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Exploring the Relationships Between Problem Gambling and ADHD: A Meta-Analysis

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Abstract

Objective: At present, there are inconsistencies in the literature pertaining to the association between ADHD and problem gambling. This study utilized meta-analytic techniques to clarify the association between symptoms of problem gambling and symptoms of ADHD. **Method:** Several meta-analyses were conducted using a random effects model. PsycINFO, PubMed, ProQuest Dissertations & Theses, and Google Scholar were searched for relevant studies. **Results:** The weighted mean correlation between ADHD symptomology and gambling severity was $r = .17$, 95% confidence interval (CI) = [0.12, 0.22], $p < .001$. Mean age of the sample was the only moderator to approach significance, with greater age being linked to a stronger relationship between symptoms of ADHD and gambling severity. **Conclusion:** Clinicians needs to be cognizant of the greater risk of ADHD symptoms when working with problem gamblers and vice versa. *(J. of Att. Dis. XXXX; XX(X) XX-XX)*

Keywords

problem gambling, ADHD, meta-analysis

ADHD

ADHD is a neurological disorder involving inattentiveness and/or hyperactive and impulsive behaviors that appear before the age of 12 years (American Psychiatric Association [APA], 2013). These symptoms are more severe and occur more regularly than behavior displayed by others at a similar level of development. As a result, these behavior patterns regularly lead to disruption in settings such as one's home, work, school, and social life. ADHD can be further subdivided into three subtypes or presentations: predominantly inattentive, predominantly hyperactive–impulsive, and combined. Regardless of the subtype, it is well established that deficits in executive functioning or self-regulation are central to this diagnosis (Barkley, 2006). ADHD has been found to affect people across different cultures, ages, and genders (APA, 2013), although it is more common in males (Kessler et al., 2006). There is some question as to differential rates and presentations of ADHD across cultures, although a very comprehensive meta-analysis recently found a diminishing effect of country of inquiry over time (Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014).

Today, ADHD is recognized as one of the most prominent childhood disorders (AACAP, 2007) with a worldwide prevalence of approximately 5% for children (Polanczyk et al., 2014) and 4.4% for adults (Kessler et al., 2006). These findings illustrate the large number of individuals that are experiencing disruption in their daily life due to inattention, hyperactivity, and impulsivity. These problems have been found to affect other areas of life including academic achievement, peer relationships, and family relationships (APA, 2013). Until recently, ADHD was considered a childhood disorder, and thus, the majority of the research on this topic has been restricted to children and adolescents; however, recent research indicates that in most cases, ADHD is a lifelong disorder, existing in at least a partial remission form into adulthood (Barkley, Fischer, Smallish, & Fletcher, 2002; Faraone, Biederman, & Mick, 2006).

With research now supporting the persistence of ADHD symptoms past adolescence, it is important to consider the impact of this condition on adolescent and adult functioning. Studies have shown that ADHD in adulthood can lead to impairment in both academic and professional settings

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(Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1993; Sobanski et al., 2008; Torgersen, Gjervan, & Rasmussen, 2006). ADHD has also been associated with later substance use problems including alcohol abuse (Gillberg et al., 2004). In addition to these addictions, studies have also begun to look at the relationship between problem gambling and ADHD.

Impulsivity, ADHD, and Gambling

Liu and colleagues (2013) proposed that impulsive individuals are more likely to engage in risk-taking or sensation-seeking activities to alleviate a state of recurrent psychological under-arousal, as is typically present in ADHD. Gambling is one such risk-taking activity. Moreover, a recent meta-analysis found strong support for decision-making deficits in individuals with ADHD (Mowinckel, Pedersen, Eilertsen, & Biele, 2015). Pathological gambling, or gambling disorder, as defined in the *Diagnostic and Statistical Manual of Mental Disorders*, involves both regular and incessant maladaptive gambling behavior that causes disruption to one's social, academic, occupational, or personal life (APA, 2013). Problem gambling represents a deficit in decision making, impulse control, and moderation (Vitaro, Arseneault, & Tremblay, 1997; Vitaro, Ferland, Jacques, & Ladouceur, 1998). While the prevalence of this condition is dependent on the availability of gambling activities in a particular location, a literature review conducted by Sassen, Kraus, and Bühringer (2011) found that the prevalence of adult pathological gambling ranged from .02% to 2%; this rate jumped to between .4% and 26% for adolescents. A recent review of the literature on problem gambling found support for the relationship between problem gambling and young age (Johansson, Grant, Kim, Odlaug, & Götestam, 2009). In addition, this review revealed that male gender is a significant risk factor for pathological gambling, while impulsivity is a probable risk factor.

Investigating the relationship between impulsivity—a core symptom of ADHD—and gambling, Vitaro, Arseneault, and Tremblay (1999) found that the problematic gambling behaviors of low socioeconomic males in late adolescence could be predicted by previously measured impulsive behaviors at age 12. A recent review on addictions held impulsivity to be a key vulnerability for problem gambling (Verdejo-García, Lawrence, & Clark, 2008), and new models posit impulsivity as a pathway to the development of pathological gambling (Blaszczynski & Nower, 2002). Another parallel being drawn between ADHD and problem gambling is that individuals with problem gambling also demonstrate deficits in executive functioning as are typically found in individuals with ADHD (e.g., Ledgerwood et al., 2012; Marazziti et al., 2008; Reid, McKittrick, Davtian, & Fong, 2012). Research has also suggested that individuals with gambling problems demonstrate behavior patterns common to those with ADHD, including a tendency to prefer immediate over delayed gratification (Crone, Vendel, & van der Molen, 2003; Dixon, Jacobs, & Sanders, 2006; Ernst et al., 2003; Goudriaan, Oosterlaan, de Beurs, & Van den Brink, 2004). In addition, a recent study of adolescents found that probable pathological gamblers reported more clinically significant symptoms of ADHD (Derevensky, Pratt, Hardoon, & Gupta, 2007). The APA (2013) also holds that clinically significant inattention and hyperactivity may serve as risk factors for the progression of gambling disorder. To this end, the results of a recent retrospective study revealed that adults were more likely to reveal clinically significant problem gambling behaviors if they remembered demonstrating childhood symptoms of hyperactivity or impulsivity (Clark, Nower, & Walker, 2013). Reports of childhood ADHD symptomatology also correspond with increased severity of adult problem gambling (Breyer et al., 2009; Grall-Bronnec et al., 2011).

Taken collectively, research in this area appears to support the existence of a relationship between ADHD symptomology and problem gambling, although some controversy over this topic continues to exist, with research by Davtian, Reid, and Fong (2012), revealing that while pathological gamblers, both with and without ADHD, reported higher levels of impulsivity than a normative control sample, levels of impulsivity were not significantly different for pathological gamblers with or without a diagnosis of ADHD. In addition, a number of questions are raised regarding gender and age in both the ADHD and problem gambling literatures that have yet to be applied to both disorders simultaneously. Given that males are at a greater risk for both ADHD and problem gambling, in addition to findings supporting a greater relationship between ADHD and gambling in young people, it is critical that we explore these topics further to develop and refine identification and intervention models. In addition, treatment options for ADHD suggest that this would be a fruitful area for prevention as applied to gambling. Although ADHD is not often considered "curable," it is treatable, both through medical and psychotherapeutic means (Faraone, Spencer, Aleardi, Pagano, & Biederman, 2004; Solanto, Marks, Mitchell, Wasserstein, & Kofman, 2008). Treatment of ADHD has been associated with a reduction in substance addictions (Wilens, 2004); however, similar research does not yet exist for problem gambling. In addition, given the large variability in prevalence of each of these disorders across cultures and countries, this variable also needs investigation, along with date of publication, given both societal shifts and shifts in diagnostic criteria for these disorders over time. This study used meta-analytic techniques, including meta-regression, to clarify the association between problem gambling and ADHD and address these important questions.

Research Questions

The aim of the present study was to answer the following research questions:

Research Question 1: How large is the association between ADHD symptoms and gambling severity?
Research Question 2: What is the prevalence of ADHD in individuals with problem gambling?
Research Question 3: What is the prevalence of problem gambling in individuals with ADHD?
Research Question 4: What are the odds of individuals with problem gambling having ADHD as compared with individuals without problem gambling?
Research Question 5: What are the odds of individuals with ADHD having problem gambling as compared with individuals without ADHD?
Research Question 6: How do the following moderators affect the association between ADHD symptoms and gambling severity: sample gender make-up, mean age of sample, country of publication (i.e., country where study was conducted if indicated, or where first author's affiliation is located), date of publication, and publication type?

Method

Search Strategy

This meta-analysis was conducted utilizing a systematic review process. Both published and unpublished studies were included to reduce publication bias (whereby studies with positive or larger effects are more likely to be published; Lipsey & Wilson, 2001; Rothstein, Sutton, & Borenstein, 2005). A moderator analysis investigating publication type was used to investigate this factor. We set the minimum number of studies required for each analysis at three, based on findings from the Cochrane database of meta-analyses that this is the median number of component studies in Cochrane meta-analyses (Davey, Turner, Clarke, & Higgins, 2011). The databases PsycINFO, Medline, Proquest Dissertations & Theses, and Google Scholar were searched. The following keywords were used to search all databases to obtain relevant studies: gambling, gambling behavior, gaming, pathological gambling, gamble, gamblers, ADHD, attention deficit disorder (ADD), ADD with hyperactivity, hyperactivity, and impulsivity. The search results of PsycINFO, Medline, and Proquest Dissertations & Theses were narrowed down by language to include only English language studies and by research methodology to exclude studies that were not appropriate for meta-analysis (e.g., qualitative studies, single-case study designs, narrative reviews). The citation indices of PsycINFO and Medline were also searched for studies citing those studies already identified. The reference lists of identified studies were also reviewed for studies not identified elsewhere. Following this extensive literature search, the search results underwent two screening processes. The initial screening process was comprised of a review of each study's title and abstract. Studies that were clearly not relevant were excluded at this point. Each study that passed the first screening process then underwent a thorough manuscript review based on the inclusion criteria (see below). The second author was primarily responsible for determining study eligibility given that the criteria were relatively straightforward. She was also provided with a simple list for clarity in making these decisions. In any case where eligibility was unclear, all co-authors discussed the study under question and made the decision through discussion and consensus.

Criteria for Study Selection

Studies were included in the meta-analysis if they were reported in English and published or prepared by June 2014. Although eligible studies were required to be in English, our Google Scholar search (which was not limited by language) did not uncover any studies in other languages, and thus, no studies were omitted on this basis. Moreover, most meta-analyses do not consider all languages (Moher, Tetzlaff, Tricco, Sampson, & Altman, 2007) and a systematic review of meta-analyses found there to be no major differences in summary effects for studies that restricted their search to English works compared with those that did not (Morrison et al., 2012). Both published (e.g., journal articles) and unpublished reports (e.g., dissertations) were eligible. Studies published online prior to June 2014 were eligible. Eligible studies required a quantitative consideration of the relationship between an individual's gambling status or habits and ADHD status or symptoms. This excluded qualitative studies, review papers, and case studies. The study must have included a direct questionnaire or interview measure of ADHD symptomology (including hyperactivity, inattention, or overall ADHD symptoms) or previous diagnosis of ADHD or ADD by a qualified health professional (e.g., psychologist, physician). No limitation regarding diagnostic criteria was used; however, most studies used *Diagnostic and Statistical Manual of Mental Disorders* criteria (see results for more information). If a study used a questionnaire or interview assessing ADHD or problem gambling symptomology and divided their participants into groups based on their scores, a clinically significant cutoff needed to be used to ensure consistency in our sample. An additional exclusion criteria—related to samples comprised entirely of individuals with Parkinson disease—was added during the search procedure as a result of a small subsample of research devoted to this specific group, given that this group may have a very different presentation (no other groups comprised of specific psychiatric or neurological comorbidities were located in the search). The recursive

nature of meta-analytic eligibility criteria is often necessary due to the presence of unanticipated data that are inconsistent with a study's purpose (Lipsey & Wilson, 2001).

Data Extraction

Manuscripts that met all eligibility criteria were then coded to retrieve bibliographic information and quantitative measurements of the dependent variables. To determine intercoder reliability, a second coder coded a subset (29%) of the studies. There was perfect agreement (100%) between coders. The data from the coding forms were then entered into Comprehensive Meta-Analysis (CMA) Version 3.0, a statistical software program used to establish and integrate the effect sizes of each relevant study to produce an overall effect size (Borenstein, Hedges, Higgins, & Rothstein, 2013). The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines were followed with respect to identification, screening, and eligibility of the reports included in the proposed study (Moher, Liberati, Tetzlaff, & Altman, 2009). In addition, all studies were examined based on Wood's (2008) procedure for identifying studies that are based on duplicate data to ensure independence between all effects used in a given analysis. When more than one study was uncovered based on the same data, the most comprehensive source was used in the meta-analysis. Furthermore, when a given study provided more than one outcome relevant for a given analysis, these findings were averaged within CMA and both included in the meta-analysis to take advantage of all available information without violating statistical independence (Borenstein, Hedges, Higgins, & Rothstein, 2009).

Data Analysis

A random effects model was utilized in all calculations given the assumed heterogeneity between effect sizes of the included studies (Borenstein et al., 2009). For Research Question 1, nine studies reported the size of the association (correlation) between ADHD symptoms and gambling severity. Pearson's product-moment correlation coefficient was used to analyze these results; however, these correlation-based effect sizes were transformed to the Fisher's *z*-scale, and the analyses were performed on these transformed values, given that variance is directly related to correlation (Borenstein et al., 2009). The results were then transformed back to Pearson product-moment correlations for reporting and interpretation. For Research Question 2, 12 studies provided the prevalence of ADHD in individuals with problem gambling. Percentage of prevalence was used to display these findings. Percentage of prevalence was also used to display findings on the five studies reporting the prevalence of problem gambling in individuals with ADHD for Research Question 3. Five studies provided data on the odds of individuals with problem gambling having ADHD for Research Question 4. Odds ratios (OR) were used to analyze these results. Four studies provided data on the odds of individuals with ADHD having problem gambling for Research Question 5. Odds ratios were again used here. For odds ratio analyses, computations were done using a log scale to ensure symmetry in the analysis; the results were converted back to their original metric for reporting and interpretation. Across all of these analyses, each study was considered in its own metric, none were transformed, except as described above. Moderator analyses were conducted using meta-regression procedures (Research Question 6, addressing whether gender, age, or ADHD treatment affect the association between ADHD symptoms and gambling severity). The correlational data from Research Question 1 were used in all moderator analyses.

Results

Characteristics of Eligible Studies

A total of 1,170 unique records were retrieved by the database searches. Of these studies, 24 (three theses/doctoral dissertations, one unpublished report, and 20 journal articles) met criteria for inclusion in the meta-analysis. See Figure 1 for further details regarding this search. The majority of the studies were conducted in North America: nine in the United States, and seven in Canada. Of the remaining studies, five were conducted in Europe, two in Australia, and one in New Zealand. The studies included in the meta-analysis were published between 1992 and 2014. The percentage of female participants in the studies ranged from 0% to 73%, and the mean age of the participants ranged from 14 to 50 years of age. See Figures 2 to 6 for further details.

For measures of gambling, most studies used a self-report measure, the most common being the South Oak Gambling Screen and the *DSM-IV-J* (J here standing for "juvenile"; Fisher, 1992). Only five studies used a semi-structured or structured interview either in combination with a self-report questionnaire or on its own. For measures of ADHD, most studies used a self-report questionnaire, such as the Conners' Adult ADHD Rating Scales, Conners-Wells Adolescent Self-Report Scale, or Wender Utah Rating Scale. There were three studies that used a previous diagnosis of ADHD and six that used a semi-structured or structured interview either singly or in conjunction with a self-report questionnaire.

Relationship Between ADHD and Problem Gambling

The correlation between symptoms of ADHD and gambling severity was statistically significant. The weighted mean effect, based on nine studies, was $r = .17$, 95% confidence

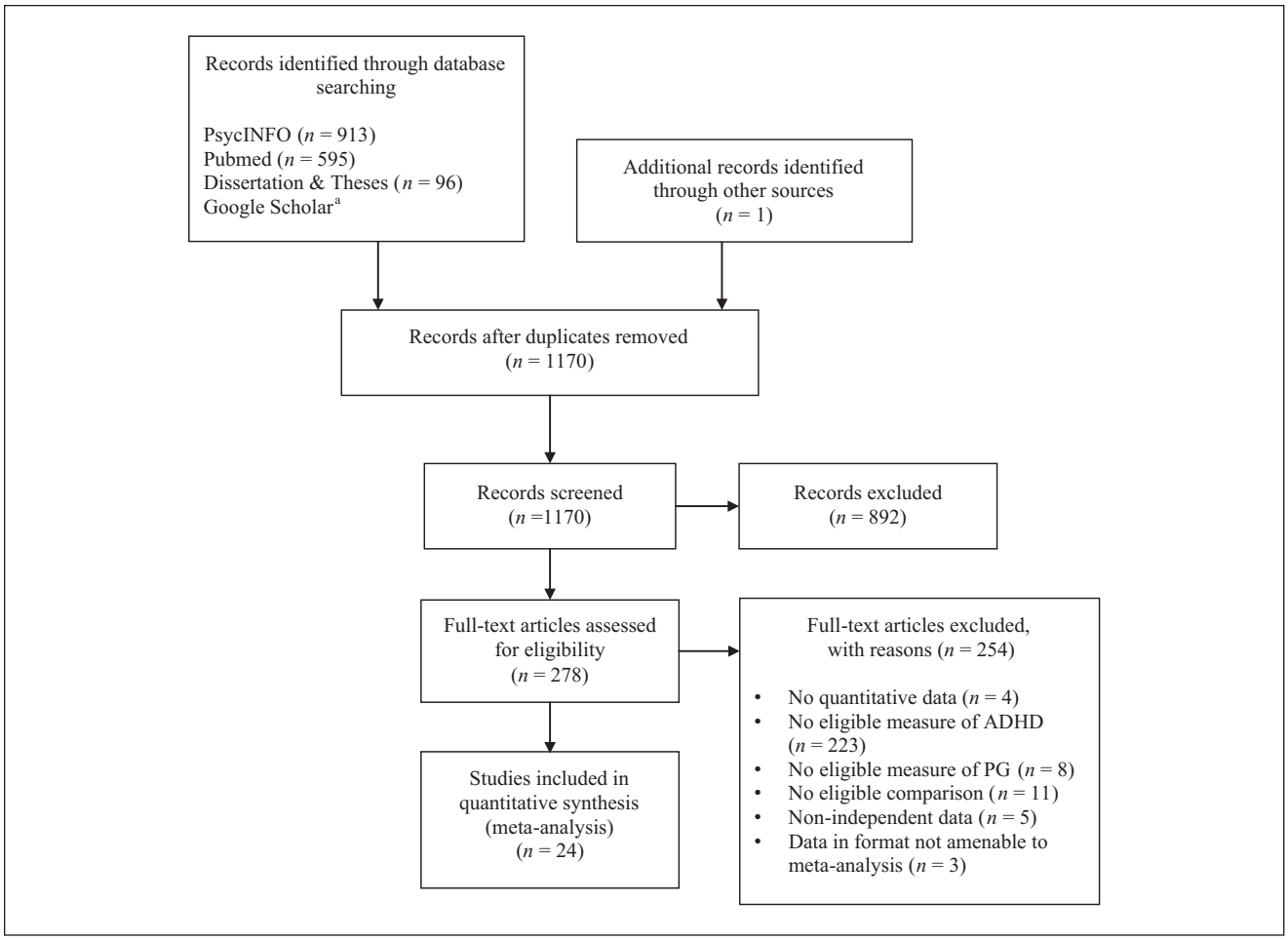

Figure 1. PRISMA flow diagram of information through the different stages of the meta-analysis.
Source. PRISMA: Moher, Liberati, Tetzlaff, and Altman (2009).
Note. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-analyses.
[a]Google Scholar was searched until 200 articles in a row were not relevant.

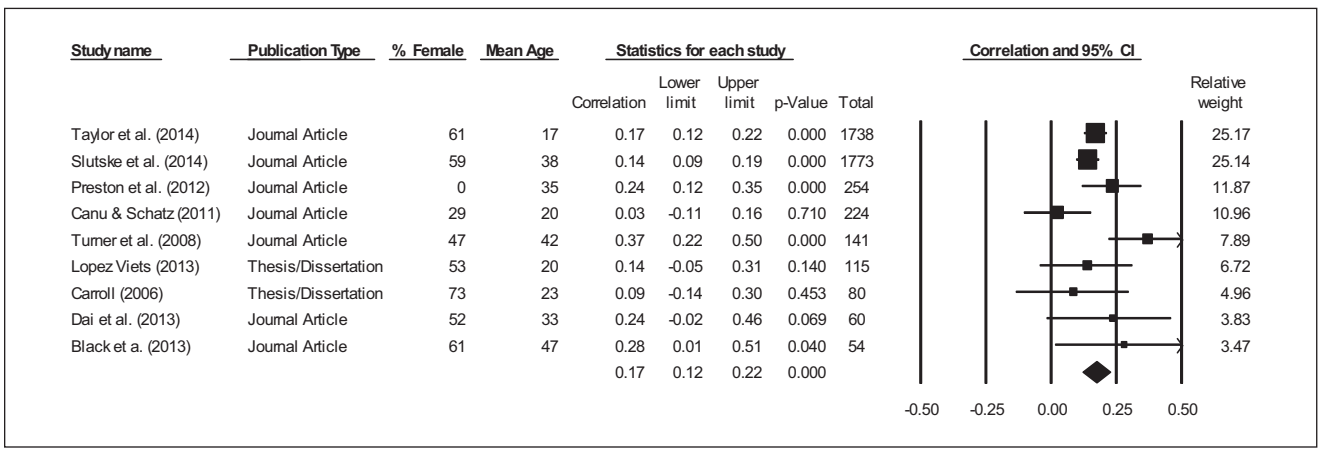

Figure 2. Characteristics of studies included in analysis of the correlation between symptoms of ADHD and problem gambling (Research Question 1).
Note. Mean age in years. CI = confidence interval.

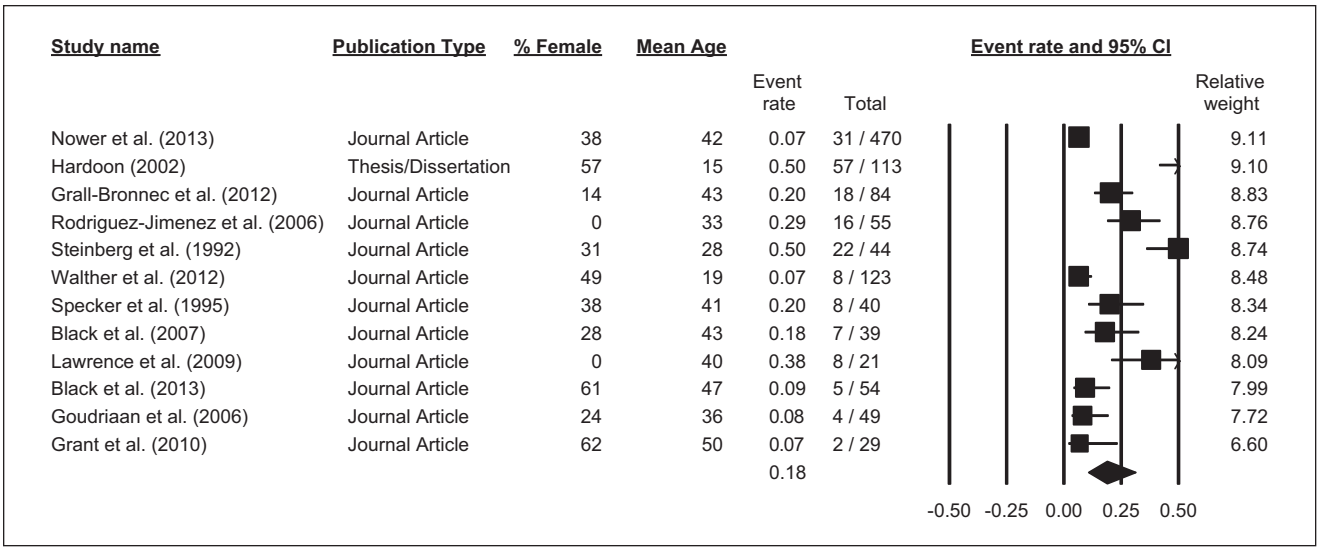

Figure 3. Characteristics of studies included in analysis of prevalence of ADHD in individuals with problem gambling (Research Question 2).
Note. Mean age in years. CI = confidence interval.

interval (CI) = [0.12, 0.22], $p < .001$. The test for heterogeneity was not significant, $Q(8) = 15.31$, $p = .054$, $I^2 = 47.73\%$, although there was still a moderate amount of heterogeneity present based on the I^2 results. Based on the results of 12 studies, the mean prevalence rate of ADHD in individuals with problem gambling was 18.46%, 95% CI = [10.29, 30.88], $Q(11) = 151.802$, $p < .001$, $I^2 = 92.75\%$. The mean prevalence rate of problem gambling in individuals with ADHD, based on five studies, was found to be 11.75%, 95% CI = [6.68, 19.86], $Q(4) = 13.56$, $p = .008$, $I^2 = 70.51\%$. The odds of individuals with problem gambling having ADHD compared with controls was significant; the weighted mean effect size, based on the results of five studies, was OR = 4.11, 95% CI = [2.25, 7.50], $p < .001$, $Q(4) = 7.30$, $p = .121$, $I^2 = 45.22\%$. The odds of individuals with ADHD having problem gambling was significant; the weighted mean effect size, based on four studies, was OR = 2.85, 95% CI = [1.89, 4.30], $p < .001$, $Q(3) = 3.08$, $p = .380$, $I^2 = 2.48\%$. See Figures 2 to 6 for further information regarding the individual effect sizes of each study.

Moderator Analyses

Five moderator analyses were conducted to determine whether they would be able to explain any of the variance in the results of the meta-analysis on the correlation between symptoms of ADHD and problem gambling. The results of four of the five moderator analyses were not statistically significant: publication type ($Q = 0.56$, $R^2 = .00\%$, $p = .453$), publication year ($Q = .00$, $R^2 = .00\%$, $p = .954$), country the study was conducted in ($Q = 1.96$, $R^2 = .00\%$, $p = .580$), and percentage of female participants ($Q = 0.16$, $R^2 = .00\%$, $p = .692$). The moderator analysis on mean age approached significance, $Q = 2.84$, $R^2 = .00\%$, $p = .091$, with greater age being linked to a stronger relationship between symptoms of ADHD and gambling severity. See Figure 2 for characteristics of the studies included in these moderator analyses.

Discussion

Overall, there was a significant correlation between symptoms of ADHD and problem gambling. The weighted mean prevalence of ADHD in individuals with problem gambling was 18.46%, and the weighted mean prevalence of problem gambling in individuals with ADHD was 11.75%. Individuals with problem gambling were 4.18 times more likely to have ADHD than controls. Individuals with ADHD were 2.85 times more likely to experience problem gambling than individual without ADHD. Clearly these results point to a substantial overlap in these disorders, with nearly one in five individuals with problem gambling having clinical levels of ADHD symptoms. Although problem gambling is also present in individuals with ADHD at levels that far exceed chance, it is not as prevalent. This study did not address any other conditions that may also be comorbid with either ADHD or problem gambling. Dowling and colleagues (2015) conducted a recent meta-analysis on comorbidities in treatment-seeking problem gamblers that found that approximately 75% of this population experiences a psychiatric comorbidity. That said, their findings on the prevalence of ADHD among individuals with problem gambling were lower than ours (9.3%), likely related to

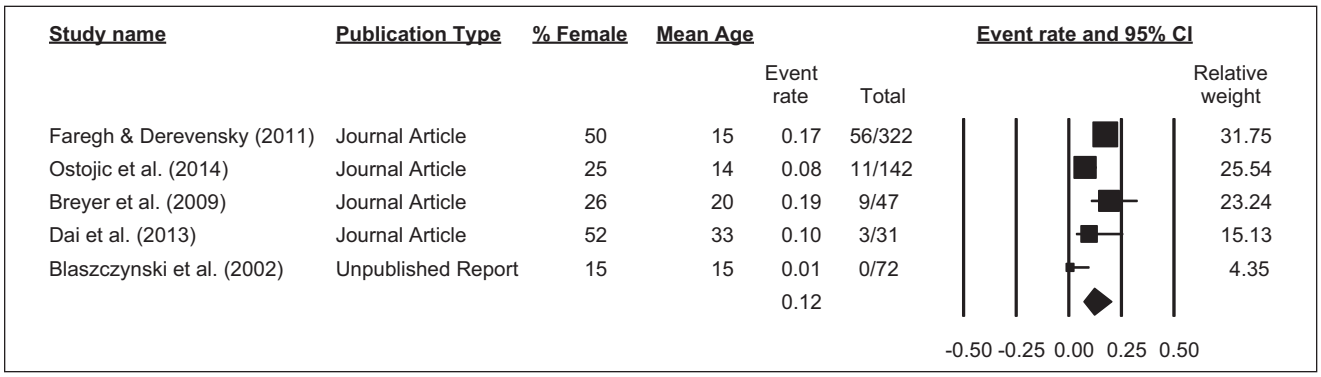

Figure 4. Characteristics of studies included in analysis of prevalence of problem gambling in individuals with ADHD (Research Question 3).
Note. Mean age in years. CI = confidence interval.

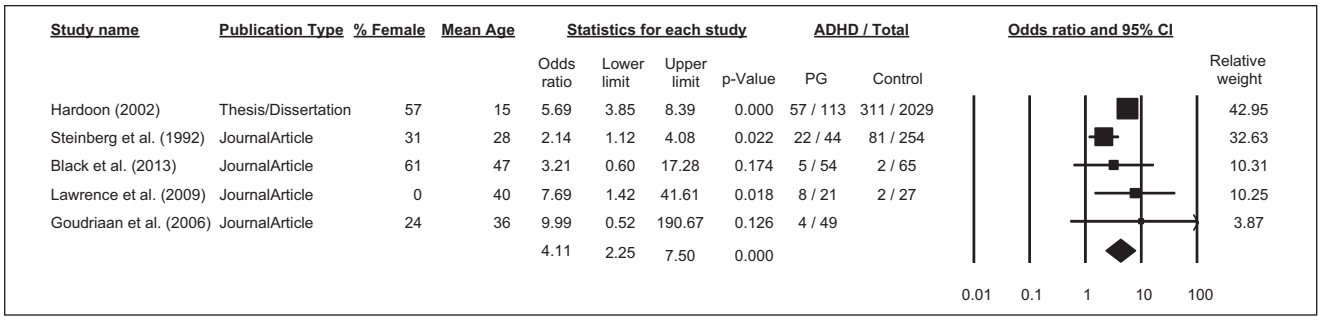

Figure 5. Characteristics of studies included in analysis of odds ratios of individuals with problem gambling having ADHD (Research Question 4).
Note. Mean age in years. CI = confidence interval.

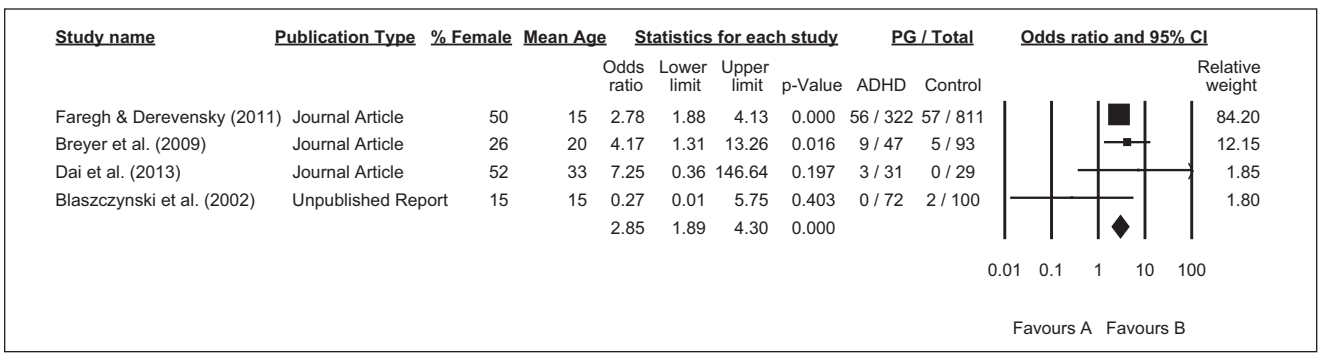

Figure 6. Characteristics of studies included in analysis of odds ratios of individuals with ADHD having problem gambling (Research Question 5).
Note. Mean age in years. CI = confidence interval.

their focus on treatment seekers. Together this suggests that consideration of comorbidities among individuals with problem gambling is an important area for clinical consideration.

Our moderator analyses on publication type (journal article, unpublished manuscript, or thesis/dissertation), publication year, country the study was conducted in, and the percentage of female participants were not statistically significant; however, given the size of our sample, they may have been underpowered and as such, all conclusions relating to them are speculative. The publication type analysis gives us greater confidence in our results and supports our inclusion of unpublished studies given its lack of significance. That said, the same power issues apply here and

interested readers are referred to Figures 2 through 6 to evaluate the effect size and publication status of each included study. The mean age of the sample approached statistical significance. That is, studies with an older mean age tended to have a larger correlation than studies with a younger mean age (within the age range of 16 to 47 years for studies included in this analysis), suggesting that the presence of elevated ADHD symptoms is linked to a greater chance of problem gambling as age increases. Given the developmental nature of inattentiveness, hyperactivity, and impulsivity, this may suggest that the co-occurrence of problem gambling and ADHD at younger ages is a developmental issue, while at older ages, ADHD treatment may be more likely to address problem gambling behaviors. Clearly, direct research to this effect is needed to confirm this relationship and test this hypothesis, as moderator analyses cannot speak to directionality or causality and full significance was not achieved here.

The findings from the present study have practical implications. The significant association between ADHD and problem gambling indicates that this is an issue that merits the attention of clinicians. This research has implications for prevention efforts targeting problem gambling in samples of individuals with ADHD, both before they display gambling problems, and perhaps even into adolescence or childhood, at which time ADHD is often first diagnosed (APA, 2013). Furthermore, these findings may suggest useful treatment options (i.e., those used for ADHD) for individuals with problem gambling; interventions focused on managing the impulsivity that is also present may be particularly helpful. Moreover knowledge of the co-occurrence of these two conditions offers useful information for clinicians in terms of making treatment plans for individuals with problem gambling. Efforts may be made to screen for ADHD in problem gamblers, given Grall-Bronnec and colleagues' (2011) findings that comorbid ADHD worsens prognosis for problem gamblers.

A limitation of the present study was that there was insufficient data to perform some of the moderator analyses that we had initially intended to run. We had planned to analyze the moderating effects of the percentage of the sample using an ADHD medication and of the percentage of the sample diagnosed with each of the ADHD subtypes. There was only one study that reported on ADHD medication usage (Blaszczynski, Sharpe, Walker, Clarke, & Kohn, 2002), and only three studies that reported on ADHD subtypes (Canu & Schatz, 2011; Dai, Harrow, Song, Rucklidge, & Grace, 2013; Faregh & Derevensky, 2011). Faregh and Derevensky (2011) found that adolescents with combined-type ADHD had a greater likelihood of probable pathological gambling compared with those with inattentive type ADHD. They also found that internalizing problems are associated with gambling severity, and this association was larger for those with combined-type ADHD. However, they did not have a comparison of adolescents with predominantly hyperactive–impulsive type. Consideration of ADHD subtypes when examining the association between ADHD and problem gambling merits further research. Furthermore, in terms of main analyses, we had hoped to investigate the correlation between inattentive symptoms of ADHD and gambling and the correlation between hyperactive–impulsive symptoms of ADHD and gambling but were unable to do so due to a scarcity of data (i.e., only one study reported on inattentive symptoms, Canu & Schatz, 2011; and only two reported on hyperactive–impulsive symptoms, Canu & Schatz, 2011; Carroll, 2006).

In conclusion, there was a moderate association found across metrics for the association between problem gambling and ADHD. There was a trend for the association to be stronger for middle age adults, than for younger samples. These finding have important implications for future research and practical implication for clinicians.

Authors' Note

Please contact Dr. Jennifer Theule at jen.theule@umanitoba.ca for any research materials relating to this project, including data, tracking files, and coding manuals/forms. An earlier version of this project was presented as a poster at the Canadian Psychological Association conference in June 2015.

Declaration of Conflicting Interests

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