifespan.

Conclusions

While research in the domain of behavioral addictions is still in its early stages, the results of this review provide preliminary evidence regarding the role of CP and DS as risk factors for PG and PVG. Additionally, this review presents a

novel way of investigating the development of PG and PVG, by drawing from a theoretical framework informed by the SUD literature and applying it to non-substance addictive behaviors. Presently, it appears as though there is significant evidence suggesting the importance of a combined pathway, including the presence of both CP and DS, in the development of PG and PVG. However, there also appears to be some evidence for an externalizing pathway for PG, and evidence for an internalizing pathway for PVG. Given the potential for adolescents and young adults to experience early CP or DS, prevention and intervention efforts should focus on intervening in an integrative manner in order to address multiple, potentially interacting problems simultaneously.

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REFERENCES

Achenbach, T. M. (1997). *Manual for the young adult self-report and young adult behaviour checklist*. Burlington (VT): Department of Psychiatry, University of Vermont.

Achenbach, T. M., & Edelbrock, C. (1987). *The manual for the youth self-report and profile*. Burlington: University of Vermont.

Achenbach, T. M., Howell, C. T., Quay, H. C., Conners, C. K., & Bates, J. E. (1991). National survey of problems and competencies among four- to sixteen-year-olds: Parents' reports for normative and clinical samples. *Monographs of the Society for Research in Child Development*, *56*(3), 1–130. https://doi.org/10.2307/1166156.

Afifi, T. O., Nicholson, R., Martins, S. S., & Sareen, J. (2016). A longitudinal study of the temporal relation between problem gambling and mental and substance use disorders among young adults. *Canadian Journal of Psychiatry – Revue Canadienne de Psychiatrie*, *61*(2), 102–111. https://doi.org/10.1177/0706743715625950.

Ahmad, S. I., & Hinshaw, S. P. (2017). Attention-deficit/hyperactivity disorder, trait impulsivity, and externalizing behavior in a longitudinal sample. *Journal of Abnormal Child Psychology*, *45*, 1077–1089. https://doi.org/10.1007/s10802-016-0226-9.

Allami, Y., Vitaro, F., Brendgen, M., Carbonneau, R., Lacourse, É., & Tremblay, R. E. (2017). A longitudinal empirical investigation of the Pathways Model of problem gambling. *Journal of Gambling Studies*, *33*(4), 1153–1167. https://doi.org/10.1007/s10899-017-9682-6.

Allami, Y., Vitaro, F., Brendgen, M., Carbonneau, R., & Tremblay, R. E. (2018). Identifying at- risk profiles and protective factors for problem gambling: A longitudinal study across adolescence and early adulthood. *Psychology of Addictive Behaviors*, *32*(3), 373–382. https://doi.org/10.1037/adb0000356.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders: DSM-IV* (4th ed.). Washington, DC: American Psychiatric Association.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders: DSM-IV-R* (4th ed., text rev.). Washington, DC: American Psychiatric Association.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed.). Washington, DC: American Psychiatric Association.

Angold, A., Costello, E. J., & Erkanli, A. (1999). Comorbidity. *Journal of Child Psychology and Psychiatry*, *40*(1), 57–87. https://doi.org/10.1111/1469-7610.00424.

Barnes, G. M., Welte, J. W., Hoffman, J. H., & Tidwell, M. C. O. (2011). The co-occurrence of gambling with substance use and conduct disorder among youth in the United States. *American Journal on Addictions*, *20*(2), 166–173. https://doi.org/10.1111/j.1521-0391.2010.00116.x.

Beck, A. T., & Beck, R. W. (1972). Screening depressed patients in family practice: A rapid technique. *Postgraduate Medical Journal*, *52*, 81–85.

Beck, A. T., Steer, R. A., Ball, R., & Ranieri, W. (1996). Comparison of Beck depression inventories -IA and -II in psychiatric outpatients. *Journal of Personality Assessment*, *67* (3), 588–597.

Benarous, X., Morales, P., Mayer, H., Iancu, C., Edel, Y., & Cohen, D. (2019). Internet gaming disorder in adolescents with psychiatric disorder: Two case reports using a developmental framework. *Frontiers in Psychiatry*, *10*, 336. https://doi.org/10.3389/fpsyt.2019.00336.

Bilevicius, E., Single, A., Bristow, L. A., Foot, M., Ellery, M., Keough, M. T., et al. (2018). Shame mediates the relationship between depression and addictive behaviours. *Addictive Behaviors*, *82*, 94–100. https://doi.org/10.1016/j.addbeh.2018.02.023.

Billieux, J., Chanal, J., Khazaal, Y., Rochat, L., Gay, P., Zullino, D., et al. (2011). Psychological predictors of problematic involvement in massively multiplayer online role-playing games: Illustration in a sample of male cybercafe players. *Psychopathology*, *44*, 165–171. https://doi.org/ 10.1159/000322525.

Billieux, J., Thorens, G., Khazaal, Y., Zullino, D., Achab, S., & Van der Linden, M. (2015). Problematic involvement in online games: A cluster analytic approach. *Computers in Human Behavior*, *43*, 242–250. https://doi.org/10.1016/j.chb.2014.10.055.

Blaszczynski, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction*, *97*(5), 487–499. https://doi.org/10.1046/j.1360-0443.2002.00015.x.

Bonnaire, C., & Baptista, D. (2019). Internet gaming disorder in male and female young adults: The role of alexithymia, depression, anxiety and gaming type. *Psychiatry Research*, *272*, 521–530. https://doi.org/10.1016/j.psychres.2018.12.158.

Brezing, C., Derevensky, J. L., & Potenza, M. N. (2010). Non-substance-addictive behaviors in youth: Pathological gambling and problematic Internet use. *Child and Adolescent Psychiatric Clinics of North America*, *19*(3), 625–641. https://doi.org/10.1016/j.chc.2010.03.012.

Brunelle, N., Leclerc, D., Cousineau, M. M., Dufour, M., & Gendron, A. (2012a). Relationship between virtual games of chance and money and certain deviant behaviors among Quebec youth. *Criminologie*, *45*(2), 107–132. https://www.jstor.org/stable/42745760.

Brunelle, N., Leclerc, D., Cousineau, M.-M., Dufour, M., Gendron, A., & Martin, I. (2012b). Internet gambling, substance use, and delinquent behavior: An adolescent deviant behavior involvement pattern. *Psychology of Addictive Behaviors*, *26*(2), 364–370. https://doi.org/10.1037/a0027079.

Burleigh, T. L., Griffiths, M. D., Sumich, A., Stavropoulos, V., & Kuss, D. J. (2019). A systematic review of the co-occurrence of gaming disorder and other potentially addictive behaviors. *Current Addiction Reports*, *6*(4), 383–401. https://doi.org/10.1007/s40429-019-00279-7.

Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, *63*, 452–459.

Calado, F., Alexandre, J., & Griffiths, M. D. (2017). Prevalence of adolescent problem gambling: A systematic review of recent research. *Journal of Gambling Studies*, *33*(2), 397–424. https://doi.org/10.1007/s10899-016-9627-5.

Caspi, A., & Moffitt, T. (2018). All for One and One for All: Mental Disorders in One Dimension. American Journal of Psychiatry, *175*(9), 831–844. https:10.1176/appi.ajp.2018.17121383.

Cheng, C., Cheung, M. W., & Wang, H.-Y. (2018). Multinational comparison of Internet gaming disorder and psychosocial problems versus well-being: Meta-analysis of 20 countries. *Computers in Human Behavior*, *88*, 153–167. https://doi.org/10.1016/j.chb.2018.06.033.

Cheung, N. W. (2014). Low self-control and co-occurrence of gambling with substance use and delinquency among Chinese adolescents. *Journal of Gambling Studies*, *30*(1), 105–124. https://doi.org/10.1007/s10899-012-9351-8.

Chinneck, A., Mackinnon, S. P., & Stewart, S. H. (2016). Investigating possible reciprocal relations between depressive and problem gambling symptoms in emerging adults. *The Canadian Journal of Psychiatry/La Revue canadienne de psychiatrie*, *61*(2), 93–101. https://doi.org/10.1177/0706743715625934.

Cook, S., Turner, N. E., Ballon, B., Paglia-Boak, A., Murray, R., Adlaf, E. M., et al. (2015). Problem gambling among Ontario students: Associations with substance abuse, mental health problems, suicide attempts, and delinquent behaviours. *Journal of Gambling Studies*, *31*(4), 1121–1134. https://doi.org/10.1007/s10899-014-9483-0.

Cosenza, M., Ciccarelli, M., & Nigro, G. (2019). Decision-making styles, negative affectivity, and cognitive distortions in adolescent gambling. *Journal of Gambling Studies*, *35*(2), 517–531. https://doi.org/10.1007/s10899-018-9790-y.

Crick, N. R. (1997). Engagement in gender normative versus nonnormative forms of aggression: Links to social–psychological adjustment. *Developmental Psychology*, *33*(4), 610–617. https://doi.org/10.1037/0012-1649.33.4.610.

Dang, D. L., Zhang, M. X., Leong, K. K.-H., & Wu, A. M. S. (2019). The predictive value of emotional intelligence for internet gaming disorder: A 1-year longitudinal study. *International Journal of Environmental Research and Public Health*, *16*(15), 2762. https://doi.org/10.3390/ijerph16152762.

Dean, J., & Keshavan, M. (2017). The neurobiology of depression: An integrated view. *Asian Journal of Psychiatry*, *27*, 101–111. https://doi.org/10.1016/j.ajp.2017.01.025.

Delfabbro, P., Lahn, J., & Grabosky, P. (2006). Psychosocial correlates of problem gambling in Australian students. *Australian and New Zealand Journal of Psychiatry*, *40*(6), 587–595. https://doi.org/10.1080/j.1440-1614.2006.01843.x.

Derevensky, J. (2019). Behavioral addictions: Some developmental considerations. *Current Addiction Reports*, *6*, 313–322. https://doi.org/10.1007/s40429-019-00257-z.

Desai, R. A., Krishnan-Sarin, S., Cavallo, D., & Potenza, M. N. (2010). Video-gaming among high school students: Health correlates, gender differences, and problematic gaming. *Pediatrics*, *126*(6), e1414–1424. https://doi.org/10.1542/peds.2009-2706.

Diamond, P. M., & Magaletta, P. R. (2006). The short-form Buss-Perry Aggression Questionnaire (BPAQ-SF): A validation study with federal offenders. *Assessment*, *13*, 227–240. https://doi.org/10.1177/1073191106287666.

Dowd, D. A., Keough, M. T., Jakobson, L. S., Bolton, J. M., & Edgerton, J. D. (2018). A latent class analysis of young adult gamblers from the Manitoba Longitudinal Survey of Young Adults. *International Gambling Studies*, *19*, 148–166. https://doi.org/10.1080/14459795.2018.1520909.

Dowling, N. A., Merkouris, S. S., Greenwood, C. J., Oldenhof, E., Toumbourou, J. W., & Youssef, G. J. (2017). Early risk and protective factors for problem gambling: A systematic review and meta-analysis of longitudinal studies. *Clinical Psychology Review*, *51*, 109–124. https://doi.org/10.1016/j.cpr.2016.10.008.

Dussault, F., Brendgen, M., Vitaro, F., Carbonneau, R., Boivin, M., & Tremblay, R. E. (2016). Co-morbidity between gambling problems and depressive symptoms: A longitudinal perspective of risk and protective factors. *Journal of Gambling Studies*, *32*(2), 547–565. https://doi.org/10.1007/s10899-015-9546-x.

Edgerton, J. D., Keough, M. T., & Roberts, L. W. (2018). Co-development of problem gambling and depression symptoms in emerging adults: A parallel-process latent class growth model. *Journal of Gambling Studies*, *34*(3), 949–968. https://doi.org/10.1007/s10899-018-9760-4.

Edgerton, J. D., Melnyk, T. S., & Roberts, L. W. (2015). Problem gambling and the youth-to- adulthood transition: Assessing problem gambling severity trajectories in a sample of young adults. *Journal of Gambling Studies*, *31*(4), 1463–1485. https://doi.org/10.1007/s10899-014-9501-2.

Ellenbogen, S., Derevensky, J., & Gupta, R. (2007). Gender differences among adolescents with gambling-related problems. *Journal of Gambling Studies*, *23*(2), 133–143. https://doi.org/10.1007/s10899-006-9048-y.

Englund, M. M., & Siebenbruner, J. (2012). Developmental pathways linking externalizing symptoms, internalizing symptoms, and academic competence to adolescent substance use. *Journal of Adolescence*, *35*(5), 1123–1140. https://doi.org/10.1016/j.adolescence.2012.03.004.

Fam, J. Y. (2018). Prevalence of internet gaming disorder in adolescents: A meta-analysis across three decades. *Scandinavian Journal of Psychology*, *59*(5), 524–531. https://doi.org/10.1111/sjop.12459.

Ferris, J. & Wynne, H. (2001). *The Canadian problem gambling Index: User manual*. Ottawa, ON: Canadian Centre of Substance Abuse.

Fisher, S. (2000). Developing the DSM-IV criteria to identify adolescent problem gambling in non-clinical populations. *Journal of Gambling Studies*, *16*, 253–273.

Fonagy, P., & Luyten, P. (2018). Conduct problems in youth and the RDoC approach: A developmental, evolutionary-based view. *Clinical Psychology Review*, *64*, 57–76. https://doi.org/10.1016/j.cpr.2017.08.010.

Giralt, S., Müller, K. W., Beutel, M. E., Dreier, M., Duven, E., & Wölfling, K. (2018). Prevalence, risk factors, and psychosocial adjustment of problematic gambling in adolescents: Results from two representative German samples. *Journal of Behavioral Addictions*, *7*(2), 339–347. https://doi.org/10.1556/2006.7.2018.37.

Givron, H., Berrewaerts, J., Houbeau, G., & Desseilles, M. (2018). Problematic use of internet and video games in students in medicine. *Sante Mentale Au Quebec*, *43*(1), 101–121. https://doi.org/10.7202/1048897ar.

González-Bueso, V., Santamaría, J., Fernández, D., Merino, L., Montero, E., & Ribas, J. (2018). Association between Internet gaming disorder or pathological video-game use and comorbid psychopathology: A comprehensive review. *International Journal of Environmental Research and Public Health*, *15*(4), 668. https://doi.org/10.3390/ijerph15040668.

Grant, J. E., Potenza, M. N., Weinstein, A., & Gorelick, D. A. (2010). Introduction to behavioral addictions. *The American Journal of Drug and Alcohol Abuse*, *36*(5), 233–241. https://doi.org/10.3109/00952990.2010.491884.

Griffiths, M. (2005). Relationship between gambling and videogame playing: A response to Johansson and Götestam. *Psychological Reports*, *96*, 644–646. https://doi.org/10.2466/pr0.96.3.644-646.

Griffiths, M. D. (2008). Digital impact, crossover technologies and gambling practices. *Casino & Gaming International*, *4*, 37–42. http://irep.ntu.ac.uk/id/eprint/883.

Griffiths, M. D. (2018). Is the buying of loot boxes in video games a form of gambling or gaming? *Gaming Law Review: Regulation, Compliance, and Policy*, *22*(1), 52–54.

Griffiths, M. D., Kuss, D. J., & King, D. L. (2012). Video game addiction: Past, present and future. *Current Psychiatry Reviews*, *8*, 308–318.

Griffiths, M. D., Kuss, D. J., Lopez-Fernandez, O., & Pontes, H. M. (2017). Problematic gaming exists and is an example of disordered gaming. *Journal of Behavioral Addictions*, *6*(3), 296–301. https://doi.org/10.1556/2006.6.2017.037.

Guillot, C. R., Bello, M. S., Tsai, J. Y., Huh, J., Leventhal, A. M., & Sussman, S. (2016). Longitudinal associations between anhedonia and internet-related addictive behaviors in emerging adults. *Computers in Human Behavior*, *62*, 475–479. https://doi.org/10.1016/j.chb.2016.04.019.

Gupta, R., Nower, L., Derevensky, J. L., Blaszczynski, A., Faregh, N., & Temcheff, C. (2013). Problem gambling in adolescents: An examination of the Pathways Model. *Journal of Gambling Studies*, *29*(3), 575–588. https://doi.org/10.1007/s10899-012-9322-0.

Hardoon, K. K., Gupta, R., & Derevensky, J. L. (2004). Psychosocial variables associated with adolescent gambling. *Psychology of Addictive Behaviors*, *18*(2), 170–179. https://doi.org/10.1037/0893-164X.18.2.170.

Hawkins, J. D., Smith, B. H., & Catalano, R. F. (2002). Delinquent behavior. *Pediatrics in Review*, *23*(11), 387–392. https://doi.org/10.1542/pir.23-11-387.

Hayatbakhsh, M. R., Clavarino, A., Williams, G. M., Bor, W., & Najman, J. M. (2013). Young adults' gambling and its association with mental health and substance use problems. *Australian & New Zealand Journal of Public Health*, *36*(2), 160–166. https://doi.org/10.1111/j.1753-6405.2011.00815.x.

Hilgard, J., Engelhardt, C. R., & Bartholow, B. D. (2013). Individual differences in motives, preferences, and pathology in video games: The gaming attitudes, motives, and experiences scales (GAMES). *Frontiers in Psychology*, *4*, 1–13. https://doi.org/10.3389/fpsyg.2013.00608.

Hussong, A. M., Jones, D. J., Stein, G. L., Baucom, D. H., & Boeding, S. (2011). An internalizing pathway to alcohol use and disorder. *Psychology of Addictive Behaviors: Journal of the Society of Psychologists in Addictive Behaviors*, *25*(3), 390–404. https://doi.org/10.1037/a0024519.

James, R. J. E., & Tunney, R. J. (2017). The need for a behavioural analysis of behavioural addictions. *Clinical Psychology Review*, *52*, 69–76. https://doi.org/10.1016/j.cpr.2016.11.010.

Jessor, R. & Jessor, S. L. (1977). *Problem behavior and psychosocial development: A longitudinal study of youth*. New York: Academic Press.

Johansson, A., Grant, J. E., Kim, S. W., Odlaug, B. L., & Gotestam, K. G. (2009). Risk factors for problematic gambling: A critical literature review. *Journal of Gambling Studies*, *25*(1), 67–92. https://doi.org/10.1007/s10899-008-9088-6.

Kaminer, Y., Burleson, J. A., & Jadamec, A. (2002). Gambling behavior in adolescent substance abuse. *Substance Abuse*, *23*(3), 191–198. https://doi.org/10.1080/08897070209511489.

Kandel, D. B., & Davies, M. (1982). Epidemiology of depressive mood in adolescents: an empirical study. Archives of general psychiatry, *39*(10), 1205–1212. https://doi.org/10.1001/archpsyc.1982.04290100065011.

Kessler, R. C., Andrews, G., Mroczek, D., Ustun, B., & Wittchen, H. U. (1998). The World Health Organization composite international diagnostic interview short-form (CIDI-SF). *International Journal of Methods in Psychiatric Research*, *7*(4), 171–185.

Khoddam, R., Jackson, N. J., & Leventhal, A. M. (2016). Internalizing symptoms and conduct problems: Redundant, incremental, or interactive risk factors for adolescent substance use during the first year of high school? *Drug and Alcohol Dependence*, *169*, 48–55. https://doi.org/10.1016/j.drugalcdep.2016.10.007.

Kim, E., Yim, H. W., Jeong, H., Jo, S. J., Lee, H. K., Son, H. J., et al. (2018). The association between aggression and risk of Internet

gaming disorder in Korean adolescents: The mediation effect of father-adolescent communication style. *Epidemiology and Health*, *40*, e2018039. https://doi.org/10.4178/epih.e2018039.

King, D., Delfabbro, P., & Griffiths, M. (2010). The convergence of gambling and digital media: Implications for gambling in young people. *Journal of Gambling Studies*, *26*, 175–187. https://doi.org/10.1007/s10899-009-9153-9.

King, D. L., Gainsbury, S. M., Delfabbro, P. H., Hing, N., & Arabanel, B. (2015). Distinguishing between gaming and gambling activities in addiction research. *Journal of Behavioral Addictions*, *4*, 215–220. https://doi.org/10.1556/2006.4.2015.045.

Kircaburun, K., Griffiths, M. D., & Billieux, J. (2019). Trait emotional intelligence and problematic online behaviors among adolescents: The mediating role of mindfulness, rumination, and depression. *Personality and Individual Differences*, *139*, 208–213. https://doi.org/10.1016/j.paid.2018.11.024.

Kong, G., Tsai, J., Krishnan-Sarin, S., Cavallo, D. A., Hoff, R. A., Steinberg, M. A., et al. (2014). A latent class analysis of pathological-gambling criteria among high school students: Associations with gambling, risk and health/functioning characteristics. *Journal of Addiction Medicine*, *8*(6), 421–430. https://doi.org/10.1097/ADM.0000000000000074.

Krossbakken, E., Pallesen, S., Mentzoni, R. A., King, D. L., Molde, H., Finseras, T. R., et al. (2018). A cross-lagged study of developmental trajectories of video game engagement, addiction, and mental health. *Frontiers in Psychology*, *9*. https://doi.org/ 10.3389/fpsyg.2018.02239.

Kuss, D. J., & Griffiths, M. D. (2012). Online gaming addiction in children and adolescents: A review of empirical research. *Journal of Behavioral Addictions*, *1*(1), 3–22. https://doi.org/10.1556/jba.1.2012.1.1.

Langhinrichsen-Rohling, J., Rohde, P., Seeley, J. R., & Rohling, M. L. (2004). Individual, family, and peer correlates of adolescent gambling. *Journal of Gambling Studies*, *20*(1), 23–46. https://doi.org/10.1023/B:JOGS.0000016702.69068.53.

Lemmens, J. S., Valkenburg, P. M., & Gentile, D. A. (2015) The internet gaming disorder scale. *Psychological Assessment 27*, 567–582.

Lemmens, J. S., Valkenburg, P. M., & Peter, J. (2009). Development and validation of a game addiction scale for adolescents. *Journal of Media Psychology*, *12*, 77–95. https://doi.org/10.1080/15213260802669458.

Lesieur, H. R., & Blume, S. B. (1987). The South Oaks Gambling Screen (SOGS): A new instrument for the identification of pathological gamblers. *American Journal of Psychiatry*, *144*(9), 1184–1188.

Li, D., Liau, A., & Khoo, A. (2011). Examining the influence of actual-ideal self-discrepancies, depression, and escapism, on pathological gaming among massively multiplayer online adolescent gamers. *Cyberpsychology, Behavior, and Social Networking*, *14*(9), 535–539. https://doi.org/10.1089/cyber.2010.0463.

Li, W., Mills, D., & Nower, L. (2019). The relationship of loot box purchases to problem video gaming and problem gambling. *Addictive Behaviors*, *97*, 27–34. https://doi.org/10.1016/j.addbeh.2019.05.016.

Liu, L., Yao, Y. W., Li, C. S. R., Zhang, J. T., Xia, C. C., Lan, J., et al. (2018). The comorbidity between internet gaming disorder and depression: Interrelationship and neural mechanisms. *Frontiers in Psychiatry*, *9*. https://doi.org/10.3389/fpsyt.2018.00154.

Lorains, F. K., Cowlishaw, S., & Thomas, S. A. (2011). Prevalence of comorbid disorders in problem and pathological gambling: Systematic review and meta-analysis of population surveys. *Addiction*, *106*(3), 490–498. https://doi.org/10.1111/j.1360-0443.2010.03300.x.

Lovibond, S. H., & Lovibond, P. F. (1996). *Manual for the depression anxiety stress scales*. Sydney, Australia: Psychology Foundation of Australia.

Mader, J., Christensen, D. R., & Williams, R. J. (2019). An evaluation of the pathways model using the quinte longitudinal dataset. *International Gambling Studies*, *19*(3), 417–431. https://doi.org/10.1080/14459795.2019.1602158.

Mannikko, N., Billieux, J., & Kaariainen, M. (2015). Problematic digital gaming behavior and its relation to the psychological, social and physical health of Finnish adolescents and young adults. *Journal of Behavioral Addictions*, *4*(4), 281–288. https://doi.org/10.1556/2006.4.2015.040.

Marchica, L. A., Mills, D. J., Derevensky, J. L., & Montreuil, T. C. (2019). The role of emotion regulation in video gaming and gambling disorder: A systematic review. *Canadian Journal of Addiction*, *10*(4), 19–29. https://doi.org/10.1097/cxa.0000000000000070.

Martin, R. J., Usdan, S., Cremeens, J., & Vail-Smith, K. (2014). Disordered gambling and co- morbidity of psychiatric disorders among college students: An examination of problem drinking, anxiety and depression. *Journal of Gambling Studies*, *30*(2), 321–333. https://doi.org/10.1007/s10899-013-9367-8.

Martins, S. S., Lee, G. P., Santaella, J., Liu, W. W., Ialongo, N. S., & Storr, C. L. (2014). Age of first arrest varies by gambling status in a cohort of young adults. *American Journal on Addictions*, *23*(4), 386–392. https://doi.org/10.1111/j.1521-0391.2014.12121.x.

Martins, S. S., Liu, W. W., Hedden, S. L., Goldweber, A., Storr, C. L., Derevensky, J. L., et al. (2013). Youth aggressive/disruptive behavior trajectories and subsequent gambling among urban male youth. *Journal of Clinical Child and Adolescent Psychology*, *42*(5), 657–668. https://doi.org/10.1080/15374416.2013.764827.

Maslowsky, J., Schulenberg, J. E., & Zucker, R. A. (2014). Influence of conduct problems and depressive symptomatology on adolescent substance use: Developmentally proximal versus distal effects. *Developmental Psychology*, *50*(4), 1179–1189. https://doi.org/10.1037/a0035085.

Mihara, S., & Higuchi, S. (2017). Cross-sectional and longitudinal epidemiological studies of Internet gaming disorder: A systematic review of the literature. *Psychiatry and Clinical Neuroscience*, *71*(7), 425–444. https://doi.org/10.1111/pcn.12532.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, *6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097.

Molde, H., Pallesen, S., Bartone, P., Hystad, S., & Johnsen, B. H. (2009). Prevalence and correlates of gambling among 16 to 19-year-old adolescents in Norway: Personality and Social Sciences. *Scandinavian Journal of Psychology*, *50*(1), 55–64. https://doi.org/10.1111/j.1467-9450.2008.00667.x.

Moon, M., Lister, J. J., Milosevic, A., & Ledgerwood, D. M. (2017). Subtyping non-treatment- seeking problem gamblers using the

pathways model. *Journal of Gambling Studies*, *33*, 841–853. https://doi.org/10.1007/s10899-016-9658-y.

Müller, K. W., Janikian, M., Dreier, M., Wölfling, K., Beutel, M. E., Tzavara, C., et al. (2015). Regular gaming behavior and internet gaming disorder in European adolescents: Results from a cross-national representative survey of prevalence, predictors, and psychopathological correlates. *European Child & Adolescent Psychiatry*, *24*(5), 565–574. https://doi.org/10.1007/s00787-014-0611-2.

Myrseth, H., & Notelaers, G. (2018). A latent class approach for classifying the problem and disordered gamers in a group of adolescence. *Frontiers in Psychology*, *9*, 2273. https://doi.org/10.3389/fpsyg.2018.02273.

National Research Council. (1999). *Pathological gambling: A critical review*. Washington, DC: The National Academies Press. https://doi.org/10.17226/6329.

Nigro, G., Cosenza, M., & Ciccarelli, M. (2017). The blurred future of adolescent gamblers: Impulsivity, time horizon, and emotional distress. *Frontiers in Psychology*, *8*, 486. https://doi.org/10.3389/fpsyg.2017.00486.

Nower, L., Gupta, R., Blaszczynski, A., & Derevensky, J. (2004). Suicidality and depression among youth gamblers: A preliminary examination of three studies. *International Gambling Studies*, *4*(1), 69–80. https://doi.org/10.1080/1445979042000224412.

Nower, L., Martins, S. S., Lin, K.-H., & Blanco, C. (2013). Subtypes of disordered gamblers: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Addiction*, *108*(4), 789–798. https://doi.org/10.1111/add.12012.

Olson, S. L., Schilling, E. M. & Bates, J. E. (1999). Measurement of impulsivity: Construct coherence, longitudinal stability, and relationship with externalizing problems in middle childhood and adolescence. *Journal of Abnormal Child Psychology*, *27*, 151–165. https://doi.org/10.1023/A:1021915615677.

Ong, R. H. S., Peh, C. X., & Guo, S. (2016). Differential risk factors associated with adolescent addictive disorders: A comparison between substance use disorders and internet/gaming addiction. *International Journal of Mental Health and Addiction*, *14*(6), 993–1002. https://doi.org/10.1007/s11469-016-9676-0.

Ouzzani, M., Hammady, H., Fedorowicz, Z., & Elmagarmid, A. (2016). Rayyan: A web and mobile app for systematic reviews. *Systematic Reviews*, *5*: 210. https://doi.org/10.1186/s13643-016-0384-4.

Pace, U., Schimmenti, A., Zappulla, C., & Di Maggio, R. (2013). Psychological variables characterizing different types of adolescent gamblers: A discriminant function analysis. *Clinical Neuropsychiatry: Journal of Treatment Evaluation*, *10*(6), 253–259. https://doi.org/10.1037/t03938-000.

Pascual-Leone, A., Gomes, K., Orr, E. S., Kaploun, K. A., & Abeare, C. A. (2011). Affective and cognitive correlates of gambling behavior in university students. *Journal of Gambling Studies*, *27*(3), 401–408. https://doi.org/10.1007/s10899-010-9226-9.

Paulus, F. W., Ohmann, S., von Gontard, A., & Popow, C. (2018). Internet gaming disorder in children and adolescents: A systematic review. *Developmental Medicine and Child Neurology*, *60*(7), 645–659. https://doi.org/10.1111/dmcn.13754.

Petry, N. M., & Tawfik, Z. (2001). Comparison of problem-gambling and non-problem- gambling youths seeking treatment for marijuana abuse. *Journal of the American Academy of Child & Adolescent Psychiatry*, *40*(11), 1324–1331. https://doi.org/10.1097/00004583-200111000-00013.

Petry, N. M., Zajac, K., & Ginley, M. K. (2018). Behavioral addictions as mental disorders: To be or not to be? *Annual Review of Clinical Psychology*, *14*(1), 399–423. https://doi.org/10.1146/annurev-clinpsy-032816-045120.

Potenza, M. N. (2014). Non-substance addictive behaviors in the context of DSM-5. *Addictive Behaviors*, *39*(1), 1–2. https://doi.org/10.1016/j.addbeh.2013.09.004.

Potenza, M. N., Wareham, J. D., Steinberg, M. A., Rugle, L., Cavallo, D. A., Krishnan-Sarin, S., et al. (2011). Correlates of at-risk/problem internet gambling in adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*, *50*(2), 150–159.e153. https://doi.org/10.1016/j.jaac.2010.11.006.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*, 385–401. https://doi.org/10.1177/014662167700100306.

Rapee, R. M., Oar, E. L., Johnco, C. J., Forbes, M. K., Fardouly, J., Magson, N. R., et al. (2019). Adolescent development and risk for the onset of social- emotional disorders: A review and conceptual model. *Behaviour Research and Therapy*, *123*, 103501. https://doi.org/10.1016/j.brat.2019.103501.

Reynolds, W. M. (1987). *Reynolds adolescent depression scale*. Champaign, IL: Psychological Assessment Resources, Inc.

Reynolds, W. M. (2001). *Reynolds Adolescent Adjustment Screening Inventory™ (RAASI™): Professional manual*. Lutz, FL: Psychological Assessment Resources.

Richard, J. (2018). From play-to-win to pay-to-win: The trap of 'loot boxes' in video games. *Youth Gambling International Newsletter*, *18*(1), 3–6.

Richard, J. & Derevensky, J. (2017). Identifying the relationship between mental health symptoms, problem behaviors and gambling among adolescents. *Annals of Behavioural Science*, *3*(2), 1–9. https://doi.org/10.21767/2471-7975.100030.

Sagoe, D., Pallesen, S., Hanss, D., Leino, T., Molde, H., Mentzoni, R. A., et al. (2017). The relationships between mental health symptoms and gambling behavior in the transition from adolescence to emerging adulthood. *Frontiers in Psychology*, *8*, 478. https://doi.org/10.3389/fpsyg.2017.00478.

Sanders, J., & Williams, R. (2019). The relationship between video gaming, gambling, and problematic levels of video gaming and gambling. *Journal of Gambling Studies*, *35*(2), 559–569. https://doi.org/10.1007/s10899-018-9798-3.

Sanscartier, M. D., Edgerton, J. D., & Roberts, L. W. (2018). A latent class analysis of gambling activity patterns in a canadian university sample of emerging adults: Socio-demographic, motivational, and mental health correlates. *Journal of Gambling Studies*, *34*(3), 863–880. https://doi.org/10.1007/s10899-017-9734-y.

Secades-Villa, R., Martínez-Loredo, V., Grande-Gosende, A., & Fernández-Hermida, J. R. (2016). The Relationship between impulsivity and problem gambling in adolescence. *Frontiers in Psychology*, *7*, 1931. https://doi.org/10.3389/fpsyg.2016.01931.

Shaffer, D., Fisher, P., Lucas, C., Dulcan, M., & Schwab-Stone, M. (2000). NIMH Diagnostic Interview Schedule for Children Version IV (NIMH DISC-IV): Description, differences from previous versions, and reliability of some common diagnoses.

Journal of the American Academy of Child & Adolescent Psychiatry, *39*, 28–38.

Shaffer, H. J., & Korn, D. A. (2002). Gambling and related mental disorders: A public health analysis. *Annual Review of Public Health*, *23*, 171–212. https://doi.org/10.1146/annurev.publhealth.23.100901.140532.

Shaffer, H. J., LaBrie, R., Scanlan, K. M. & Cummings, T. H. (1994). Pathological gambling among adolescents: Massachusetts gambling screen (MAGS). *Journal of Gambling Studies*, *10*, 339–362.

Shead, N. W., Derevensky, J. L., & Gupta, R. (2010). Risk and protective factors associated with youth problem gambling. *International Journal of Adolescent Medicine and Health*, *22*(1), 39–58.

Stockdale, L., & Coyne, S. M. (2018). Video game addiction in emerging adulthood: Cross- sectional evidence of pathology in video game addicts as compared to matched healthy controls. *Journal of Affective Disorders*, *225*, 265–272. https://doi.org/10.1016/j.jad.2017.08.045.

Strittmatter, E., Kaess, M., Parzer, P., Fischer, G., Carli, V., Hoven, C. W., et al. (2015). Pathological Internet use among adolescents: Comparing garners and non-garners. *Psychiatry Research*, *228*(1), 128–135. https://doi.org/10.1016/j.psychres.2015.04.029.

Stuhldreher, W. L., Stuhldreher, T. J., & Forrest, K. Y. Z. (2007). Gambling as an emerging health problem on campus. *Journal of American College Health*, *56*(1), 75–83. https://doi.org/10.3200/JACH.56.1.75-88.

Sugaya, N., Shirasaka, T., Takahashi, K., & Kanda, H. (2019). Bio-psychosocial factors of children and adolescents with internet gaming disorder: A systematic review. *BioPsychoSocial Medicine*, *13*(1), 3. https://doi.org/10.1186/s13030-019-0144-5.

Tackett, J. L., Krieger, H., Neighbors, C., Rinker, D., Rodriguez, L., & Edward, G. (2017). Comorbidity of alcohol and gambling problems in emerging adults: A bifactor model conceptualization. *Journal of Gambling Studies*, *33*(1), 131–147. https://doi.org/10.1007/s10899-016-9618-6.

Tejeiro, R. A., Gomez-Vallecillo, J. L., Pelegrina, M., Wallace, A., & Emberley, E. (2012). Risk factors associated with the abuse of video games in adolescents. *Psychology*, *3*(4), 310–314. https://doi.org/10.4236/psych.2012.34044.

Terrone, G., Musetti, A., Raschielli, S., Marino, A., Costrini, P., Mossi, P., et al. (2018). Attachment relationships and internalization and externalization problems in a group of adolescents with pathological gambling disorder. *Clinical Neuropsychiatry*, *15*(1), 66–74. 2018-11717-009.

Tian, M., Tao, R., Zheng, Y., Zhang, H., Yang, G., Li, Q., et al. (2018). Internet gaming disorder in adolescents is linked to delay discounting but not probability discounting. *Computers in Human Behavior*, *80*, 59–66. https://doi.org/10.1016/j.chb.2017.10.018.

Torres-Rodriguez, A., Griffiths, M. D., Carbonell, X., & Oberst, U. (2018). Internet gaming disorder in adolescence: Psychological characteristics of a clinical sample. *Journal of Behavioral Addictions*, *7*(3), 707–718. https://doi.org/10.1556/2006.7.2018.75.

Trucco, E. M., Villafuerte, S., Hussong, A., Burmeister, M., & Zucker, R. A. (2018). Biological underpinnings of an internalizing pathway to alcohol, cigarette, and marijuana use. *Journal of Abnormal Psychology*, *127*(1), 79–91. https://doi.org/10.1037/abn0000310.

Turner, N. E., Paglia-Boak, A., Ballon, B., Cheung, J. T. W., Adlaf, E. M., Henderson, J., et al. (2012). Prevalence of problematic video gaming among Ontario adolescents. *International Journal of Mental Health and Addiction*, *10*(6), 877–889. https://doi.org/ 10.1007/s11469-012-9382-5.

Vadlin, S., Aslund, C., Hellstrom, C., & Nilsson, K. W. (2016). Associations between problematic gaming and psychiatric symptoms among adolescents in two samples. *Addictive Behaviors*, *61*, 8–15. https://doi.org/10.1016/j.addbeh.2016.05.001.

Valleur, M., Codina, I., Vénisse, J.-L., Romo, L., Magalon, D., Fatséas, M., et al. (2016). Towards a validation of the three pathways model of pathological gambling. *Journal of Gambling Studies*, *32*(2), 757–771. https://doi.org/10.1007/s10899-015-9545-y.

Van Rooij, A. J., Kuss, D. J., Griffiths, M. D., Shorter, G. W., Schoenmakers, T. M., & Van De Mheen, D. (2014). The (co-) occurrence of problematic video gaming, substance use, and psychosocial problems in adolescents. *Journal of Behavioral Addictions*, *3*(3), 157–165. https://doi.org/10.1556/JBA.3.2014.013.

Vitaro, F., Brendgen, M., Ladouceur, R., & Tremblay, R. E. (2001). Gambling, delinquency, and drug use during adolescence: Mutual influences and common risk factors. *Journal of Gambling Studies*, *17*(3), 171–190. https://doi.org/10.1023/A:1012201221601.

Walther, B., Morgenstern, M., & Hanewinkel, R. (2012). Co-occurrence of addictive behaviours: Personality factors related to substance use, gambling and computer gaming. *European Addiction Research*, *18*(4), 167–174. https://doi.org/10.1159/000335662.

Wanner, B., Vitaro, F., Carbonneau, R., & Tremblay, R. E. (2009). Cross-lagged links among gambling, substance use, and delinquency from midadolescence to young adulthood: Additive and moderating effects of common risk factors. *Psychology of Addictive Behaviors*, *23*(1), 91–104. https://doi.org/10.1037/a0013182.

Wartberg, L., Kriston, L., Kramer, M., Schwedler, A., Lincoln, T. M., & Kammerl, R. (2017). Internet gaming disorder in early adolescence: Associations with parental and adolescent mental health. *European Psychiatry*, *43*, 14–18. https://doi.org/10.1016/j.eurpsy.2016.12.013.

Wartberg, L., Kriston, L., Zieglmeier, M., Lincoln, T., & Kammerl, R. (2019). A longitudinal study on psychosocial causes and consequences of Internet gaming disorder in adolescence. *Psychological Medicine*, *49*(2), 287–294. https://doi.org/10.1017/S003329171800082X.

Welte, J. W., Barnes, G. M., & Hoffman, J. H. (2004). Gambling, substance use, and other problem behaviors among youth: A test of general deviance models. Journal of Criminal Justice, *32*(4), 297–306. https://doi.org/10.1016/j.jcrimjus.2004.04.002.

Welte, J. W., Barnes, G. M., Tidwell, M.-C. O., & Hoffman, J. H. (2009). Association between problem gambling and conduct disorder in a national survey of adolescents and young adults in the United States. *Journal of Adolescent Health*, *45*(4), 396–401. https://doi.org/10.1016/j.jadohealth.2009.02.002.

Widinghoff, C., Berge, J., Wallinius, M., Billstedt, E., Hofvander, B., & Hakansson, A. (2019). Gambling disorder in male violent

offenders in the prison system: Psychiatric and substance-related comorbidity. *Journal of Gambling Studies*, *35*(2), 485–500. https://doi.org/10.1007/s10899-018-9785-8.

Wiesner, M., Kim, H. K., & Capaldi, D. M. (2005). Developmental trajectories of offending: Validation and prediction to young adult alcohol use, drug use, and depressive symptoms. *Development and Psychopathology*, *17*, 251–270. https://doi.org/10.1017/s0954579405050133.

Willoughby, T., Chalmers, H., & Busseri, M. A. (2004). Where is the syndrome? Examining co- occurrence among multiple problem behaviors in adolescence. *Journal of Consulting and Clinical Psychology*, *72*(6), 1022–1037. https://doi.org/10.1037/0022-006X.72.6.1022.

Winters, K. C., Stinchfield, R. D., & Fulkerson, J. (1993). Toward the development of an adolescent gambling problem severity scale. *Journal of Gambling Studies*, *9*(1), 63–84. https://doi.org/10.1007/BF01019925.

Wohl, M. J. A., Matheson, K., Young, M. M., & Anisman, H. (2008). Cortisol rise following awakening among problem gamblers: Dissociation from comorbid symptoms of depression and impulsivity. *Journal of Gambling Studies*, *24*(1), 79–90. https://doi.org/10.1007/s10899-007-9080-6.

World Health Organization. (2019). *International statistical classification of diseases and related health problems (11th Revision)*. Retrieved from: https://icd.who.int/browse11/l-m/en.

Yakovenko, I., & Hodgins, D. C. (2018). A scoping review of co-morbidity in individuals with disordered gambling. *International Gambling Studies*, *18*(1), 143–172. https://doi.org/10.1080/14459795.2017.1364400.

Yip, S. W., Desai, R. A., Steinberg, M. A., Rugle, L., Cavallo, D. A., Krishnan-Sarin, S., et al. (2011). Health/functioning characteristics, gambling behaviors, and gambling-related motivations in adolescents stratified by gambling problem severity: Findings from a high school survey. *American Journal on Addictions*, *20*(6), 495–508. https://doi.org/10.1111/j.1521-0391.2011.00180.x.

Yücel, M., Whittle, S., Youssef, G. J., Kashyap, H., Simmons, J. G., Schwartz, O., et al. (2015). The influence of sex, temperament, risk-taking and mental health on the emergence of gambling: A longitudinal study of young people. *International Gambling Studies*, *15*(1), 108–123. https://doi.org/10.1080/14459795.2014.1000356.

Yu, H., & Cho, J. (2016). Prevalence of internet gaming disorder among Korean adolescents and associations with non-psychotic psychological symptoms, and physical aggression. *American Journal of Health Behavior*, *40*(6), 705–716. https://doi.org/10.5993/AJHB.40.6.3.

Zendle, D., Meyer, R., & Over, H. (2019). Adolescents and loot boxes: Links with problem gambling and motivations for purchase. *Royal Society Open Science*, *6*(6), 190049. https://doi.org/10.1098/rsos.190049.

Zigmond, A. B. & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, *67*, 361–370.

Zucker, R. A. (1994). Pathways to alcohol problems and alcoholism: A developmental account of the evidence for multiple alcoholism and for contextual contributions to risk. In: R. A. Zucker, G. Boyd, & J. Howard (Eds.), *The development of alcohol problems: Exploring the biopsychosocial matrix of risk* (pp. 255–289). National Institute on Alcohol Abuse and Alcoholism Research Monograph No. 26. National Institute on Alcohol Abuse and Alcoholism, Rockville, MD.

Zucker, R. A., Heitzeg, M. M., & Nigg, J. T. (2011). Parsing the undercontrol/disinhibition pathway to substance use disorders: A multilevel developmental problem. *Child Development Perspectives*, *5*(4), 248–255. https://doi.org/10.1111/j.1750-8606.2011.00172.x.