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 in order 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% 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.

Keywords. problem gambling, ADHD, meta-analysis

Introduction

Attention Deficit Hyperactivity Disorder (ADHD)

ADHD is a neurological disorder involving inattentiveness and/or hyperactive and impulsive behaviours that appear before the age of 12 years (American Psychiatric Association [APA], 2013). These symptoms are more severe and occur more regularly than behaviour displayed by others at a similar level of development. As a result, these behaviour 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 impact 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 impact 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 (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) propose 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. To this end, high rates of video game usage and addiction have been found in individuals with ADHD, likely to provide for these risk-taking and sensation-seeking tendencies (Gentile et al., 2011). Gambling is another 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 behaviour 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, & Gotestam, 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 behaviours of low socioeconomic males in late adolescence could be predicted by previously measured impulsive behaviours at age 12. A recent review on addictions held impulsivity to be a key vulnerability for problem gambling (Verdejo-Garcia, 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, McKitrick, Davtian, & Fong, 2012). Research has also suggested that individuals with gambling problems demonstrate behaviour 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 behaviours 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 in order to develop and refine identification and intervention models. Additionally, 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. Additionally, 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, in order 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:

1. How large is the association between ADHD symptoms and gambling severity?
2. What is the weighted mean frequency of ADHD in individuals with problem gambling?
3. What is the weighted mean frequency of problem gambling in individuals with ADHD?
4. What are the odds of individuals with problem gambling having ADHD as compared to individuals without problem gambling?
5. What are the odds of individuals with ADHD having problem gambling as compared to individuals without ADHD?
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 in order to reduce publication bias (whereby studies with positive or larger effects are more likely be published; Lipsey & Wilson, 2001; Rothstein, Sutton, & Borenstein, 2005). A moderator analysis investigating publication type was employed 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 in order to obtain relevant studies: gambling, gambling behavior, gaming, pathological gambling, gamble, gamblers, ADHD, attention deficit disorder, attention deficit disorder 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 in order 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 to those that did not (Morrison et al., 2012). Both published (e.g., journal articles) and unpublished reports (e.g., dissertations) 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 (attention-deficit disorder) by a qualified health professional (e.g., psychologist, physician). No limitation regarding diagnostic criteria was used, however, most studies employed DSM 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 cut-off 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 and we did not want it to sway the results (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 is 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 (Liberati et al., 2009; Moher, Liberati, Tetzlaff, & Altman, 2009). In addition, all studies were examined based on Wood's procedure (2008) 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 in order 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, twelve studies provided the weighted mean frequency of ADHD in individuals with problem gambling. Percentages were used to display these findings. Percentages were also used to display findings on the five studies reporting the weighted mean frequency 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 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 was used in all moderator analyses.

Results

Characteristics of eligible studies

A total of 1170 unique records were retrieved by the database searches. Of these studies, 24 (3 theses/doctoral dissertations, 1 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. 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' Adults 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. Please see Table 1 for details of assessment tools used in each primary study.

Relationship between ADHD and problem gambling

The correlation between symptoms of ADHD and gambling severity was statistically significant, although not large. The weighted mean effect, based on 9 studies, was r = .17, 95% 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. I^2 provides us with an estimate of true heterogeneity, excluding sampling error.

Based on the results of 12 studies, the weighted mean frequency 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%. This suggests a rate far above chance, but with considerable heterogeneity between the twelve studies examined. Please see Figure 3 for a visual representation of this heterogeneity.

The weighted mean frequency rate of problem gambling in individuals with ADHD, based on 5 studies, was found to be 11.75%, 95% CI = [6.68, 19.86], $Q(4)$ = 13.56, p = .008, I^2 = 70.51%. This rate is again far above chance, and shows substantial heterogeneity between the effects making up this summary effect.

The odds of individuals with problem gambling having ADHD compared to controls was significant; the weighted mean effect size, based on the results of 5 studies was OR = 4.11, 95% CI = [2.25, 7.50], p < .001, $Q(4)$ = 7.30, p = .121, I^2 = 45.22%. These results more clearly demonstrate the above chance rates of ADHD in individuals with problem gambling, with moderate heterogeneity.

The odds of individuals with ADHD having problem gambling was significant; the weighted mean effect size, based on 4 studies, was OR = 2.85, 95% CI = [1.89, 4.30], p < .001, $Q(3)$ = 3.08, p = .380, I^2 = 2.48%. This shows a lower rate of problem gambling in individuals with ADHD than vice-versa; however, this may be due to the differing base rates in these two disorders. True heterogeneity here was quite limited. 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 if 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 = 0.00%, p = .453), publication year (Q = .00, R^2 = 0.00%, p = .954), country the study was conducted in (Q = 1.96, R^2 = 0.00%, p = .580), and percentage of female participants (Q = 0.16, R^2 = 0.00%, p = .692). The moderator analysis on mean age approached significance, Q = 2.84, R^2 = 0.00%, 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

Conclusions

This study has clarified and summarized the research literature on the relationship between

ADHD and problem gambling using meta-analytic techniques. Overall, we found a significant correlation between symptoms of ADHD and problem gambling. The weighted mean frequency of ADHD in individuals with problem gambling was 18.46% and the weighted mean frequency 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. One wonders whether the comorbidity identified here is related to symptom overlap in these two disorders, or whether one disorder is leading to the other. Impulsivity, risk-taking, sensation-seeking, and executive functioning deficits tend to be present in both these disorders. Most interpretations of the overlap between these disorders have focused on impulsivity, sensation-seeking, as well as a tendency toward addiction in individuals with ADHD as causative factors in this co-occurrence. That said, research in this area has not yet evolved to exploration of mediating models to explain this relationship. Developmentally, one would expect that ADHD would lead to problem gambling, given that ADHD has its onset during childhood, while problem gambling usually begins in adolescence or adulthood. That said, most studies included in our analyses used self-report current measures of ADHD symptoms and did not confirm childhood onset of symptoms of ADHD. With concurrent measurement of both conditions, we cannot speak with confidence to the developmental/temporal sequence of the progression of these conditions.

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 their focus on treatment-seekers. Together this suggests that consideration of comorbidities among individuals with problem gambling is an important area for clinical consideration. In particular, consideration of other addictions is critical given the elevated rates of substance abuse in individuals with ADHD (Barkley, Murphy, & Fischer, 2008). Indeed, it is not yet clear if problem gambling is unique in its relationship to ADHD, or if it merely reflects an underlying tendency toward addiction.

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. 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.

Implications

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.

Limitations

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 to 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). Finally, it should be noted that the majority of the primary studies included in our analysis were convenience and clinical samples; this may have significant effects on the generalizability of our frequency findings for problem gambling in individuals with ADHD and ADHD in individuals with problem gambling as it may have exaggerated the size of the effects. That said, given that many of the samples were clinical samples, this research may be highly reflective of the clients presenting for treatment, and as such should be generalizable to populations seen by treatment providers. Moreover, we would expect these findings to be most relevant in North American populations of individuals up to 50 years of age given the primary source data. One final limitation relates to the sources of data themselves. Most included studies used self-report measures of both ADHD and gambling, with all of their attendant biases and limitations. Furthermore, this type of data gambling did not enable us to investigate the relationship between gambling format (e.g., internet, video terminals, cards) and ADHD.

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.

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Table 1

Measures Used in Included Studies

Study	ADHD measure	Problem gambling measure
Black et al. (2007)	ADHD-RS;	DSM-IV; NODS; SOGS
Black et al. (2013)	ADHD-RS	GSAS; NODS; SOGS
Blaszczynski et al. (2002)	CASS:S; CPRS; DSM-IV-TR	DSM-IV- J; Semi-Structured Gambling Interview Schedule
Breyer et al. (2009)	ADI; HI-P; HI-T	SOGS-RA
Canu & Schatz (2011)	CAARS	SOGS
Carroll (2008)	CAARS	DSM-IV-TR
Dai et al. (2013)	CAADID; CAARS: DSM-IV-TR	CPT; GRCS; SOGS
Faregh & Derevensky (2011)	CASS:L	DSM-IV-MR-J; GAQ
Goudriaan et al. (2006)	ADHD-RS-IV; DIS	DIS; SOGS
Grall-Bronnec et al. (2012)	ASRS; UPPS; WURS-C	Pathological Gambling Section in the DSM-IV; Structured interview
Grant et al. (2010)	SCID	DSM-IV; GSAS; PG-YBOCS
Hardoon (2004)	CASS:L	DSM-IV-MR-J; GAQ
Lawrence et al. (2009)	ASRS	DSM-IV; SOGS
Lopez Viets (2001)	ADHD Behavior Checklist for Adults	The Gambler Profile; SOGS
Nower et al. (2012)	AUDADIS-IV	AUDADIS-IV

Ostojic et al. (2014)	DSM-IV-TR; Parent Interview for Child Symptoms	SOGS-RA
Preston et al. (2012)	DSM-IV-TR	DSM-IV-TR; HCG; PGSI; SOGS
Rodriguez-Jimenez et al. (2006)	WURS	SOGS
Slutske et al. (2014)	DSM–IV	DSM–IV Screen for Gambling Problems
Steinberg et al. (1992)	DSM-III-R; SADS-L	DSM-III-R; SADS-L
Taylor et al. (2014)	CASS:S	DSM-IV-J; GRCS
Turner et al. (2009)	DSM-IV-TR	DSM-IV-TR; SOGS
Walther et al. (2012)	SBB-HKS	SOGS-RA

Note. ADHD = attention deficit hyperactivity disorder; ADHD-RS = ADHD Rating Scale; ADHD-RS –IV = ADHD Rating Scale-IV; ADI = Adolescent Diagnostic Interview; ASRS = Adult ADHD Self-Report Scale; AUDADIS-IV = Alcohol Use Disorder and Associated Disabilities Interview Schedule; CAADID = Conners' adult ADHD diagnostic interview for Diagnostic and Statistical Manual of Mental Disorders; CAARS = Conners Adult ADHD Rating Scale; CASS:L = Conners-Wells' Adolescent Self-Report Scale; CASS:S = Conners' Adolescent Self-Rating Scale: Short Form; CPRS = Conners' Parent Rating Scale; CPT = Card Playing Task; DICA-R = Revised Parent Version of the Diagnostic Interview for Children and Adolescents; DIS = Dutch version of section T of the Diagnostic Interview Schedule; DSM-III-R = Diagnostic and Statistical Manual of Mental Disorders 3rd edition-revised; DSM-IV-J = Diagnostic and Statistical Manual of Mental Disorders –Juvenile; DSM-IV-MR-J = Diagnostic and Statistical Manual of Mental Disorders Multiple Response-Juvenile; DSM-IV-TR = Diagnostic and Statistical Manual of Mental Disorders 4th edition-text revised; GAQ = Gambling Activities Questionnaire; GRCS = Gambling-Related Cognitions Scale; GSAS = Gambling Symptom Assessment Scale; HCG = Harmful Consequences of Gambling Scale; HI-P = Conners' Hyperactivity Index (Parent); HI-T = Conners' Hyperactivity Index (Teacher); K-SADS:PL = Kiddie- Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version; NODS = National Opinion Research Center's DSM Screen for Gambling Problems; PG-YBOCS = Yale Brown Obsessive Compulsive Scale Modified for Pathological Gambling; PGSI = Canadian Problem Gambling Index; SADS-L = Schedule for Affective Disorders and Schizophrenia-Lifetime version; SBB-HKS = Rating Scale for Attention-Deficit/Hyperactivity Disorder; SCID = Structured Clinical Interview for DSM-IV; SOGS = South Oaks Gambling Scale; SOGS-RA = South Oaks Gambling Screen- Revised for Adolescents; UPPS = UPPS Impulsive Behaviour Scale; WURS = Wender Utah Rating Scale; WURS-C = Wender-Utah Rating Scale-Child.

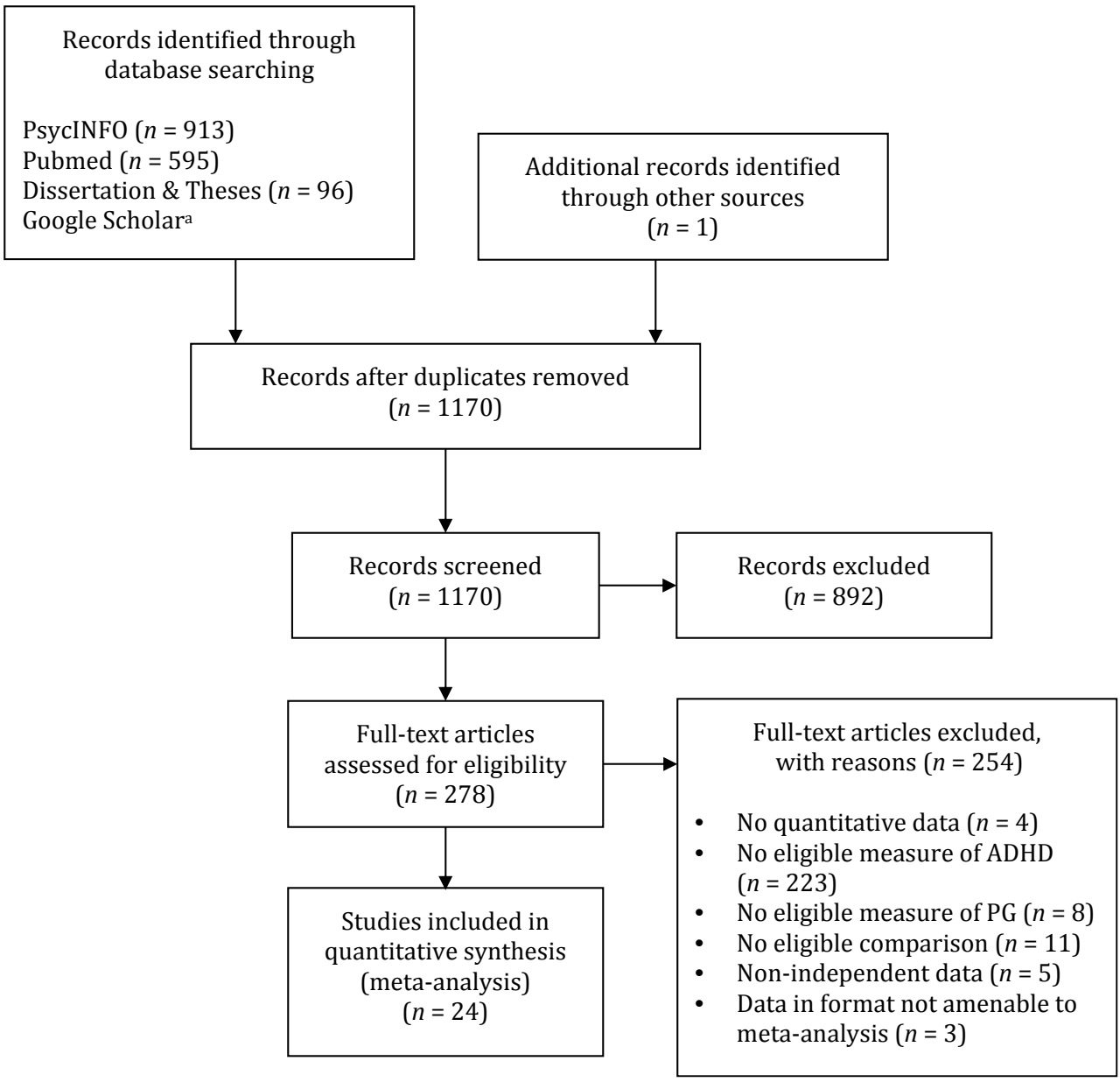

Figure 1. PRISMA flow diagram of information through the different stages of the meta-analysis (PRISMA; Moher, Liberati, Tetzlaff, & Altman, 2009). [a]Google Scholar was searched until 200 articles in a row were not relevant.