A META-ANALYTIC REVIEW OF SELF-ESTEEM IN CHILDREN AND ADOLESCENTS WITH ATTENTION-DEFICITT/HYPERACIVITY DISORDER

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A META-ANALYTIC REVIEW OF SELF-ESTEEM IN CHILDREN AND ADOLESCENTS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

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Abstract: Attention deficit/hyperactivity disorder (ADHD) is characterized by impairments of inattention, hyperactivity, and impulsivity, and conveys increased risk comorbid psychiatric difficulties and an abundance of impairments in academic, behavioral, and social functioning. Notably, findings from extant reviews provide evidence of self-esteem deficits in children (Barber et al., 2018; Mazzone et al., 2013), adolescents (Dvorsky et al., 2019; Kita & Inoue, 2017; Klassen et al., 2004), and adults (Dan & Raz, 2015; Newark et al., 2016; Rucklidge et al., 2007) with ADHD. Methodological and analytical strategies of previous reviews, however, limit inferences about specific self-esteem domains and potential moderator effects of the magnitude of between-group differences. The current study is the first to use meta-analytic methods to examine global and domain-specific (i.e., academic, social, behavioral) self-esteem, as well as potential moderators of study-wise heterogeneity, in studies of children and adolescents with ADHD. Results revealed a small-to-moderate overall effect size for global self-esteem, and a moderate overall effect size for academic self-esteem and social self-esteem. Additionally, results indicated that there were no significant moderating effects. Collectively, these findings suggest that global, academic, and social self-esteem are important variables to consider when evaluating outcomes for children and adolescents with ADHD. Furthermore, exploratory ad hoc examination of moderators suggested that specific self-esteem domains may be more impacted in children/adolescents with ADHD than other domains, which may provide important implications for treatment.

TABLE OF CONTENTS

Chapter Page

I. INTRODUCTION 1

II. METHOD 9

Literature Searches 9
Inclusion Criteria 10
Data Analytic Strategy 15
Moderator Analyses 16

III. RESULTS 19

Global Self-Esteem 19
Academic Self-Esteem 20
Social Self-Esteem 21
Behavioral Self-Esteem 22
Exploratory Ad Hoc Examination of Moderators 22

IV. DISCUSSION 28

V. APPENDIX 37

Overview of ADHD 37
History of ADHD 38
Associated Negative Outcomes of ADHD 42
Theories and Models of Self-Esteem 46
Evidence of Low Self-Esteem in ADHD 58
Section 41

REFERENCES 63

LIST OF TABLES

Table 1……Page 111
Table 2……Page 114
Table 3……Page 116
Table 4……Page118
Table 5……Page 119
Table 6……Page 121
Table 7……Page 123

LIST OF FIGURES

Figure 1…….....Page 124
Figure 2……..Page 125
Figure 3……..Page 126
Figure 4……..Page 127
Figure 5……..Page 128
Figure 6……..Page 129
Figure 7……..Page 130
Figure 8……..Page 131
Figure 9……..Page 132

CHAPTER I

INTRODUCTION

Attention deficit/hyperactivity disorder (ADHD) affects between 3% to 7% of the population and is characterized by inattention, hyperactivity, and impulsivity, (American Psychiatric Association, 2013; Barkley, 2006), as well as a myriad of secondary negative outcomes such as social (de Boo and Prins, 2007; Huang-Pollock et al., 2009), family (Ghanizadeh & Shams, 2007; Kendall et al., 2005), romantic (Eakin et al., 2004; Murphy & Barkley, 1996; Overbey, Snell, & Callis, 2011), academic (Loe & Feldman, 2007; Scholtens, Rydell, & Yang-Wallentin, 2013), and occupational (Barkley & Murphy, 2010; Safren et al., 2009) deficits in children, adolescents, and adults with the disorder. It is not surprising, therefore, that a diagnosis of ADHD also conveys increased risk for low self-esteem relative to the self-esteem of peers without the disorder (Edbom, Lichtenstein, Granlund, & Larsson, 2006).

Self-esteem is a relatively nebulous construct that refers to a person's attitude towards themselves as a whole (i.e., *global self-esteem*; Robins, Hendin, & Trzesniewski, 2001) or across specific dimensions of life (i.e., *specific self-esteem*; Rosenberg et al., 1995), such as academics (academic self-esteem; Eisenberg & Schneider, 2007; Kakouros, Maniadaki, & Papaeliou, 2004) and social functioning (social self-esteem; Lawson, et al., 1979; Lysaker et al., 2007). Unidimensional models describe self-esteem as being an overall attitude towards the self (Coopersmith, 1967; Rosenburg, 1965; James, 1980; Maslow 1954; Rogers, 1951), whereas more contemporary multidimensional models describe self-esteem as being a set of attitudes towards specific domains (Cast & Burke, 2002; Epstein, 1980; Harter, 1999). Self-esteem may be a cognitive self-evaluation (Ek et al., 2008, Slomkowski et al., 1995), an affective "self-liking" (Brown & Marshall, 2006; Loney, 2007), or a combination of both (Capelatto et al., 2014; Tafarodi & Swann, 1995; Tafarodi & Swann, 2001). Many studies use the term "self-concept" to refer to the cognitive component of self-esteem (Houck et al., 2011; Hoza et al., 2002; Piers, 1984); however, the self-concept construct most often refers to an individual's knowledge, perceptions, and beliefs about themselves, which may include both evaluative (e.g., abilities, worth) and non-evaluative information (e.g., name, address, and age; Garaigordobil & Bernarás, 2008; Huitt, 2004; Montemayor & Eisen, 1977). In contrast, self-esteem refers only to evaluations of oneself rather than the full set of information about oneself (Brown, 2014; Brown et al., 2001; Wayment et al., 1995).

Although self-esteem is a relatively stable trait that develops slowly over time through the accumulation of life experiences (Heatherton & Wyland, 2003), it may also function as a "state" that can be temporarily manipulated (Heatherton & Polivy, 1991; Leary et al., 1995; Wells & Marwell, 1976). Several models of self-esteem propose that both global self-esteem (Donnellan, Kenny, Trzesniewski, Lucas, & Conger, 2012; Kuster & Orth, 2013; Rentzch & Schroder-Abe, 2018) and specific self-esteem (Coopersmith, 1967; Donnellan et al., 2012; Fleming & Courtney, 1984; Heatherton & Polivy, 1991; Rentzsch & Schroder-Abe, 2018; Wagner et al., 2016) are largely stable, while other models propose that specific self-esteem is less stable than global self-esteem (Brown & Dutton, 1995; Brown, Dutton, & Cook 2001; Hank & Baltes-Gotz, 2019; Shavelson & Bolus, 1982) due to domain-related developmental milestones (i.e., school, romantic relationships). That is, with the exception of scholastic competence, other domains of self-esteem (e.g., physical appearance, social acceptance, close friendships, romantic appeal, and athletic competence) appear to increase with age (Von Soest, Wichstrom, & Kvalem, 2016).

Collectively, the self-esteem construct is relatively heterogeneous with varying definitions across extant studies that differ with respect to whether or not self-esteem is considered unidimensional or multidimensional (Marsh et al., 2006; Marsh et al., 2008; O'Brien, 1985), cognitive or affective (Andersen et al., 1985; Cai et al., 2007), and/or stable or context-dependent (Ballespí et al., 2019; Harter et al., 2003). Extant studies of ADHD-related self-esteem most often define the construct as a relatively stable

combination of cognitive self-evaluations and affective feelings of worth or value (Leary et al., 1986; Mruk, 2013). The construct is comprised of domain-specific (e.g., academic, social) aspects of self-perception that converge to form an overall/global perception of self. Common indexes of self-esteem in ADHD research include multidimensional rating scale measures, such as the Self-Perception Profile for Children (SPPC; Harter, 1985) and the Piers-Harris Children's Self-Concept Scale (PHSCS; Piers, 1984), unidimensional rating scale measures, such as the Rosenburg Self-Esteem Scale (RSES; Rosenberg, 1965) and the Child Depression Inventory (CDI) Negative Self-Esteem scale (Kovacs, 2014), and implicit measures, such as the Implicit Association Task (IAT; Greenwald & Farnham, 2000).

To date, two previous systematic reviews have examined self-esteem in children and adolescents with ADHD. The first systematic review examined quality of life of children and adolescents with ADHD, and noted that eight of twelve studies reported lower self-esteem in children with the disorder (Danckaerts et al., 2010). A subsequent systematic review of 23 self-esteem studies found approximately 57% of studies reported that individuals with untreated ADHD had lower self-esteem than non-ADHD controls (Harpin, Mazzone, Rayaud, Kahle, & Hodgkins, 2016). Further, 50% (2/4) of child studies, 45% (4/9) of adolescent studies, 67% (2/3) of young adult studies, and 71% (5/7) of adult studies found that the non-ADHD group had higher self-esteem than the ADHD group. A number of methodological limitations of these reviews, however, warrant consideration. For example, Danckaerts and colleague's (2010) review broadly examined

quality of life in children and adolescents with ADHD, and only a small proportion of included studies (k = 12) reported findings regarding self-esteem. Reviews that examine small numbers of studies are inherently vulnerable to publication bias, reduced generalizability, and diminished confidence in inferences that may be drawn (Greco et al., 2013; Hedges & Vevea, 1996; Spector & Thompson, 1991). Moreover, both Danckaerts et al. (2010) and Harpin et al. (2016) only examined global self-esteem in lieu of specific self-esteem domains (e.g., academic, social, behavior). Although previous findings suggest that global self-esteem is an effective predicter of global outcomes (i.e., depression, externalizing problems, psychological well-being), specific self-esteem is more effective at predicting specific behavioral outcomes (e.g., academic performance; Rosenburg et al., 1995; Swann et al., 2007). Thus, inferences from a review of global self-esteem are expected to have limited generalizability relative to inferences from a review that also includes specific self-esteem domains. Further, Danckaerts and colleagues' review only included parent-report measures of self-esteem that tend to provide an underestimate of self-esteem relative to the children's self-report (Klassen, Miller, & Fine, 2005). Harpin and colleagues' inclusion of studies which used child-report measures of self-esteem is a relative strength, however, inclusion of both parent and child-report measures is expected to yield optimal internal and external validity (Martel, Schimmack, Nikolas, & Nigg, 2015).

To date, only one review has utilized meta-analytic methods to quantify ADHD-related self-esteem deficits in children. Specifically, Klassen (2005) examined between-

group differences in self-esteem across four studies and found a large-magnitude aggregate effect (d = -0.75), such that children with ADHD had significantly lower self-esteem compared to TD children, consistent with conclusions from the previous systematic reviews (Danckaerts et al., 2010; Harpin et al., 2016). Although the use of meta-analytic methods is a notable strength relative to the previous reviews, a number of limitations warrant consideration. For example, Klassen's (2005) review limited its examination to only studies that indexed self-esteem via the Child Health Questionnaire (CHQ-PF50; Landgraf et al., 1999). In addition to yielding a small sample of included studies (k = 4) that precluded examination of potential moderating variables, the review's focus on the CHQ-PF50 limits potential inferences to domain-general self-esteem. Specifically, the CHQ-PF50 is a broad measure of health that provides an abbreviated metric of self-esteem (i.e., it only includes 6 items that measure self-esteem) and excludes information about domain-specific self-esteem that might present unique implications regarding ADHD outcomes. For example, previous findings suggest that global and specific self-esteem differentially influence one's reaction to evaluative feedback, such that global self-esteem impacts one's emotional reaction to feedback, specific self-esteem impacts one's cognitive reaction to feedback, and the interaction between global and specific self-esteem influences information-seeking behavior (Bernichon et al., 2003). Finally, it is notable that Klassen's (2005) previous meta-analytic review excluded adolescent and adult ADHD studies, which limits potential inferences about ADHD-related self-esteem to children.

Collectively, children and adolescents with ADHD experience a broad range of outcomes, including academic, social, and behavioral difficulties, as well as increased rates of comorbid internalizing and externalizing disorders that likely contribute to diminished self-esteem (Harpin et al., 2013). Previous reviews (Danckaerts et al., 2010; Harpin et al., 2016; Klassen, 2005) have reliably reported group differences in self-esteem that appear to vary across age, while a previous meta-analytic review (Klassen, 2005) reported that the magnitude of ADHD-related self-esteem deficits in children and adolescents is large. Inferences drawn from previous reviews are limited, however, due to previous reviews' use of a narrow range of self-esteem measures, use of overly restrictive inclusion criteria, and absence of the examination of potential moderators. Furthermore, these reviews were published between 5 to 16 years ago, suggesting an updated-comprehensive review that includes contemporary studies of self-esteem and ADHD is needed.

The current study is the first to use meta-analytic methods to examine global and domain-specific (i.e., academic, social) self-esteem in both children and adolescents with ADHD. In contrast to previous reviews, the current review includes a large number of studies of ADHD and self-esteem that use a wide range of self-esteem measures. Further, this is the first meta-analytic review to examine the potential moderating effects of demographic (internalizing and externalizing comorbidity, age, and sex of ADHD sample) and methodological variables (diagnostic grouping methods, informants of self-esteem ratings, and self-esteem metrics) on study-wise heterogeneity in the magnitude of

ADHD-related self-esteem impairments. Based on previous reviews (Danckaerts et al., 2010; Harpin et al., 2016; Klassen, 2005), a large magnitude group difference was expected, such that typically developing children and adolescents would be associated with higher global self-esteem than children and adolescents with ADHD. Previous reviews also provided evidence to suggest that the distribution of effect sizes would be heterogeneous, and that studies that used a more comprehensive diagnostic methodology, self-report ratings of self-esteem in lieu of parent-ratings, older samples, and a greater percentage of females, would be associated with larger effect sizes.

CHAPTER II

METHOD

Literature Searches

Literature searches were conducted using the Web of Science, PubMed, PsycINFO, and GoogleScholar databases. The following keywords were used in each search engine: attention deficit hyperactivity disorder, ADD, ADDH, ADHD, hyper*, and atten*. Each keyword was paired with self-esteem, self-concept, and self-perception. An asterisk at the end of a root word instructs the search engines to search for any derivative of that root word (e.g., hyper* = hyperactivity, hyperactive), maximizing search results for that particular search term. A forward search was conducted using the Social Science Citation Index, and a backward search was completed by examining references cited in included studies.

Authors were contacted via email if insufficient data was provided and were given two weeks to respond. An initial search yielded 16,824 articles. Based on the inclusion criteria outlined above, 26 studies were included in the review. In total, 79 independent effect sizes were included in the review. Specifically, separate analyses included 48 global self-esteem effect sizes ($ADHD_N$ = 2470; TD_N = 9418), 12 academic self-esteem effect sizes, ($ADHD_N$ = 386; TD_N = 315), 11 social self-esteem effect sizes ($ADHD_N$ = 258; TD_N = 254), and 8 behavioral self-esteem effect sizes ($ADHD_N$ = 231; TD_N = 211). Figure 1 provides a PRISMA flow diagram of study location, identification, and exclusion.

Abstracts of all articles were independently examined and coded by two advanced doctoral students who were trained by a senior researcher with experience publishing and reviewing meta-analyses. Means and standard deviations were recorded for global, academic, social, and behavioral self-esteem, and moderator information was coded by two doctoral students. In the event of coding discrepancies between raters, operational definitions and coding instructions were revised, and articles were re-coded to improve reliability and validity. Coders independently recoded the studies until interrater agreement reached 100%.

Potential Moderators

Diagnostic complexity

Studies of ADHD and self-esteem vary considerably with respect to grouping procedures, with some studies relying solely on rating scale cut-off scores (Healey and Rucklidge, 2006; Ostrander et al., 2006; Scholtens et al., 2012) and others using comprehensive evaluations that include parent and teacher rating scales combined with

parent and child clinical interviews to confirm diagnosis (Fliers et al., 2009; Hoza et al., 2000; Millich & Okazaki, 1991). Diagnostic methods that use only rating scale cutoff scores appear to have the least validity (Martel, Schimmack, Nikolas, & Nigg, 2015) due to the transdiagnostic nature of inattention (Platt, 2017; Weissman et al., 2012), impulsivity (Beauchaine & McNulty, 2013), and motor activity disturbances (Finazzi-Agrò et al., 2010; Ginsburg et al., 2006). Moreover, compared with clinical interviews, rating scales are unable to capture important information such as onset, course, and duration of symptoms, and do not allow for open-ended probing to improve diagnostic clarification. The inclusion of a clinical interview increases validity (Parker & Corkum, 2016; Quintana et al., 2007) by accounting for variability in symptom endorsement that is not captured in rating scales (McGrath et al., 2004). The validity of a differential diagnosis of ADHD is also increased when diagnostic methods include information from both the child and another informant (e.g., child and parent or child and teacher; Martel, Schimmack, Nikolas, & Nigg, 2015), compared with diagnoses based solely on one rater (i.e., parent or child). To that end, smaller between-group effect size estimates are expected when studies determine diagnoses from a single source of information, as doing so is likely to increase within-group heterogeneity and between-group homogeneity by including TD children and adolescents in the ADHD group, and/or children and adolescents with ADHD in the control group. Studies that grouped/diagnosed participants via one source of information (i.e., parent rating scale) were coded as 0, whereas studies that grouped/diagnosed participants via at least two sources of information (i.e., parent rating scale and clinical interview) were coded as a 1.

Self-esteem Informant

Children often do not communicate their covert feelings of distress to parents (Aldridge & Wood, 1997), which in turn leads to low parent-child agreement on ratings of internalizing symptoms (Achenbach et al., 1987; De Los Reyes et al., 2015; Duhig et al., 2000), even when parents and children complete parallel measures (Kemper, Gerhardstein, Repper, & Kistner, 2003). Specifically, parents often underestimate their child's internalizing symptoms (Rothen et al., 2009), whereas children with ADHD often overestimate their performance (Gresham et al., 1998; Hoza et al., 1993; Ohan & Johnston, 2011; Wiener et al., 2012) and report their symptoms less accurately (Smith et al., 2000). Consequently, studies with self-report measures of self-esteem completed by children were expected to be associated with larger effect sizes than studies that used parent-report measures of their children's self-esteem. Studies with self-report measures of self-esteem were coded as 0, whereas studies with parent-report measures of self-esteem were coded as 1.

Age

Findings from previous meta-analytic reviews of the normative ontological trajectory of self-esteem suggest that self-esteem is generally high in young children, declines in older children as they begin to make social comparisons and evaluate external feedback, and further declines in adolescence as challenges associated with puberty and school arise (Robins, Trzesniewski, Tracy, Gosling, & Potter, 2002; Robins & Trzesniewski, 2005; Trzesniewski, Donnellan, & Robins, 2001; Twenge & Campbell, 2001). The only study of the ontological course of self-esteem in ADHD found three distinct trajectories: high and increasing (44.4% of participants), moderate and decreasing (48.8% of participants), and low and decreasing (6.8% of participants (Dvorsky et al.,

2019). A strength of meta-analyses is that they allow for examination of empirical questions that have received minimal attention in the literature. For instance, despite only one study existing in the literature to date, the relationship between maturation/development and ADHD-related self-esteem may be examined meta-analytically by comparing between-group effects across studies that vary with respect to their participants' mean age. Consequently, studies with ADHD samples with an older mean age were expected to be associated with larger effect sizes.

Percent Female

Converging evidence from previous studies suggest that self-esteem in the general population significantly differs according to sex, such that males generally experience higher self-esteem than females (Bleidorn et al., 2016; Robin & Trzesniewski, 2005). While studies of self-esteem in adults with ADHD suggest no significant sex differences (Babinski et al., 2011; Newark, Elsasser, & Stieglitz, 2016), there is evidence in children that boys with ADHD have higher self-esteem than girls with the disorder (Barber, Grubbs, & Cottrell, 2005; Ek, Westerlund, Holmberg, & Fernell, 2008; Quinn & Wigal, 2004). Given these findings, studies with samples that include a greater percentage of females were expected to be associated with larger between-group effect sizes. The total percentage of females included in each study was examined as a continuous moderating variable.

Comorbid Internalizing Disorder

Having one or more comorbid mental health conditions is positively related to lower self-esteem (Mann et al., 2004; Silverstone & Salsali, 2003). Internalizing conditions (i.e., MDD, GAD) have an especially strong association with lower self-

esteem (Henning et al., 2007; Orth et al., 2009) and are common among children with ADHD (Connor et al., 2003). Furthermore, previous studies (Arsandaux et al., 2020; Henriksen et al., 2017; Kita and Inoue, 2017) have found an indirect effect of ADHD symptoms on depression symptoms through self-esteem. It stands to reason, therefore, that children/adolescents with comorbid internalizing disorders experience lower self-esteem compared to samples without internalizing comorbidities. Consequently, studies that included children and adolescents with ADHD and comorbid internalizing disorders were expected to be associated with larger between-group ESs. Studies that excluded children/adolescents with comorbid internalizing disorders were coded as a 0, whereas studies that did not exclude comorbid internalizing disorders were coded as a 1.

Comorbid Externalizing Disorder

Externalizing behaviors are common among children with ADHD (Donnellan et al., 2005; Trzesniewski et al., 2006) and convey increased risk for lower self-esteem (Glass et al., 2011; Treuting & Hinshaw, 2001). Therefore, studies that included children and adolescents with ADHD and comorbid externalizing disorders were expected to be associated with larger between-group ESs. Studies that excluded children and adolescents with comorbid internalizing disorders were coded as a 0, whereas studies that did not exclude comorbid internalizing disorders were coded as a 1.

Self-Esteem Dimension

Self-esteem may be measured as a unidimensional construct (e.g., the Rosenberg Self-Esteem Scale[1]; Rosenberg, 1965; Child Depression Inventory Self Esteem Scale;

[1] Recent findings suggest a 2-factor model best explains the Rosenberg Self-Esteem Scale (RSES; Ang et al., 2006; Boduszek et al., 2013; Quilty et al., 2006; Supple et al., 2013). However, the RSES was coded as unidimensional in this review because it does not include specific domains of self-esteem.

Kovacs, 2014), or as a multidimensional construct that includes specific domains of self-esteem (i.e., academic, social, behavioral) that converge to form an overall or global measure. Notably, findings from factor analytic studies suggest multidimensional self-esteem models have greater construct validity, relative to unidimensional models (Marsh & Craven, 2006). Therefore, multidimensional measurements of self-esteem were expected to better detect differences between children/adolescents with and without ADHD, and thus be associated with larger between-group effect sizes. Studies using unidimensional measures were coded as 0, whereas studies using multidimensional measures were coded as 1.

Data Analytic Strategy

Effect Size Estimation

Separate effect sizes for global, academic, social, and behavioral self-esteem were estimated using Comprehensive Meta-Analysis Version 3 (CMA; Borenstein, Hedges, Higgins, & Rothstein, 2014) software, and reflect the magnitude of difference between children/adolescents with ADHD and typically developing children/adolescents. Hedges's (1982) *g* effect sizes were used to correct for the upward bias of studies with small sample sizes (Lipsey & Wilson, 2001). Effect sizes are classified as small (effect size ≤ 0.20), medium ($0.20 <$ effect size < 0.8), or large (effect size ≥ 0.8) based on Cohen's conventions, and an effect size of zero indicates no difference between group means (Cohen, 1992). A 95% confidence interval that does not include 0 indicates a significant ES. Positive effect sizes reflect greater self-esteem in the TD group compared to the ADHD group, while negative effect sizes reflect less self-esteem in the TD group

compared to the ADHD group. Means, standard deviations, and sample sizes were used to calculate all effect sizes.

Heterogeneity analyses

Heterogeneity was examined within three-level, mixed-effects models using the metafor package in R (Viechtbauer & Cheung, 2010), as both systematic effects and unmeasured random effects were expected. Two separate log-likelihood-ratio tests were conducted for each group of self-esteem studies (global, academic, social, and behavioral self-esteem) to examine the significance of within-study (level 2) and between-study variance (level 3). A significant *Q* indicated that the assumption of homogeneity was rejected, and supported the statistical examination of potential moderator effects in level 3 (Lipsey & Wilson, 2001). Heterogeneity was also examined using Hunter and Schmidt's (1990) 75% rule due to low statistical power associated with log-likelihood-ratio tests. This rule indicates that heterogeneity can be regarded as substantial and moderation analyses are warranted if less than 75% of the total variance can be attributed to sampling variance (level 1).

Moderator Analyses

Examination of effect size variability and potential moderators was performed using the metafor package in R (Viechtbauer & Cheung, 2010). Random effects models were utilized to adjust for variability in effect sizes that is assumed to be randomly distributed (i.e., between-study variability), in addition to subject-level sampling error. Several studies produced multiple effect sizes, and therefore, multi-level modeling analyses with three levels were performed. The three-level model approach is superior to traditional meta-regressions since it allows for inclusion of multiple effect sizes from a

single study while controlling for dependency between effect sizes (Cheung, 2014; Hox, 2010; Van den Noortgate et al., 2013, 2014). Specifically, the three-level approach models three sources of variance, including sampling variance of the extracted effect sizes at level 1, within-study variance at level 2, and between-study variance at level 3.

A two-step approach to examining potential moderators via the three-level meta-analytic model was planned a priori. Specifically, each moderator was examined individually in step 1 to determine which moderators predicted significant between-study (level 3) variance, following recommendations of Hox (2010). Significant variables identified in step 1 would be included in a single model to examine unique variability attributable to each variable in step 2. This two-step approach is advantageous because it informs whether or not multicollinearity contributes to non-significant variables in step 2.

Finally, limited study-wise variability may result from the tendency of researchers to use methodological approaches identical or similar to those reported in previous peer-reviewed studies. In such cases, consideration of *Q* tests and/or Hunter and Schmidt's (1990) 75% rule, and/or limited numbers of studies with varying methods, may suggest examinations of potential moderators is not warranted. It is possible, however, that studies with novel or emerging methodological approaches may yield unique, interesting, and potentially impactful findings, but do not occur with sufficient frequency to reject the assumption of homogeneity. Subgroup analyses are an appropriate alternative to meta-regressions when there are vastly disproportionate numbers of studies represented across categorical levels of a moderating variable, or when low study numbers are suspected to be the source of a null meta-regression effect, or preclude meta-regression analyses due to concerns of insufficient power. Subgroup analyses are a hybrid of meta-analytic and

traditional methods common to systematic reviews (Lipsey and Wilson, 2001), and were conducted in this review post hoc by first separating studies into dichotomous groups based on the levels of a categorical variable of interest, and then comparing effect sizes to infer potential moderation effects (Meinzer, Petit, & Viswesvaran, 2014).

Publication bias

Publication bias occurs when population effect size estimates are inflated due to the increased likelihood that statistically significant effects are published more often than non-significant effects. Several methods were used to assess the presence of potential publication bias. First, a funnel plot (i.e., a scatterplot of the between-group effects on the x-axis and sample size on the y-axis) was examined to determine the symmetry of effect sizes across studies (i.e., asymmetry in the distribution would suggest potential publication bias). Second, Egger's regression test (Egger, Smith, Schneider, & Minder, 1997) was used to statistically examine the symmetry of the funnel plot via a regression analysis, where greater y-intercept values are associated with increased likelihood of publication bias. Next, a fail-safe *N* analysis was used to provide an estimate of the amount of unpublished studies with null findings that would be needed to alter the confidence interval of the aggregated effect size to include zero (i.e., non-significant effect size). Finally, a *p*-curve analysis was performed using the dmetar package in R (Harrer et al., 2019) to examine if the distribution of published studies provides evidential value, if identified evidential value is adequate, and the extent to which findings reflect ambitious *p*-hacking (Simonsohn et al., 2016). Of note, *p*-curve assumes statistical independence between effect sizes, and therefore, only one effect size was selected at random for studies that reported more than one effect size.

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CHAPTER III

RESULTS

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Global Self-Esteem

Twenty-six studies, consisting of 11,888 children and adolescents ($ADHD_N$ = 2470; TD_N = 9418), reported measures of global self-esteem and provided sufficient data to calculate 48 effect sizes (see Table 1 and Figure 2). A statistically significant, small-to-moderate-magnitude effect size of 0.46 (95% CI [0.27, 0.65], $p < .001$) indicated that the TD group was associated with moderately greater global self-esteem, compared to the ADHD group (see Table 2). A visual inspection of the funnel plot indicated a symmetrical distribution of effect sizes across studies, and Egger's regression intercept of -0.70 (95% CI [-2.60, 1.19], $p = 0.46$) suggested no evidence of publication bias. Additionally, *Fail-safe N* analysis revealed that an unlikely 4066 unpublished studies with null effects would be needed to change the confidence interval to include zero..

One effect size was identified as an outlier but was retained in analyses based on previous research that suggests outliers may reveal important patterns related to study characteristics (Viechtbauer & Cheung, 2010). Finally, *p*-curve analyses indicated the presence of evidential value and that *p*-hacking was not likely (see Figure 6).

Log-likelihood-ratio tests indicated within-study, $\sigma^2 = 0.06$, $p < 0.0001$, and between-study variability, $\sigma^2 = 0.16$, $p = .002$, were both significant. Furthermore, only 12% of the total variance could be attributed to sampling variance, and therefore, an examination of potential moderators was supported. Separate random-effects meta-regressions were examined for each potential moderator (i.e., *diagnostic grouping method, self-esteem dimension, internalizing comorbidities, externalizing comorbidities, age, and percentage of females*) to determine which moderators predicted significant between-study (level 3) variance in the effect size distribution. Results indicated that there were no significant moderating effects (all $p > .05$, see Table 2), so a multiple meta-regression was not conducted as planned.

Academic Self-Esteem

Nine studies, consisting of 701 children and adolescents ($ADHD_N = 386$; $TD_N = 315$), reported measures of academic self-esteem and provided sufficient data to calculate 12 effect sizes (see Table 3 and Figure 3). A statistically significant, moderate-magnitude effect size of 0.60 (95% CI [0.18, 1.02], $p = 0.009$) indicated that the TD group had moderately higher academic self-esteem than the ADHD group (see Table 4). A visual inspection of the funnel plot indicated a symmetrical distribution of effect sizes across studies, while Egger's regression intercept of 0.06 (95% CI [-5.32, 5.45], $p = 0.98$) suggested no evidence of publication bias. *Fail-safe N* analysis revealed that 109

unpublished studies with null effects would be needed to change the confidence interval to include zero. Finally, *p*-curve analyses indicated the presence of evidential value and suggested that *p*-hacking was not likely (see Figure 7).

Log-likelihood-ratio tests indicated that there was not significant within-study variability, $\sigma^2 = 0.00$, $p = 1.000$, or significant between-study variability, $\sigma^2 = 0.27$, $p = .10$. However, only 20% of the total variance could be attributed to sampling variance, and therefore, an examination of potential moderators was supported. The planned meta-regressions were not conducted, however, due to the small sample of effect sizes ($k = 12$) obtained from only nine studies.

Social Self-Esteem

Seven studies, consisting of 512 children and adolescents ($ADHD_N = 258$; $TD_N = 254$), reported measures of social self-esteem and provided sufficient data to calculate 11 effect sizes (see Table 5 and Figure 4). A statistically significant, medium-magnitude effect size of 0.67 (95% CI [0.33, 1.02], $p = .001$) indicated that TD children exhibited moderately higher social self-esteem than children with ADHD (see Table 4). A visual inspection of the funnel plot indicated a symmetrical distribution of effect sizes across studies and Egger's regression intercept of 1.67 (95% CI [-0.82, 4.16], $p = 0.16$) suggested no evidence of publication bias. The *Fail-safe N* analysis, however, revealed that only 35 unpublished studies with null effects would be needed to change the confidence interval to include zero. Finally, *p*-curve analyses indicated the presence of evidential value and suggested that *p*-hacking was not likely (see Figure 8).

Log-likelihood-ratio tests indicated that there was not significant within-study variability, $\sigma^2 = 0.00$, $p = 1.000$, or between-study variability, $\sigma^2 = 0.112$, $p = 0.11$.

However, only 41% of the total variance could be attributed to sampling variance, and therefore, an examination of potential moderators was supported. The planned meta-regressions were not conducted due to the small sample of effect sizes (k = 11) obtained from only seven studies.

Behavioral Self-Esteem

Five studies, consisting of 442 children and adolescents ($ADHD_N$ = 231; TD_N = 211), reported measures of behavioral self-esteem and provided sufficient data to calculate 8 effect sizes (see Table 6 and Figure 5). The effect size of 0.20 (95% CI [-0.53, 0.91], p = .54) was not significant, indicating that TD children did not exhibit higher behavioral self-esteem than children with ADHD (see Table 4). A visual inspection of the funnel plot indicated a symmetrical distribution of effect sizes across studies and Egger's regression intercept of 4.57 (95% CI [-0.58, 9.73], p = 0.07) suggested no evidence of publication bias. Finally, *p*-curve analyses indicated the presence of evidential value and suggested that *p*-hacking was not likely (see Figure 9).

Log-likelihood-ratio tests indicated that there was not significant within-study variability, σ^2 = 0.064, p = 0.71, or between-study variability, σ^2 = 0.255, p = 0.36. However, only 41% of the total variance could be attributed to sampling variance, and therefore, an examination of potential moderators was supported. The planned meta-regressions were not conducted due to the very small sample of effect sizes (k = 8) obtained from only five studies.

Exploratory Ad Hoc Examination of Moderators

Potential moderators of academic, social, or behavioral self-esteem effect size variability were not examined via meta-regressions due to the small number of effect

sizes obtained from studies that reported metrics of these constructs. As such, diagnostic complexity, self-esteem informant, comorbidities, age, and percent female were examined post hoc via a hybrid of meta-analytic methods and traditional methods common to systematic reviews. A summary of the results of this hybrid approach can be found in Table 7.

Diagnostic complexity.

Five academic self-esteem effect sizes were calculated from four studies (n_{ADHD} = 103, n_{TD} = 83) that used a less complex diagnostic grouping method (Hedges' g = 0.44, p = 0.08), while seven academic self-esteem effect sizes were calculated from five studies (n_{ADHD} = 283, n_{TD} = 232) that used a more complex diagnostic grouping method (Hedges' g = 0.78, p = 0.06). Six social self-esteem effect sizes were calculated from four studies (n_{ADHD} = 88, n_{TD} = 83) that used a less complex diagnostic grouping method (Hedges' g = 0.78, p = 0.07), while five social self-esteem effect sizes were calculated from three studies (n_{ADHD} = 155, n_{TD} = 171) that used a more complex diagnostic grouping method (Hedges' g = 0.38, p = 0.11). Finally, three behavioral self-esteem effect sizes were calculated from two studies (n_{ADHD} = 76, n_{TD} = 40) that used a less complex diagnostic grouping method (Hedges g = 0.28, p = 0.47), while five behavioral self-esteem effect sizes were calculated from three studies (n_{ADHD} = 155, n_{TD} = 171) that used a more complex diagnostic grouping method (Hedges' g = 0.16, p = 0.76). Collectively, with the exception of social self-esteem, studies that use a more comprehensive diagnostic grouping method were associated with a larger overall between-group self-esteem effect size, compared to those that used less comprehensive methods.

Self-Esteem Informant.

Eleven academic self-esteem effect sizes were calculated from nine studies (n_{ADHD} = 386, n_{TD} = 315) that used child/adolescent self-ratings of self-esteem (Hedges' g = 0.59, p = 0.01), while one academic effect size was calculated from one study (n_{ADHD} = 21, n_{TD} = 21) that used teacher ratings of the child's/adolescent's self-esteem (Hedges' g = 0.17, p = 0.10). Ten social self-esteem effect sizes were calculated from seven studies (n_{ADHD} = 258, n_{TD} = 254) that used child/adolescent self-ratings of self-esteem (Hedges' g = 0.65, p = 0.01), while one effect size was calculated from a study (n_{ADHD} = 21, n_{TD} = 21) that used teacher ratings of the child's/adolescent's self-esteem (Hedges' g = 0.45, p = 0.10). Finally, seven behavioral effect sizes were calculated from five studies (n_{ADHD} = 231, n_{TD} = 211) that used child/adolescent self-ratings of self-esteem (Hedges' g = 0.44, p = 0.06), while one behavioral social effect size was calculated from a study (n_{ADHD} = 21, n_{TD} = 21) that used teacher ratings of the child's/adolescent's self-esteem (Hedges' g = -0.98, p = 0.11). Collectively, studies that used the child's/adolescent's ratings of their own self-esteem were associated with a larger aggregated effect size, relative to studies that used teacher ratings.

Comorbidities.

Studies were originally coded for exclusion of externalizing comorbidities and exclusion of internalizing comorbidities as two separate variables. However, no studies excluded only externalizing or only internalizing comorbidities. For this reason, these variables were collapsed into one variable (comorbidities) for the ad hoc examination of moderators. Ten academic effect sizes were calculated from nine studies (n_{ADHD} = 386, n_{TD} = 315) that did not exclude comorbidities (Hedges' g = 0.68, p = 0.01), while two academic effect sizes were calculated from one study (n_{ADHD} = 21, n_{TD} = 21) that did

exclude comorbidities (Hedges' g = 0.02, p = 0.95). Nine social effect sizes were calculated from eight studies (n_{ADHD} = 258, n_{TD} = 254) that did not exclude comorbidities (Hedges' g = 0.71, p = 0.01), while two social effect sizes were calculated from one study (n_{ADHD} = 21, n_{TD} = 21) that did exclude comorbidities (Hedges' g = 0.34, p = 0.43). Finally, six behavioral effect sizes were calculated from one study (n_{ADHD} = 231, n_{TD} = 211) that did not exclude comorbidities (Hedges' g = 0.52, p = 0.048), while two behavioral effect sizes were calculated from one study (n_{ADHD} = 21, n_{TD} = 21) that did exclude comorbidities (Hedges' g = -0.70, p = 0.32). Collectively, the aggregate effect size from studies that did not exclude comorbidities was associated with a larger overall effect, relative to the aggregate effect size derived from a single study that did exclude comorbidities.

Age.

Age was recoded as a categorical variable for the hybrid approach by calculating a median cut point for age across all studies (median = 9.815 years old) and comparing effect sizes with a mean age above and below the median split. Seven academic self-esteem effect sizes were calculated from four studies (n_{ADHD} = 199, n_{TD} = 151) that had a younger sample (Hedges' g = 0.28, p = 0.08), while five academic effect sizes were calculated from five studies (n_{ADHD} = 187, n_{TD} = 164) that had an older sample (Hedges' g = 0.85, p = 0.06). Seven social self-esteem effect sizes were calculated from four studies (n_{ADHD} = 199, n_{TD} = 255) that had a younger sample (Hedges' g = 0.65, p = 0.04), while four social self-esteem effect sizes were calculated from three studies (n_{ADHD} = 59, n_{TD} = 103) that had an older sample (Hedges' g = 0.63, p = 0.11). Six behavioral self-esteem effect sizes were calculated from three studies (n_{ADHD} = 189, n_{TD} = 125) that had a

younger sample (Hedges' $g = 0.52$, $p = 0.048$), while two behavioral self-esteem effect sizes were calculated from two studies ($n_{ADHD} = 42$, $n_{TD} = 86$) that had an older sample (Hedges' $g = 0.58$, $p = 0.37$). Collectively, studies with an older sample were associated with larger academic and behavioral self-esteem effect sizes compared to studies with a younger sample. The aggregate effect sizes obtained from studies with younger and older samples were nearly identical with respect to social self-esteem.

Percent Female.

Percent female was recoded as a categorical variable to allow for comparison of the aggregate effect size from studies with fewer females with ADHD, compared to studies with more females with ADHD. Studies were recoded using a median cut point for percent female across all studies (median = 18% female). Six academic self-esteem effect sizes calculated from five studies ($n_{ADHD} = 192$, $n_{TD} = 144$) had an ADHD sample with a smaller proportion of females (Hedges' $g = 0.59$, $p = 0.02$), while four academic self-esteem effect sizes calculated from five studies ($n_{ADHD} = 66$, $n_{TD} = 127$) had an ADHD sample with a larger proportion of females (Hedges' $g = 0.27$, $p = 0.10$). Six social self-esteem effect sizes calculated from four studies ($n_{ADHD} = 184$, $n_{TD} = 151$) had an ADHD sample with a smaller proportion of females (Hedges' $g = 0.65$, $p = 0.03$), while five social self-esteem effect sizes calculated from four studies ($n_{ADHD} = 66$, $n_{TD} = 127$) had an ADHD sample with a larger proportion of females (Hedges' $g = 0.60$, $p = 0.08$). Four behavioral self-esteem effect sizes calculated from three studies ($n_{ADHD} = 175$, $n_{TD} = 127$) had an ADHD sample with a smaller proportion of females (Hedges' $g = 0.60$, $p = 0.08$), while four behavioral self-esteem effect sizes calculated from three studies ($n_{ADHD} = 56$, $n_{TD} = 101$) had an ADHD sample with a larger proportion of females

(Hedges' $g = 0.19$, $p = 0.68$). Collectively, studies with a smaller proportion of females in the sample were associated with larger academic and behavioral self-esteem effect sizes, compared to studies with a larger proportion of females. The aggregate effect sizes obtained from studies with fewer or more females in the samples were nearly the same with respect to social self-esteem.

CHAPTER IV

DISCUSSION

Overall, 48 effect sizes from 26 studies that included a measure of global self-esteem suggest a small-to-moderate magnitude effect (Hedges' g = 0.46), indicating that TD children and adolescents experience higher self-esteem than children and adolescents with ADHD. This finding is consistent with our a priori expectations based on previous systematic reviews (Danckaerts et al., 2010; Harpin et al., 2016), but smaller than the overall effect (Cohen's d = -0.75) reported in Klassen's (2005) previous meta-analysis. There are several possible explanations for this discrepancy. First, Klassen's (2005) review only included studies that used the Child Health Questionnaire (CHQ-PF50), which may suggest that the CHQ-PF50 is a particularly sensitive metric of ADHD-related self-esteem deficits. A more likely explanation, however, is that Klassen's (2005) larger effect size reflects a spurious finding, given only four effect sizes were used to estimate the aggregate effect size across studies.,

Nevertheless, our finding of a robust, moderate-magnitude effect has important implications for children and adolescents with ADHD, particularly as diminished global self-esteem is a predictor of psychopathology and reduced quality of life (Bos et al., 2010; Greger et al., 2017). Low self-esteem in childhood, for instance, is related to aggression in adolescence (Donnellan et al., 2005) and suicidal ideation in adulthood (McGee et al., 2001). Moreover, low self-esteem in adolescence conveys increased risk for comorbid psychopathology, lower relationship satisfaction (Boden et al., 2008; Orth et al., 2010), lower job satisfaction (Orth et al., 2010), and lower overall life satisfaction (Boden et al., 2008) in adulthood.

Not surprisingly, the aggregated medium-magnitude effects for academic self-esteem (Hedges' $g = 0.61$) and social self-esteem (Hedges' $g = 0.65$) indicate that TD children and adolescents experience higher academic and social self-esteem than children and adolescents with ADHD. The non-significant aggregated effect for behavioral self-esteem (Hedges' $g = 0.44$), in contrast, was not expected given the wealth of previous findings that suggest behavioral difficulties are commonly comorbid with ADHD (Donnellan et al., 2005; Trzesniewski et al., 2006). One potential explanation is that children and adolescents with ADHD do not hold a ubiquitous negative self-perception of difficulties across behavioral, academic, and social domains of functioning. Indeed, extant evidence suggests that boys with ADHD exhibit a positive illusory bias towards academic, social, and behavioral domains, and the positive illusory bias may be greatest with respect to the social and behavioral domains when ADHD occurs comorbid with aggression (Hoza et al., 2002). Alternatively, it is possible that behavioral performance may yield relatively less intrinsic-tangible indices of feedback, as compared to feedback

that often accompanies academic and social performance. For example, academic underachievement is often communicated to children and adolescents through the use of objective grades, such as star charts and checks for younger children, and formal letter grades and grade point averages (GPA) for older children and adolescents. Similarly, indicators of social difficulties, such as peer rejection and bullying, are often overt and salient (Andrade et al., 2009; de Moor et al., 2014;Masten et al., 2009). In contrast, children and adolescents with ADHD are often unaware of their own behavioral problems (Sternberg et al., 2006) and may receive relatively less direct feedback or consequences for problematic behavior (Akhter et al., 2011).

Notably, the academic and social self-esteem effect size estimates were 33% and 41% larger, respectively, than the aggregated global self-esteem effect size. One potential explanation for this finding is that global self-esteem is more stable throughout the lifespan compared to specific self-esteem domains (Asendorpf & van Aken, 1993; Brown et al., 2001; Marsh et al., 1983; Rentzch & Schroder-Abe, 2018; Shavelson et al., 1976; von Soest et al. 2016), and consequently, less likely to be adversely impacted by ADHD-related difficulties. Alternatively, it is possible that unexamined domains that are distal to ADHD, such as physical appearance, creative ability, and athletic ability, are less likely to be negatively impaired by ADHD, and consequently serve to bolster global self-esteem and buffer against the adverse effects of diminished academic and social self-esteem. Finally, perhaps the most parsimonious explanation for the discrepancy in effect size magnitudes relates to how effect sizes are calculated. Specifically, within-group variability is reflected in the denominator of effect size calculations as a pooled standard deviation, and consequently, increasing within-group variability in turn decreases the

effect size magnitude. Global self-esteem metrics, compared to indices of specific self-esteem domains, are inherently associated with greater within-study variability since survey items tend to cover a broader range of constructs by design.

Although null findings typically warrant caution and often have limited interpretive value, especially when power is a concern due to small sample sizes, non-significant meta-analytic findings are potentially meaningful because each datum represents a study that includes a larger sample of participants. To that end, our meta-regression findings that indicate diagnostic complexity, informant, comorbid externalizing disorders, comorbid internalizing disorders, mean age, percent female, and self-esteem dimension were not significant moderators of global self-esteem, warrant further consideration. For example, the null effect of age as a moderator suggests that group differences in global self-esteem remain relatively consistent across childhood and adolescence, contrary to expectations based on previous meta-analytic reviews of the normative ontological trajectory of self-esteem that declines somewhat from early childhood to adolescence (Robins, Trzesniewski, Tracy, Gosling, & Potter, 2002; Robins & Trzesniewski, 2005; Trzesniewski, Donnellan, & Robins, 2001; Twenge & Campbell, 2001). Likewise, the percent of studies' female ADHD participants did not significantly moderate between-group differences, contrary to previous findings that suggest girls with ADHD experience lower self-esteem than boys with the disorder (Barber, Grubbs, & Cottrell, 2005; Ek, Westerlund, Holmberg, & Fernell, 2008; Quinn & Wigal, 2004). In hindsight, it is possible that the inclusion of adolescents in this study obscured the moderating effect, as studies of self-esteem in adults with ADHD have not reported evidence of a sex difference (Babinski et al., 2011; Newark, Elsasser, & Stieglitz, 2016).

Our finding that diagnostic complexity was not a significant moderator was surprising. A priori, we noted that increased diagnostic complexity is more likely to yield diagnostically pure ADHD and TD groups, while less rigorous diagnostic approaches are likely to yield heterogeneous ADHD groups consisting of some children and adolescents with ADHD, and others with non-ADHD psychopathology. Consequently, we predicted larger between-group effect sizes that reflect ADHD-related self-esteem impairments when complex-comprehensive methods were utilized. The null finding of diagnostic complexity as a moderator of effect size magnitude appears to suggest that self-esteem impairments observed in children and adolescents with ADHD, are similar to those observed in children and adolescents with other psychopathologies. The non-significant effect of the self-esteem dimension variable was unexpected given factor analytic studies that suggest multidimensional models of self-esteem typically provide a better fit relative to unidimensional models (Braken & Howell; Marsh & Craven, 2006). It is possible that our coding of the Rosenburg Self-Esteem Scale (RSES) as a unidimensional measure of self-esteem dampened the moderating effect, as previous factor analytic studies have identified that the best fitting model for the RSES includes two factors (Ang et al., 2006; Boduszek et al., 2013; Quilty et al., 2006; Supple et al., 2013). Finally, the non-significant moderating effects of self-esteem informant and comorbidity (externalizing and internalizing disorders) are likely due to limited heterogeneity in the variables across studies. Specifically, very few studies included parent-report measures of self-esteem, and very few studies reported information regarding exclusion/inclusion criteria of externalizing or internalizing comorbidities.

Academic, social, and behavioral self-esteem were underreported across studies of global self-esteem, which limited the ability to conduct meta-regressions to test potential moderator effects for these specific domains. Thus, diagnostic complexity, self-esteem informant, comorbidities, age, and percent female were examined as potential moderating variables ad hoc via a hybrid meta-analytic/systematic-review approach. Collectively, at the aggregate level, studies that used complex/comprehensive grouping methods, obtained child reports of self-esteem, included participants with comorbid diagnoses, examined samples with an older mean age, and included fewer females were associated with larger academic and behavioral self-esteem effect sizes, compared to studies that used less complex/comprehensive grouping methods, obtained parent or teacher reports of self-esteem, excluded participants with comorbid diagnoses, examined samples with a younger mean age, and included a greater number of females. These findings were not surprising and consistent with our a priori hypothesis.

Our hybrid-approach examination of social self-esteem generally produced a similar pattern of findings with a few notable exceptions. For example, social self-esteem effect sizes were larger when studies used less complex grouping methods. Although this finding contrasts the previously discussed null meta-regression effect of diagnostic approach on global self-esteem, our explanation for the findings applies well in both instances. As a reminder, we hypothesize that decreasing diagnostic rigor increases the likelihood of heterogeneous ADHD groups that include children and adolescents with ADHD, as well as children and adolescents with psychopathology other than ADHD. Considering findings from both the null meta-regression and the hybrid approach, it

appears that children and adolescents with ADHD experience self-esteem that is analogous or better compared to children and adolescents with other psychopathologies.

Notably, grouping studies by age and the percent of female participants did not yield meaningfully different aggregate social self-esteem effect sizes. It is possible that comparing children/adolescents to adults might yield greater effect sizes and that similar effect sizes reflect limited variability because adults weren't included. To that end, sex-related differences in social self-esteem may be most apparent as interaction effects, such that differences become more apparent in adults. Future reviews that include adult participants are needed to test this hypothesis.

Finally, it is noted that caution is warranted in interpreting these findings. Very few studies reported academic, social, and behavioral self-esteem (9, 7, and 5 studies respectively), and 70% of subgroups created for these analyses were a non-significant effect size. These findings and interpretations are included here as a preliminary step to promote further examinations of these constructs and potential effects. As the body of literature grows with the publication of additional studies, stronger analytic approaches will be needed to provide evidence for the reliability and validity of these findings.

The present study is the first to review global, academic, social, and behavioral self-esteem in children and adolescents with ADHD, and to examine methodological and sample characteristics as potential moderator variables. As with any study, a few limitations warrant consideration. For example, the small sample of studies that reported academic, social, and behavioral self-esteem limited our ability to utilize meta-regression procedures to test potential moderator effects. Although the ad hoc use of a hybrid approach yielded insight about potential moderators, the analyses were based on a very

small number of effect sizes and most of the aggregated effect sizes were non-significant. Future studies of ADHD and self-esteem are encouraged to measure and report these constructs to allow for their examination via a three-level modeling approach or other similar procedures. This study is also limited in its ability to allow for inferences about ADHD-related self-esteem across the lifespan, as adult participants were not included. However, the choice to focus on children and adolescents allows for implications that may be beneficial for treatment in younger populations. Finally, findings from this study may not generalize to all presentations of ADHD since the low number of published studies precluded an examination of ADHD-presentation as a potential moderator. Future studies are therefore needed to further parse the relationship between ADHD presentations and self-esteem.

Collectively, findings from the current study indicate lower global, academic, and social self-esteem in children and adolescents with ADHD, compared to their typically developing peers. Implications of these findings are profound, as low self-esteem conveys increased risk for a range of negative outcomes, such as non-ADHD psychopathology (Atroszko et al., 2017; Bos et al., 2010; Greger et al., 2017), health compromising behaviors (McGee & Williams, 2000; Trzesniewski et al., 2006), and limited economic prospects (Trzesniewski et al., 2006). Moreover, low academic self-esteem predicts lower academic performance (Paralta Sanchez et al., 2003), aggression at school (Taylor et al., 2007), and lower level of academic attainment (Guay et al., 2008), while low social self-esteem predicts internalizing problems (Spilt et al., 2014) and suicidal ideation (Au et al., 2009). Consequently, self-esteem would likely serve as an appropriate target of intervention when considering the development of novel ADHD

treatment modalities. Also notable is our finding that academic and social self-esteem effect sizes were larger than the effect sizes for behavioral and global self-esteem. To that end, novel treatment interventions might aim to capitalize on the relatively higher global self-esteem of affected children and adolescents by identifying and targeting protective factors. Finally, preliminary findings from our ad hoc subgroup analyses suggest potential moderating effects of diagnostic complexity, self-esteem informant, comorbidities, age, and sex distribution on academic, social, and behavioral self-esteem. Future studies that utilize meta-regressions or other analogous procedures are needed to further investigate these potential moderator effects with more rigorous analytic approaches.

APPENDIX

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Overview of ADHD

Attention deficit/hyperactivity disorder (ADHD) is characterized by impairment related to inattention, hyperactivity, and impulsivity and affects between 3% to 7% of the population (American Psychiatric Association, 2013; Barkley, 2006). The Diagnostic and Statistical Manual of Mental Disorders – 5th Edition (DSM 5) defines ADHD as having three presentations: primarily inattentive (ADHD-I), primarily hyperactive/impulsive (ADHD-H), and combined (ADHD-C). ADHD is characterized by pervasive symptoms of inattention and/or hyperactivity/impulsivity that impair functioning in multiple settings (APA, 2013). ADHD is commonly comorbid with anxiety, depressive, and behavioral disorders (Jensen et al., 2001; Reale et al., 2017).

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Children and adolescents with ADHD are associated with higher rates of comorbid internalizing symptoms (Connor, Edwards, Fletcher, Baird, Barkley, & Steingard, 2003) and an abundance of negative outcomes the pervade most aspects of affected individuals' lives, including academics (Loe & Feldman, 2007), social interactions (Lopez-Williams et al., 2005), and adaptive functioning (Stein et al., 1995). These pejorative outcomes in turn contribute to diminished self-esteem (Denissen et al., 2008; Goodman et al., 1993; In-Albon et al., 2017; Park et al., 2007).

History of ADHD

The earliest recorded description of what appears to be ADHD was written in 1798 by Sir Alexander Chricton (Lange, Reichl, Lange, Tucha, and Tucha, 2010). In his book, "On Attention and its Diseases," he defines attention as "When any object of external sense, or of thought, occupies the mind in such a degree that a person does not receive a clear perception from any other one, he is said to attend to it" (Crichton, 1798, reprint p. 200). Crichton describes a disorder that includes symptoms of difficulty sustaining attention and being easily distracted with onset before the age of seven (Crichton, 1798). Sir George Frederic Still, a pediatrician, subsequently provided the first widely published description of a group of symptoms that are similar to ADHD (Martinez-Badia & Martinez-Raga, 2015). Still believed that children with a pattern of inattention, aggression, and emotional instability had a "defect in moral control", meaning that they had deficits in "cognitive relation to the environment", "moral consciousness", and "inhibitory volition" (Still, 1902, p. 1077).

Interest in hyperactivity exhibited by children grew during an encephalitis epidemic in 1917-1918 (Barkley, 2006). Children who survived encephalitis often

displayed symptoms similar to those of modern ADHD, Oppositional Defiant Disorder (ODD), and Conduct Disorder (CD), and were diagnosed with "postencephalitic behavior disorder" (Barkley, 2006). Two physicians, Franz Kramer and Hans Pollnow, later reported cases of "hyperkinetic disease of infancy" (Kramer and Pollnow, 1932) that were distinct from postencephalitic behavior disorder and excluded symptoms such as sleep difficulty and poor motor control (Lange, Reichl, Lange, Tucha, & Tucha, 2010).

In 1937, Charles Bradley discovered that stimulants reduced symptoms in children with behavior and academic problems (Bradley, 1937). Benzodrine was given to reduce children's headaches that commonly followed pneumoencephalograms administered during Bradley's study of children with behavior problems, and serendipitously, he discovered that the stimulants improved behavior and academic performance for a portion of the children (Lange et al., 2010). Laufer et al. (1957) later investigated the brain functioning of stimulant treatment of "hyperkinetic impulse syndrome" and identified an association between hyperactivity and deficits in the thalamic area. Notably, this research showed that although many children who exhibited characteristics of hyperkinetic impulse syndrome had a history of brain injury, many had no history of brain injury.

In 1968, The DSM-II added the diagnosis of "Hyperkinetic Reaction of Childhood", which described a disorder "characterized by overactivity, restlessness, distractibility, and short attention span, especially in young children; the behavior diminishes by adolescence" (American Psychiatric Association, 1968, p. 50). The diagnostic moniker was revised to "Attention Deficit Disorder (ADD)" in the DSM-III to reflect contemporary models of the time that suggested attention, and not hyperactivity,

served as the core feature of the disorder. That is, hyperactivity was not considered an essential diagnostic criterion and the disorder was conceptualized as having two subtypes (i.e., ADHD with or without hyperactivity). ADHD with hyperactivity (ADHD/H) required symptoms of inattention, hyperactivity, and impulsivity, whereas, ADHD without hyperactivity (ADHD/WO) required symptoms of inattention and impulsivity (American Psychiatric Association, 1968). The DSM-III also introduced a symptom cutoff score and guidelines for age of onset and symptom duration.

Research into differences between ADHD subtypes boomed following their introduction in the DSM-III, such that children with ADD without hyperactivity, relative to children with hyperactivity, were found to have a *sluggish cognitive tempo* (Hynd, Lorys, Semrud-Clikeman, Nieves, Huettner, & Lahey, 1991; Lahey, Shaughency, Hynd, Carlson, & Nieves, 1987). Moreover, children with ADHD with hyperactivity were more impulsive (Lahey et al., 1987), exhibited more externalizing and internalizing symptoms (Barkley, DuPaul, & McMurray, 1990), engaged in more substance abuse (Barkley, DuPaul, & McMurray, 1990), and exhibited more aggression (Barkley, DuPaul, & McMurray, 1990; Lahey et al., 1987).

The DSM-III-R again revised the diagnostic moniker by removing subtypes and introducing "Attention deficit-Hyperactivity Disorder (ADHD)" and "undifferentiated ADD (American Psychiatric Association, 1987)." ADHD required any 8 of the 14 symptoms of inattention/hyperactivity/impulsivity instead of having a symptom cut-off for each symptom domain. This approach was consistent with the DSM-III-R's polythetic approach to other disorders. Additionally, symptoms were required to be present for at least 6 months with an onset before the age of seven, and a mild-to-severe range was

added. “Undifferentiated ADD” did not require hyperactivity or impulsivity, and was assigned as a diagnosis to characterize inattention not otherwise accounted for by another disorder.

Introduction of the DSM-IV in 1994 brought with it a return to the attention-deficit/hyperactivity disorder (ADHD) nomenclature and included three subtypes: inattentive, hyperactive-impulsive, and combined (American Psychiatric Association, 1994). This change was based on research that provided evidence of meaningful differences between children with ADHD with hyperactivity and children with ADHD without hyperactivity, such that hyperactive children were more impulsive (Cantwell and Baker, 1992; Hynd et al., 1991; Lahey et al., 1984, 1987), less anxious (Lahey et al., 1984, 1987), and had more social problems (Barkley et al., 1990; Cantwell and Baker, 1992; Hynd et al., 1991; Lahey et al., 1984).

The DSM-5 is the most recent iteration of the diagnostic manual and classifies three presentations of the disorder, including ADHD Combined Presentation (ADHD-C), ADHD Predominantly Inattentive Presentation (ADHD-I), and ADHD Predominantly Hyperactive/Impulsive Presentation (ADHD-H; APA, 2013). The change from “subtypes” to “presentations” reflects research findings that suggest the presentation of symptoms often changes through the course of development (Hurtig et al., 2007). For example, while symptoms of inattention remain relatively stable, symptoms of hyperactivity tend to decrease with age (Alderson, Kasper, Hudec, & Patros, 2013; Biederman et al., 2000; Dopfner, Hautmann, Gortz-Dorten, Klassen, Ravens-Sieberer, & the BELLA study group, 2015; Hart et al., 1995; Larsson, Lichtenstein, & Larsson, 2006). These findings also led to a revised age of onset requirement from age 7 years to

age 12 years, age-appropriate examples of symptoms, and the inclusion of occupational difficulties as an area of impairment (APA, 2013). Notably, although ADHD was classified as a Disruptive Behavior Disorder in previous editions of the DSM, the DSM-5 re-classified ADHD as a Neurodevelopmental Disorder following a wealth of findings in children and adults that suggest reliably moderate to large deficits of working memory (Alderson et al., 2010; Kasper et al., 2012; Kofler et al., 2011; Rapport et al., 2008; Rapport et al., 2009), inhibition (Nigg et al., 2002; Schachar et al., 2007; Scheres et al., 2004; Wodka et al., 2007), and self-control (Barkley & Murphy, 2011; Schweitzer et al., 1995) that underlie core inattention (Brocki & Bohlin, 2006; Kofler et al., 2010; Nigg et al., 2002; Nigg et al., 2005), hyperactivity (Klimkeit et al., 2005; Rapport et al., 2009; Rapport et al., 2001), and impulsivity (Rapport et al., 2001; Sarkis et al., 2005) symptoms, as well as tertiary symptoms such as academic underachievement (Hale et al., 2011; Rogers et al., 2011), emotion dysregulation (Sarkis et al., 2005; Sjowall et al., 2013), and social skills difficulties (Huang-Pollack et al., 2009; Kofler et al., 2011).

Associated Negative Outcomes of ADHD

ADHD is related to negative outcomes in many areas, which may in turn lower self-esteem. Academic underachievement serves as one of the most common reasons for referral (Loe & Feldman, 2007). To that end, ADHD negatively impacts both academic achievement (i.e., the skills and information learned as measured by standardized academic achievement tests) and academic performance (i.e., school success; Arnold et al., 2020; Zendarski, Sciberra, Mensah, & Hiscock, 2017), and persists even when controlling for differences in IQ (Arnold et al., 2020). Inattentive symptoms are more strongly associated with academic underachievement than hyperactive symptoms

(Polderman, Boomsma, Bartels, Verehulst, & Huizingk, 2010); albeit, disruptive hyperactive symptoms are more likely to result in undesirable disciplinary actions (Barkley et al., 1990). ADHD is associated with more suspensions and expulsions (Achilles, McLaughlin, & Croninger, 2007), lower high school graduation rates (Fried, Petty, Faraone, Hyder, Day, Biederman, 2016), lower college GPAs (Advokat, Lane, & Luo, 2011; Gormley, DuPaul, Weyandt, & Anastopoulos, 2019), and lower college graduation rates (Wolf, 2001).

In addition to academic difficulties, children with ADHD often exhibit impairment in many areas of social functioning, including difficulties in interactions with peers and increased social isolation and peer rejection (de Boo and Prins, 2007). Children with ADHD are often rated by teachers and peers as having worse overall social skills and being more disruptive, being less cooperative, and being less popular than typically developing (TD) children (Bagwell et al., 2001; Flicek, 1992). It is noted that social problems in children with ADHD appear to be related to a deficit in social performance rather than a social skills deficit, meaning that children with ADHD are often aware of how they should behave socially, but nevertheless experience problems behaving in a socially appropriate manner (Aduen et al., 2018; de Boo and Prins, 2007; Huang-Pollock et al., 2009; Kofler, Rapport, Bolden, Sarver, Raiker, & Alderson, 2011). This is further supported by findings that children with ADHD are able to express appropriate social behavior when reminded (Merrrell & Boelter, 2001), and social interactions are often improved with psychostimulant treatment in lieu of social skills training (de Boo & Prins, 2007).

ADHD-related social difficulties appear to be associated with deficits in the central executive component of working memory (Kofler et al., 2011). Specifically, Kofler and colleagues suggest that ADHD-related impairments in the ability to temporarily store and efficiently process information in a social context leads affected children to act and speak quickly before forgetting what they want to do or say, rather than listening to others. Additionally, deficits in the phonological component of working memory increase the likelihood of irrelevant thoughts interfering with accurate encoding, processing, and/or maintenance of verbal information, while deficits in the visuospatial component of working memory lead children with ADHD to less frequently orient towards others during social interactions.

Interestingly, specific symptoms of ADHD that contribute to social impairments vary ontologically, such that "being on the go" and "not listening" is most problematic in early childhood, while "not following through with directions" and "interrupting others" is the predominant contributor in adolescence (Zoromski, Owens, Evans, and Brady, 2015). Safren, Sprich, Cooper-Vince, Knouse, & Lerner (2009) found that adults with ADHD experience their greatest impairments in occupational and interpersonal contexts. In particular, university students with more ADHD symptoms experience greater relationship stress and used more maladaptive coping strategies in their relationships. Furthermore, marriages in which one spouse has ADHD tend to have higher rates of divorce (Murphy & Barkley, 1996). Spouses of adults with ADHD report that behaviors having to do with communication, task completion/time management, and self-regulation of affect most negatively impact their marriage (Robin & Payson, 2002). Not surprisingly, of the 25 categories of romantic strategies examined, the strongest

correlation with ADHD symptoms was “emotional expression and reaction”, a subscale consisting of items that reflect telling oneself how stupid one is, feeling like a failure, and feeling depressed, tense, and anxious (Overbey, Snell, & Callis, 2011).

In addition to the impact of ADHD on social relationships, individuals with ADHD also experience more difficulty with “adaptive functioning” or the skills needed to deal with the demands of life in home and school settings. Controlling for IQ and symptoms of conduct disorder and oppositional defiant disorder, children with ADHD often score in the low-average to borderline range for adaptive functioning (self-help skills, independence, self-knowledge, motor skills, social knowledge, and language/communication skills; Stein et al., 1995), while longitudinal studies have found that children with ADHD show impairment in several “major life activities” and have worse job performance (Barkley, Murphy, & Fischer, 2008). Adults with ADHD report worse performance at work and are fired significantly more often than those without ADHD (Shifrin, Proctor, & Prevatt, 2010). Additionally, young adults with ADHD depend more financially on their family and the welfare system, and can expect to earn between $543,000 and $616,000 less over their lifetime compared to adults without ADHD (Altszuler et al., 2016).

Collectively, it is not surprising that, given the numerous social (de Boo and Prins, 2007; Huang-Pollock et al., 2009), family (Ghanizadeh & Shams, 2007; Kendall et al., 2005), romantic (Eakin et al., 2004; Murphy & Barkley, 1996; Overbey, Snell, & Callis, 2011), academic (Loe & Feldman, 2007; Scholtens, Rydell, & Yang-Wallentin, 2013), and occupational (Barkley & Murphy, 2011; Safren et al., 2009) difficulties that children, adolescents, and adults with ADHD experience, diagnosis of ADHD also

conveys increased risk for low self-esteem relative to peers (Edbom, Lichtenstein, Granlund, & Larsson, 2006). Notably, extant literature suggests that low self-esteem is a strong predictor of depression (Lee & Hankin, 2009; Sowislo & Orth, 2013; Steiger et al., 2014), anxiety (Guo et al., 2018; Lee & Hankin, 2009; Sowislo & Orth, 2013;), externalizing problems (Donnellan et al., 2005; Trzesniewski et al., 2006), and health problems (Trzesniewski et al., 2006; McGee & Williams, 2000).

Theories and Models of Self-Esteem

Domain Importance Models

The early, highly influential Jamesian theory of self-esteem (1890) suggests that culture and circumstances result in the development of different domains of "self", or areas of interest (e.g., body, family, occupation), and individuals learn to prioritize some of these "selves" over others. Concurrently, individuals develop an overall evaluation of how well they meet expectations of these various aspects of self. The theory suggests that self-esteem varies based on successes and failures related to mastering these domains. Relatively recent findings from structural equation modeling (SEM), path analyses, and latent interaction analyses provide support for the Jamesian theory, such that perceiving oneself as having low competence in a domain that is highly valued/important is related to lower global self-esteem (Lindwall, Asci, Palmeira, Fox, & Hagger, 2011). In contrast, Marsh (1995) argues that differential importance placed on one ability/characteristic (e.g., intellectual/academic ability, social skills/social competence, physical attractiveness) may only influence self-esteem related to a few specific traits or subgroups, and not global self-esteem. Moreover, differential importance placed on one ability/characteristic relative to other abilities/characteristics, appears to be only related to

global self-esteem for people with negative self-views (Pelham & Swann, 1989; Pelham, 1995). Differential importance is also more strongly related to self-esteem for people who are highly certain of their self-views.

More recently, Hardy and Moriarty (2006) proposed a model that uses idiographic approach to analyze the Jamesian theory of self-esteem by having participants rank order the importance of the self-esteem domains. The three most important and three least important domains both explained significant variance in self-esteem. Marsh (2008) argued against the claims of Hardy and Moriarty (2006) and found that the idiographic approach did not perform better than the nomothetic approach. Given these findings, the importance placed on specific domains of self-esteem (e.g., academic, social) may influence levels of self-esteem in children with ADHD. Furthermore, latent-variable analysis failed to support the Jamesian model and instead support the Marsh's (2008) group importance-weighted approach (Scalas et al., 2008). This nomothetic approach proposes that some self-esteem domains affect global self-esteem more than other self-esteem domains for the population as a whole. Although the Jamesian model was seminal in its explication of self-esteem, it is relatively outdated and infrequently cited in recent research.

Social learning theories

Rosenburg (1965) and Coopersmith (1967) explained self-esteem in context of social learning. Specifically, they suggest that social and cultural factors create an overall attitude towards oneself, or self-esteem. Self-esteem develops through a process of comparing one's true self to their ideal self, and an individual is biased towards having a positive attitude towards oneself. The Rosenburg Self-Esteem Scale (RSES; Rosenburg,

1965) was originally designed to measure one overall attitude towards the self. However, factor analysis found that it actually captures two facets of self-esteem, self-competence and self-liking (Tafarodi & Milne, 2002). Additionally, these facets have been found to vary by the individualism/collectivism of the culture (Schmitt & Allik, 2005), as well as demographic characteristics such as sex, age, employment status, and marital status (Sinclair, Blais, Gansler, Sandberg, Bistis, & LoCicero, 2010). More recently, Marsh and colleagues (2010) proposed a bifactor structure of the RSES that included a general factor ("global self-esteem") and two grouping factors ("positive self-esteem" and "negative self-esteem") and was supported by longitudinal data. Findings from subsequent structural equation modelling provide evidence that the bifactor structure of the RSES has the best fit (Alessandri et al., 2015; Hyland et al., 2014).

In contrast to Rosenburg who emphasized the attitudinal aspect of self-esteem, Coopersmith defined self-esteem as having evaluative and attitudinal components, meaning that it consists of a cognitive evaluation of competence and an affective attitude of self-worth (1981). This definition was meant to aid in the measurement and enhancement of self-esteem by serving as a framework that would be beneficial for therapeutic intervention. To that end, Coopersmith (1967) developed the Self-Esteem Inventory (SEI) that was originally meant to be interpreted as a global measure of self-esteem. Subsequent factor analysis, however, indicated that the measure is heterogeneous and social, academic, family, and personal contexts should be viewed separately (Ahmed, Valliiant, & Swindle, 1985; Hills, Francis, & Jennings, 2011; Potard, Amoura, Kubiszewski, Le Samedy, Moltrecht, & Courtois, 2015; Roberson & Miller, 1986). Many studies of self-esteem continue to reference Rosenburg's (1965) model (Dan & Raz,

2015; Henriksen et al., 2017; Kong et al., 2013; Sinclair et al., 2010) and Coopersmith's (1967) model (Capelatto et al., 2014; Hills et al., 2011; Potard et al., 2015; Rentch et al., 2016).

Hierarchical Theories

According to Dominance Theory, the human drive to increase self-esteem is based on the same needs that drive non-human animals (Barkow, 1980). That is, most non-human animal societies are arranged hierarchically through behavioral patterns of dominance and submission, in ways that determine who gets priority access to mates and resources (Packer & Pusey, 1979). Along with aggression, movement along the hierarchy is determined based on characteristics such as ability and personality (Hurd, 2006). The human ability to self-evaluate leads individuals to evaluate themselves as better than others (Anderson et al., 2015). Similar to the Dominance Theory, the Hierometer Theory argues that self-esteem is contingent on social status. However, it proposes that continually striving for higher social status is not usually adaptive because doing so could result in failure (Mahadevan et al., 2016).

Findings from several studies suggest that social status indeed predicts self-esteem, even after controlling for social inclusion (Huo et al., 2010; Mahadevan et al., 2016), as well as self-perceived social support and peer rated likability (Fournier, 2009). More recently, Mahadevan and colleagues (2020) found evidence that changes in social status are related to changes in self-esteem, providing support for the Hierometer Theory. Both the Dominance Theory (Barkow, 1980) and the Hierometer Theory (Mahadeevan et al., 2016) have fallen out of favor in studies of self-esteem, albeit the Hierometer Theory

has garnered some attention in contemporary studies (Mahadevan et al., 2020; Steinmetz et al., 2017).

Cognitive Experiential Self-Theory

Cognitive Experiential Self-Theory proposes that information about the world and ourselves is organized into "personal theories of reality," including a "self-theory" or understanding of who one is in relation to others (Epstein, 1980). According to this theory, there are two types of self-esteem, explicit self-esteem which is conscious and cognitive, and implicit self-esteem which is unconscious and affective. Self-esteem is defined as a basic human need to be "loveworthy" and is an essential motivation of behavior. Anxiety is described as a result of one's self-esteem being threatened and serves as motivation to maintain one's self-esteem. Additionally, self-esteem is composed of three levels: basic self-esteem which is most stable, intermediate self-esteem which differs depending on the domain, and upper self-esteem which varies depending on the situation but does not usually affect the other two levels. The Multidimensional Self-Esteem Inventory (MSEI; O'Brien & Epstein, 1988) was developed in order to better capture this hierarchical structure of self-esteem. Based on this theory, Kernis (2005) found that individuals with conflicting explicit and implicit self-esteem promote themselves and rate out-group members more negatively than individuals with corresponding explicit and implicit self-esteem. Furthermore, individuals with stable high self-esteem are less verbally defensive than individuals with unstable self-esteem and individuals with low self-esteem (Kernis et al., 2008). This model is seldomly referenced in recent research.

Terror Management Theory

Terror Management Theory attempts to explicate the role of self-esteem as a basic human need. According to this theory, self-esteem, along with a cultural worldview or shared set of morals, protects against fear of death (Greenburg, Psyzczynski, & Solomon, 1986). Self-esteem is described as being one's perception of how well they are meeting the standards set by their worldview. This theory argues that self-esteem has evolved to reduce anxiety about death by encouraging individuals to live within communities that share morals. Indeed, Harmon-Jones, Simon, Greenberg, Pyszczynski, Solomon, and Mcgregor (1997) found evidence that high self-esteem protects against mortality-related anxiety. Moreover, findings suggest that when self-esteem is high, individuals feel less anxious and are more likely to explore motives that create a more meaningful life, such as creativity and exploration (Arndt, Routledge, Greenberg, & Sheldon, 2005; Routledge, Arndt, Vess, & Sheldon, 2008). Furthermore, thinking about death appears to be related to increased defensiveness of one's worldview for those with low implicit self-esteem but not for those with high implicit self-esteem (Schmeichel et al., 2009). Additionally, thinking about death appears to be related to increased report of one's positive personality traits only for those with high explicit and low implicit self-esteem (Schmeichel et al., 2009). A meta-analysis of Terror Management Theory research found moderate effects (r = .35) for the relationship between thinking about death and self-esteem (Burke et al., 2010). More recently, Bergman & Bodner (2020) found that age-awareness is related to decreased self-esteem. Unlike previously discussed models/theories, the terror management theory is well-referenced in contemporary research (Bergman & Bodner, 2020; Guan et al., 2015; Helm et al., 2018); however, it is not often cited in studies of ADHD and self-esteem.

Two-factor Theory

Baumeister's theory proposes that self-esteem is affected by the motives of self-consistency (i.e., seeking information that confirms previously held believes) and self-enhancement (i.e., seeking information that improves one's self-image; Baumeister, 1993). Individuals with low self-esteem tend towards the self-consistency motive and prefer negative information that aligns with their negative self-perceptions. Individuals with high self-esteem, in contrast, tend towards the self-enhancement motive and prefer information that boosts their self-perceptions. Evidence for the self-enhancement component of the theory is provided by findings that individuals with low self-esteem uniquely tend to disparage a friend who had slighted them (Nail et al., 2004). More recently, a review found evidence that on average, the self-consistency motive has a significant small effect on cognition (r = .25), and on average, the self-enhancement motive has a significant small effect on affect (r = .10; Kwang & Swann, 2010). Baumeister's theory is a leading theory in the field and is often cited in recent research (Henriksen et al., 2017; Kwang & Swann, 2010; Rentch et al., 2016; Sowislo & Orth, 2013).

Self-Determination Theory

Ryan, Kuhl, and Deci (1997) proposed that humans have evolved an innate need for competence, relatedness, and autonomy, which serve to promote the well-being of the individual and of the society. Indeed, findings suggest that the pursuit of intrinsic goals that directly align with these needs (e.g., affiliation, personal growth, and community) is positively related to high self-esteem. Additionally, findings suggest that the pursuit of extrinsic goals that do not directly align with competence, relatedness, and autonomy

(e.g., wealth, fame, and image) are negatively related to high self-esteem (Kasser & Ryan, 1993; Kasser & Ryan, 1996; Ryan, Chirkov, Little, Sheldon, Timoshina, & Deci, 1999). More recently, findings that satisfaction of the needs for competence, autonomy, and relatedness are related to well-being in children and adolescents (Veronneau et al., 2005). Furthermore, a study of college students from eight countries found that the relationship between satisfaction of the three needs and well-being was similar for all cultures (Church et al., 2013). Self-determination theory is rarely cited in studies of ADHD and self-esteem.

Cognitive-Behavioral Model

Fennell's (1997) model of self-esteem suggests that individuals develop a schema about themselves based upon past experiences (e.g., "I'm worthless"), which in turn influences how they interpret new incoming information. When the view of oneself is negative, rules are developed to hide this view from others (e.g., "I must always succeed or else others will see that I am worthless"). When a rule is broken, the negative schema is activated and the individual tries to predict potential negative outcomes. This process leads to anxiety and safety-seeking behaviors, and the focus on the negative schema increases self-criticism and worsened mood. Activation of the negative schema is more likely during episodes of dysthymic mood, and consequently, a cycle of low self-esteem may persist. Notably, Safren's (2006) ADHD model similarly proposes that symptoms of ADHD predict a history of failure, underachievement, and relationship problems which increase dysfunctional cognitions and beliefs. These beliefs produce a mood disturbance (including low self-esteem) that reduce the utilization of compensatory strategies and ultimately lead to functional impairment, which continues a cycle of failure,

underachievement, and relationship problems. Supporting Fennell's proposition that low self-esteem indirectly leads to anxiety and depressed mood, a systematic review found evidence that low self-esteem is related to clinically significant anxiety and depression in children and adolescents (Keane & Loades, 2017). Treatment studies examining the effect of CBT on self-esteem often cite this model (Keanne & Loades, 207; Kolubinski et al., 2018, Waite et al., 2012).

Sociometer Theory

The sociometer theory of self-esteem hypothesizes that humans have evolved an essential need to belong (Heatherton & Wylandand, 2003) and that variability in self-esteem is due to social acceptance and rejection (Leary & Baumeister, 2000; Leary & Downs, 1995). This theory argues that cooperating with others was essential to survival, and thus, humans developed a "sociometer" or ability to assess important social information, such as social status, social relationships, and cues for rejection or exclusion (Leary, 2004). The sociometer theory further argues that perceptions about how one is perceived by others are related to one's self-esteem (Reitz, Motti-Stefanidi, & Asendorpf, 2016; Thomaes, Reijntjes, de Castro, Poorthuis, Bushman, & Telch, 2010). Importantly, developmental history leads to individual variability in the resting state of the sociometer which causes some to have inaccurate or unstable perceptions of their social value or self-esteem (Leary, 2004). The social difficulties of children with ADHD, such as experiencing more social isolation and peer rejection (deBoo & Prins, 2007) may, in some cases, lower the resting state of their self-esteem, which then leads to negative outcomes. For example, low self-esteem has been found to partially mediate the relationships between social isolation and alienation associated with depression and

social anxiety (Bosacki, Dane, Marini, & YLC-CURA, 2007). Sociometer theory is a prominent theory in the field and is often cited by contemporary research (Donnellan et al., 2012; Henriksen et al., 2017; Mahadevan et al., 2016; Reitz et al., 2016; von Soest et al., 2016).

Identity theory

Cast and Burke (2002) proposed that one's sense of self is made up of multiple identities expressing the different social roles one holds within society. When an individual's social situation matches their identity, self-esteem is increased. Additionally, self-esteem acts as a defense mechanism to protect against distress that results when an individual's social situation does not match their identity. Therefore, it is argued that people seek to increase self-esteem by creating or seeking situations where their identities will be confirmed and avoid situations where identities might be threatened. Cast and Burke suggest that confirming identity increases competence and doing so increases self-worth. In support of this theory, individuals who have a self-perception that is discrepant from others' perceptions have significantly lower efficacy-based and worth-based self-esteem (Burke & Stets, 2009; Cast & Burke, 2002; Stets & Cast, 2007). Additionally, Cast and Burke (2002) found that efficacy is a more powerful buffer against the negative effects of failing to confirm one's identity and that low efficacy-based self-esteem, but not low worth-based self-esteem, motivates people to leave relationships. This theory is sometimes cited in recent research (Kwang & Swann, 2010, Stets & Burke, 2014), but is not often cited in studies of ADHD and self-esteem.

Two-dimensional Model

Tafarodi and Milne (2002) proposed that global self-esteem is made up of two dimensions, self-competence and self-liking. They argue that the diversity of self-esteem definitions throughout the literature is caused by a lack of recognition of these dimensions. Tafarodi and Milne's (2002) factor analytic study of the RSES provides support that the traditionally conceptualized unidimensional measure has better fit as a two-factor model with self-competence and self-liking as factors. Tafarodi and Milne (2001) developed a scale based upon this model, The Self-Liking/Self-Competence Scale (SLSC) that was ultimately supported with confirmatory factor analyses (Carraro et al., 2013; Dogan, 2011).

Similarly, Mruk (2006) proposed that self-esteem is comprised of competence, worthiness, and the relationship between the two. Specifically, individuals with high levels of competence and worthiness have high self-esteem, while individuals with low levels of competence and worthiness have low self-esteem. Further, individuals with high levels of competence and low levels of worthiness have competence-based self-esteem, while individuals with high levels of worthiness and low levels of competence have worthiness-based self-esteem. Collectively, Mruk's model suggests two-dimensions of self-esteem rather than one unitary construct. Individuals who have high worthiness and low competence often compensate for their low competence through various methods of minimizing failures and believing that high self-esteem is justified without competence. Those with high competence and low worthiness often compensate for low sense of worth by devoting themselves to increasing competence in areas that are important while avoiding experiencing the feelings of low self-worth. A study based on Mruk's model found that both worthiness-based self-esteem and competence-based self-esteem

predicted higher levels of authenticity and narcissism and lower levels of depression (Kapikiran et al., 2019). Tafarodi and Milne's (2001) model (Alessandri et al., 2015; Geng & Jiang, 2013; Urban et al., 2014) and Mruk's (2006) model are often cited in general self-esteem literature but are not often referenced in studies of ADHD and self-esteem (Mulyadi et al., 2016; Palacios et al., 2015; Sternke, 2010).

Developmental Model of Self-Esteem

Harter theorized that both competence and social approval were important factors in the formation of self-esteem (1999). An important focus of this theory is how self-esteem typically develops across the lifespan and how the developmental process varies greatly between individuals. Three different typical trajectories of self-esteem from adolescence to young adulthood have been found in a normative sample: consistently high, chronically low, and decreasing from age 14-18 then increasing from age 18-23 (Birkeland, Melkevik, Holsen, & Wold, 2012). Harter's (1999) theory suggests that the development of specific domain-level self-esteem occurs throughout the lifespan, but global self-esteem does not develop until cognitive capacities mature enough to be able to make an overall evaluation of oneself across domains of life. It also proposes that the development of self-esteem is bidirectional, meaning that experiences in different domains of life and relationships influence self-esteem, and self-esteem influences experiences in domains of life and relationships. This approach to describing self-esteem also argues that self-esteem is a common mediator and/or moderator between psychopathology and outcomes/treatment response (Shirk, Burwell, & Harter, 2003). To that end, self-esteem has been found to mediate and moderate the relationship between loneliness and life satisfaction (Civitci & Civitci, 2009), and between social support and

subjective well-being (Kong, Zhao, & You, 2013). Harter's (1999) model is well-known and is often cited by recent research (Dvorsky et al., 2019; Kita & Inoue, 2017; Schuck et al., 2018).

Evidence of Low Self-Esteem in ADHD

Examinations of self-esteem began in the mid-1960s and expanded to studies of self-esteem in children with ADHD in the 1970s. Whaley-Khlan & Loney (1977) reported correlations between self-esteem deficits in hyperactive children and severity of negative affect, aggression, and impulsivity. Continued research over the next two decades provided reliable evidence of relatively low self-esteem in individuals with ADHD (Chapman, 1988; Dooling-Litfin & Rosen, 1997; Hechtman & Weiss, 1986; Lahey, Schaughency, Strauss, & Frame, 1984), and the late 1990s and 2000s saw an increase in studies examining predictors and outcomes of low self-esteem in ADHD. Diener and Milich (1997), for example, found that boys with ADHD often experience inflated self-esteem about social interactions, but their self-esteem decreases after receiving positive feedback, suggesting that inflated self-esteem serves a protective function when no feedback is provided. More recently, a growing body of extant studies have provided reliable evidence that the self-esteem of children (Barber, Grubbs, & Cotrell, 2005; Kurman, Rothschild-Yakar, Angel, & Katz, 2018; Mazzone et al., 2013), adolescents (Dvorsky, Langberg, Becker, & Evans, 2019; Kita & Inoue, 2017; Klassen, Miller, & Fine, 2004), and adults (Dan & Raz, 2015; Newark, Elsasser, & Stieglitz, 2012) with ADHD is diminished compared to healthy controls.

Given the ubiquitous nature of ADHD symptoms that pervade nearly every aspect of life for those diagnosed with the disorder, it is not surprising that risk factors for

diminished self-esteem are relatively broad. For example, several existing models, including the cognitive behavioral model (Safren, Sprich, Chulvick, & Otto, 2004), the competency-based model (Cole, 1990), and the interpersonal model (Ybrandt, 2008), theorize that academic failure may be part of the causal pathway between ADHD and low self-esteem. The cognitive behavioral model (Safren, Sprich, Chulvick, & Otto, 2004) in particular theorizes that internalizing symptoms develop from negative thought patterns and self-perceptions caused by the experience of multiple failures in specific tasks, such as completing homework.

In support of these models, ADHD symptoms in 6th grade have been linked to later academic difficulties in the 6th, 11th, and 12th grades, and ADHD symptoms in 11th grade have been related to academic difficulties, lower academic self-esteem, and lower expectations for the future in 12th grade (Scholtens, Rydell, & Yang-Wallentin, 2013). Self-esteem has been found to partially mediate the relationship between ADHD and difficulty thinking before and during a test and to fully mediate the relationship between ADHD and concerns about social denigration (Dan & Raz, 2015). Children with ADHD regularly exhibit academic underachievement (Loe & Feldman, 2007) as well as poorer "adaptive functioning" skills related to tasks of daily living (Barkley, 2006; Stein et al., 1995). To that end, longitudinal research has found that negative self-esteem significantly mediates the relationship between GPA and overall functional impairment in college students with ADHD (Eddy et al., 2018). Similarly, the competency-based model (Cole, 1990) and the interpersonal model (Ybrandt, 2008) both theorize that the experience of failure and negative evaluations from others lead to low self-esteem. Support for these models' application to individuals with ADHD is provided by research

that suggests negative self-perceptions of social competence mediates the indirect relationship between ADHD and depression (Ostrander, Crystal, & August, 2006).

Poorer social performance in individuals with ADHD (de Boo and Prins, 2007; Huang-Pollock et al., 2009) may also predict low self-esteem. Children and adults with ADHD often show impairment in their abilities to attend to socially relevant information (Marotta, Casagrande, Rosa, Maccari, Berloco, & Pasini, 2014), to accurately recognize emotion in others (Kats-Gold & Priel, 2009), and to change their behavior to match the dynamics of a social group (Waschbusch et al., 2007). It is therefore not surprising that children with ADHD are more often disliked (Diamantopoulou, Henricsson, & Rydell, 2005; Hoza et al., 2005) and rejected by peers (Gagliano et al., 2014; Grygiel, Humenny, Rebisz, Bajcar, & Switaj, 2018; Lopez-Williams et al., 2005), are less satisfied with their social position within peer groups (Grygiel et al., 2018), and have fewer close friendships (Hoza et al., 2005). This reduced social acceptance is expected to lead children with ADHD to have lower self-esteem, as previous findings indicate perceived social acceptance is significantly correlated with self-esteem (Vanhalst, Luyckx, Scholte, Engels, & Goossens, 2013).

The relationship between ADHD and self-esteem is not homogenous, however, as extant examinations of sex differences in ADHD-related self-esteem, for example, suggest that girls with ADHD experience lower self-esteem relative to their male counterparts and healthy controls (Ek, Westerlund, Holmberg, & Fernell, 2008; Rucklidge & Tannock, 2001; Zalecki & Hinshaw, 2004). More recently, findings have suggested that relational victimization is related to lower self-esteem in adolescent males

with ADHD, but not in adolescent females with the disorder (Becker, Mehari, Langberg & Evans, 2017).

Additionally, heterogeneity appears to be related to a positive illusory bias often observed in children and adolescents with ADHD (Gresham, MacMillan, Bocian, Ward, & Forness, 1998; Hoza, Pelham, Milich, Pillow, & McBride, 1993; Ohan & Johnston, 2011; Wiener et al., 2012). The positive illusory bias is when an individual assesses their own competence as higher than their competence according to an objective measure (Hoza et al., 2002). This overestimation of competence may prevent children with ADHD from recognizing the need for improvement (Milich & Okazaki, 1991). Moderate levels of this effect are typical of the general population (Cummins & Nistico, 2002), however, this effect is much stronger in children with ADHD (Hoza et al., 2004). Additionally, the positive illusory bias is associated with greater well-being, higher social status, higher quality interactions with peers in the general population (Humberg et al., 2019), and some short-term benefits in children with ADHD, such as bolstering their global self-esteem (Ohan & Johnston, 2011) and protecting against depression (Mikami, Calhoun, & Abikoff, 2010). According to the self-protective hypothesis, positive illusory bias functions in children with ADHD to protect their self-esteem (Diener & Milich, 1997). This hypothesis has been supported by Hoza and colleagues (2004, 2002) who found that children with ADHD have the greatest overestimates in competency in the areas where they have the most deficit and by Evangelista and colleagues (2008) who found that although children with ADHD overestimate their own competency, they do not overestimate the competency of others. However, the positive illusory bias is associated with negative long-term consequences in children with ADHD, such as interference with

motivation for treatment (Hoza & Pelham, 1995), which lead to long-term poorer outcomes in the areas of social preference of peers, and friendship (Mikami, Calhoun, & Abikoff, 2010), prosocial behavior (Linea, Hoza, Tomb, & Kaiser, 2012), and behavioral problems (Hoza, Murray-Close, Arnold, Hinshaw, & Hechtman, 2010; Mikami, Calhoun, & Abikoff, 2010).

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TABLES AND FIGURES

Table 1

Global Self- Esteem

Study	ES ID	Outcome	Dx Comp.	SE Inform.	SE Dim.	Com. Ext.	Com Int.	Age *M*	% Female	ADHD *n*	TD *n*	Hedges' *g*	95 % CI
Barber et al., 2005	1	SPPC	0	0	1	1	1	9.47	100	38	39	0.5	(0.06, 0.95)
Capelatto et al., 2014	2	EMAE	0	0	1	1	1	9.92	12	17	17	1.06	(0.36, 1.77)
Capelatto et al., 2014	4	EAC-IJ	0	0	1	0	0	9.92	12	17	17	0.51	(-0.17, 1.19)
Capodieci et al., 2018	7	ICS	1	0	1	0	0	9.73	.	21	21	-0.32	(-0.92, 0.27)
Capodieci et al., 2020	11	ICS	1	1	1	1	1	9.73	38.1	21	21	0.59	(-0.03, 1.21)
Craparo et al., 2015	15	SIE	0	0	0	1	1	13.56	0	87	80	0.41	(0.11, 0.72)
DeWolfe et al., 2000	16	PSPCSA	1	0	0	0	1	4.84	16	25	25	-0.04	(-0.59, 0.50)
DeWolfe et al., 2000	17	PSPCSA	1	0	0	0	1	4.84	5.88	25	25	-0.33	(-0.88, 0.22)
Elkins et al., 2011	18	PHSCS	0	0	1	1	1	11.9	100	58	406	0.86	(0.58, 1.14)
Elkins et al., 2011	19	PHSCS	0	0	1	1	1	11.9	0	25	406	0.66	(0.25, 1.06)
Elkins et al., 2011	20	PHSCS	0	0	1	1	1	11.9	100	26	406	0.6	(0.20, 1.00)
Elkins et al., 2011	21	PHSCS	0	0	1	1	1	11.9	37.5	62	324	0.56	(0.28, 0.83)
Elkins et al., 2011	22	PHSCS	0	0	1	1	1	11.9	11.2	34	324	-0.08	(-0.43, 0.28)
Elkins et al., 2011	23	PHSCS	0	0	1	1	1	11.9	0	48	324	0.78	(0.47, 1.10)
Escobar et al., 2005	24	CHQ	1	1	0	1	1	9.15	21.7	120	120	1.08	(0.81, 1.35)

Gagliano et al., 2014	25	MSCS	0	0	1	1	1	10.14	100	22	23	0.63	(0.04, 1.22)
Graetz et al., 2001	29	CHQ PF50	0	1	0	1	1	11	18	133	3298	1.01	(0.83, 1.18)
Graetz et al., 2001	30	CHQ PF50	0	1	0	1	1	9.4	18	68	3298	0.41	(0.17, 0.65)
Graetz et al., 2001	31	CHQ PF50	0	1	0	1	1	10	31.7	67	3298	0.94	(0.70, 1.18)
Greatz et al., 2005	32	CHQ PF50	0	1	0	1	1	9.7	0	108	976	0.71	(0.51, 0.91)
Greatz et al., 2005	33	CHQ PF50	0	1	0	1	1	9.1	100	52	1075	1.14	(0.86, 1.42)
Greatz et al., 2005	34	CHQ PF50	0	1	0	1	1	8.1	0	41	976	0.4	(0.09, 0.71)
Greatz et al., 2005	35	CHQ PF50	0	1	0	1	1	7.7	100	21	1075	0.14	(-0.29, 0.57)
Greatz et al., 2005	36	CHQ PF50	0	1	0	1	1	9.2	0	76	976	0.93	(0.69, 1.17)
Greatz et al., 2005	37	CHQ PF50	0	1	0	1	1	8.9	100	26	1075	0.64	(0.25, 1.03)
Grskovik & Zentall, 2010	38	PHSCS	1	0	1	1	1	12.7	36.8	20	63	0.56	(0.05, 1.06)
Haas et al., 2015	42	SPPC	0	0	1	1	1	9.7	0	39	17	1.37	(0.75, 1.99)
Haas et al., 2015	46	SPPC	0	0	1	1	1	9.7	27.59	15	17	2.56	(1.64, 3.48)
Healey & Rucklidge, 2006	50	RSES	1	0	0	1	1	11.27	37	29	30	-0.3	(-0.80, 0.21)
Healey & Rucklidge, 2006	51	RSES	1	0	0	0	0	11.15	31.2	16	30	-0.08	(-0.69, 0.53)
Hoza et al., 2002	52	SPPC	1	0	1	1	1	9.83	31.7	32	73	0.11	(-0.30, 0.52)
Hoza et al., 2002	53	SPPC	1	0	1	1	1	9.83	100	160	73	0.1	(-0.17, 0.38)
Jarrett et al., 2007	54	CDI	1	0	0	1	1	10.98	38.1	39	60	-0.05	(-0.38, 0.29)
Jarrett et al., 2007	55	CDI	0	0	0	1	1	10.63	17.4	78	60	-0.52	(-0.92, -0.11)

Jiang & Johnston, 2017	56	SPPC	1	0	1	1	1	10.22	0	42	55	0.17	(-0.23, 0.57)
Kurman et al., 2018	57	PHSCS	1	0	1	1	1	10.45	0	43	35	0.47	(0.02, 0.92)
Latimer et al., 2003	59	PHSCS	1	0	1	1	0	8.9	16	115	59	0.4	(0.08, 0.71)
Mazzone et al., 2013	60	TMA	1	0	1	1	1	10.03	26.32	85	26	1.16	(0.70, 1.63)
Ohan & Johnston, 2002	62	SPPC, CSDS	1	0	1	1	1	9.63	32.1	45	43	1.02	(0.58, 1.46)
Primack et al., 2012	63	4-point Likert	0	0	0	1	1	10.32	17.9	240	2269	0.14	(0.01, 0.28)
Rucklidge & Tannock, 1999	64	CDI	1	0	0	1	1	14.68	0	24	28	-0.51	(-1.06, 0.04)
Rucklidge & Tannock, 1999	65	CDI	1	0	0	1	1	14.8	0	35	20	-0.42	(-0.96, 0.13)
Stewart & Buggey, 1994	66	CSEI	0	0	1	1	1	9.5	31.6	10	26	0.56	(-0.17, 1.28)
Treuting & Hinshaw, 2001	69	PHSCS	1	0	1	1	1	9.6	0	53	87	0.35	(0.01, 0.70)
Treuting & Hinshaw, 2001	73	PHSCS	1	0	1	1	1	9.6	30	61	87	0.66	(0.33, 1.00)
Ucar et al., 2020	77	RSS	0	0	0	1	1	13.56	0	41	35	0.51	(0.06, 0.97)
Volz-Sidiropoulou et al., 2016	78	CCA	1	0	1	1	1	11.6	0	89	88	0.43	(0.13, 0.72)
Volz-Sidiropoulou et al., 2016	79	CCA	1	1	0	0	0	11.6	11.2	89	88	0.47	(-0.08, 1.02)

Note. ES = effect size, Dx Comp. = Diagnostic Complexity, SE Inform. = Self-esteem Informant, SE Dim. = Self-esteem Dimension, Com. Ext. = Comorbidity Externalizing, Com. Int. = Comorbidity Internalizing, SPPC (Self-Perception Profile for Children), EMAE (Multidimensional Scale of Self-Esteem), EAC-IJ (Self-Concept Scale for Children and Youth), ICS (Interpersonal Competence Scale), SIE (Self-Image Evaluation), PSPCSA (Pictorial Scale of Perceived Competence and Social Acceptance-Preschool version), PHSCS (Piers-Harris Self-Concept Scale), MSCS (Multidimensional Self-Concept Scale), CHQ (Child Health Questionnaire), CDI (Children's Depression Inventory), CSEI (Coopersmith Self-Esteem Inventory), TMA (Self-Esteem Multidimensional Test), CSDS (Children's Social Desirability Scale), RSS (Rosenberg Self-Esteem Scale), CCA (Competence Scale for Children and Adolescents)

Table 2. *Regression models and moderating variables for global self-esteem*

	Global Self-esteem	
	k	ADHD *n*
	48	2470
	$\hat{\beta}_1$	
DX complexity	-0.21	
SE informant	0.38	
Comorbidities externalizing	0.54	
Comorbidities internalizing	0.22	
Mean age	0.01	
% Female	0.00	
SE dimension	0.29	

Note. $\hat{\beta}_1$ = slope, $\hat{\beta}_0$ = intercept, $\hat{\mu}$ = the standardized mean difference (i.e., effect size), CI = 95% confidence interval of mean effect size over studies, $\hat{\sigma}^2_{estimate}$ = the estimated variance between effect size estimates, $\hat{\sigma}^2_{study}$ = the estimated variance between studies, QE = test for residual heterogeneity, *k* = number of effect sizes, *n* = number of participants, *df* = degrees of freedom, ADHD = Attention-Deficit/Hyperactivity Disorder, DX = diagnostic, SE = self-esteem, TD = typically developing control group,

$* p < 05$, $** p < .01$, $*** p < .001$

Table 3

Academic Self-Esteem

Study	ES ID	Outcome	Dx Comp.	SE Inform.	SE Dim.	Com. Ext.	Com. Int.	Age *M*	% Female	ADHD *n*	TD *n*	Hedges' *g*	95 % CI
Capelatto et al., 2014	5	EAC-IJ	0	0	1	1	1	9.92	12	17	17	0	(-0.66, 0.66)
Capodieci et al., 2018	8	ICS	1	0	1	0	0	9.73	38.1	21	21	-0.07	(-0.67, 0.52)
Capodieci et al., 2020	12	ICS	1	1	1	1	1	9.73	38.1	21	21	0.17	(-0.43, 0.78)
Gagliano et al., 2014	26	MSCS	0	0	1	1	1	10.14	0	22	23	0.84	(0.24, 1.44)
Grskovik & Zentall, 2010	39	PHSCS	1	0	1	1	1	12.7	100	20	63	0.43	(-0.07, 0.94)
Haas et al., 2015	43	SPPC	0	0	1	1	1	9.7	18	39	17	0.28	(-0.29, 0.84)
Haas et al., 2015	47	SPPC	0	0	1	1	1	9.8	20	15	17	0.18	(-0.50, 0.86)
Kurman et al., 2018	58	PHSCS	1	0	1	1	1	10.45	.	43	35	2.12	(1.57, 2.67)
Mazzone et al., 2013	61	TMA	1	0	1	1	1	10.03	5.88	85	26	0.97	(0.52, 1.43)
Stewart & Buggey, 1994	67	Coopersmith Self-Esteem Inventory	0	0	1	1	1	9.5	30	10	26	0.5	(-0.22, 1.22)

Treuting & Hinshaw, 2001	70	PHSCS	1	0	1	1	1	9.6	0	53	87	0.36	(0.01, 0.70)
Treuting & Hinshaw, 2001	74	PHSCS	1	0	1	1	1	9.6	0	61	87	0.7	(0.40, 1.04)

Note. ES = effect size, Dx Comp. = Diagnostic Complexity, SE Inform. = Self-esteem Informant, SE Dim. = Self-esteem Dimension, Com. Ext. = Comorbidity Externalizing, Com. Int. = Comorbidity Internalizing, EAC-IJ (Self-Concept Scale for Children and Youth), ICS (Interpersonal Competence Scale), MSCS (Multidimensional Self-Concept Scale), PHSCS (Piers-Harris Self-Concept Scale), SPPC (Self-Perception Profile for Children), TMA (Self-Esteem Multidimensional Test)

Table 4. *Effect size estimates for academic self-esteem, social self-esteem, and behavioral self-esteem*

	k	ADHD *n*	TD *n*	$\hat{\mu}$	95% CI	$\hat{\sigma}^2_{\text{estimate}}$	$\hat{\sigma}^2_{\text{study}}$	*QE* (*df*)
Academic SE	12	386	315	0.60**	[0.18, 1.02]	0.00	0.27	38.47 (11)***
Social SE	11	258	254	0.67**	[0.33,1.02]	0.00	0.11	20.22(10)**
Behavioral SE	8	231	211	0.06	[-0.52,0.91]	0.06	0.26	18.17(7)

Note. $\hat{\mu}$ = the standardized mean difference (i.e., effect size), CI = 95% confidence interval of mean effect size over studies, $\hat{\sigma}^2_{\text{estimate}}$ = the estimated variance between effect size estimates, $\hat{\sigma}^2_{\text{study}}$ = the estimated variance between studies, QE = test for residual heterogeneity, *k* = number of effect sizes, *n* = number of participants, *df* = degrees of freedom, ADHD = Attention-Deficit/Hyperactivity Disorder, SE = self-esteem, TD = typically developing control group

$* p < 05$

$** p < .01$

$*** p < .001$

Table 5

Social Self-Esteem

Study	ES ID	Outcome	Dx Comp.	SE Inform.	SE Dim.	Com. Ext.	Com. Int.	Age *M*	% Female	ADHD *n*	TD *n*	Hedges' *g*	95 % CI
Capelatto et al., 2014	3	EMAE	0	0	1	1	1	9.92	12	17	17	0.55	(-0.12, 1.22)
Capelatto et al., 2014	6	EAC-IJ	0	0	1	1	1	9.92	12	17	17	0.61	(-0.07, 1.28)
Capodieci et al., 2019	9	ICS	1	0	1	0	0	9.73	38.1	21	21	0.03	(-0.56, 0.62)
Capodieci et al., 2020	13	ICS	1	1	1	1	1	9.73	38.1	21	21	0.44	(-0.17, 1.06)
Gagliano et al., 2014	27	MSCS	1	0	1	1	1	10.14	0	22	23	1.04	(0.42, 1.65)
Grskovik & Zentall, 2010	40	PHSCS	0	0	1	1	1	12.7	100	20	63	0.37	(-0.13, 0.87)
Haas et al., 2015	44	SPPC	0	0	1	1	1	9.7	18	39	17	1.18	(0.57, 1.78)
Haas et al., 2015	48	SPPC	1	0	1	1	1	9.8	20	15	17	1.7	(0.91, 2.50)
Stewart & Buggey, 1994	68	Coopersmith Self-Esteem Inventory	0	0	1	1	1	9.5	30	10	26	0.75	(0.02, 1.49)
Treuting & Hinshaw, 2001	71	PHSCS	0	0	1	1	1	9.6	0	53	87	0.39	(0.05, 0.74)

Treuting & Hinshaw, 2001	75	PHSCS	1	0	1	1	1	9.6	0	61	87	0.46	(0.13, 0.79)

Note. ES = effect size, Dx Comp. = Diagnostic Complexity, SE Inform. = Self-esteem Informant, SE Dim. = Self-esteem Dimension, Com. Ext. = Comorbidity Externalizing, Com. Int. = Comorbidity Internalizing, EMAE (Multidimensional Scale of Self-Esteem), EAC-IJ (Self-Concept Scale for Children and Youth), ICS (Interpersonal Competence Scale), MSCS (Multidimensional Self-Concept Scale), PHSCS (Piers-Harris Self-Concept Scale), SPPC (Self-Perception Profile for Children)

Table 6

Behavioral Self-Esteem

Study	ES ID	Outcome	Dx Comp.	SE Inform.	SE Dim.	Com. Ext.	Com. Int.	Age *M*	% Female	ADHD *n*	TD *n*	Hedges' *g*	95 % CI
Capodieci et al., 2020	10	ICS	1	0	1	0	0	9.73	38.1	21	21	-0.17	(-0.77, 0.42)
Capodieci et al., 2020	14	ICS	1	1	1	1	1	9.73	38.1	21	21	-0.98	(-1.62, -0.34)
Gagliano et al., 2014	28	MSCS	0	0	1	1	1	10.14	0	22	23	0.54	(-0.05, 1.12)
Grskovik & Zentall, 2010	41	PHSCS	1	0	1	1	1	12.7	100	20	63	0.61	(0.11, 1.12)
Haas et al., 2015	45	SPPC	0	0	1	1	1	9.7	18	39	17	0.36	(-0.20, 0.93)
Haas et al., 2015	49	SPPC	0	0	1	1	1	9.8	20	15	17	-0.1	(-0.78. 0.57)
Treuting & Hinshaw, 2001	72	PHSCS	1	0	1	1	1	9.6	0	53	87	0.38	(0.04, 0.72)

Treuting & Hinshaw, 2001	76	PHSCS	1	0	1	1	1	9.6	0	61	87	1	(0.66, 1.35)

Note. ES = effect size, Dx Comp. = Diagnostic Complexity, SE Inform. =Self-esteem Informant, SE Dim. = Self-esteem Dimension, Com. Ext. = Comorbidity Externalizing, Com. Int. = Comorbidity Internalizing, ICS (Interpersonal Competence Scale), MSCS (Multidimensional Self-Concept Scale), PHSCS (Piers-Harris Self-Concept Scale), SPPC (Self-Perception Profile for Children)

Table 7. Ad hoc examination of potential moderator effects.

	Academic				Social				Behavioral			
	Total *k*	ADHD *n*	TD *n*	ES	Total *k*	ADHD *n*	TD *n*	ES	Total *k*	ADHD *n*	TD *n*	ES
Diagnostic												
Complexity												
Less Complex	5	103	83	0.44	6	88	83	0.78	3	76	40	0.28
More Complex	7	283	232	0.78	5	155	171	0.38	5	155	171	0.16
SE Informant												
Self	11	386	315	0.59*	10	258	254	0.65*	7	231	211	0.44
Other	1	21	21	0.17	1	21	21	0.45	1	21	21	-0.98
Comorbidities												
Not Excluded	10	386	315	0.68*	9	258	254	0.71*	6	231	211	0.52*
Excluded	2	21	21	0.02	2	21	21	0.34	2	21	21	-0.70
Age												
Younger	7	199	151	0.28	7	184	151	0.65*	6	189	125	0.52*
Older	5	187	164	0.85	4	59	103	0.63	2	42	86	0.58
Percent Female												
Fewer Females	6	277	170	0.59*	6	192	144	0.65*	4	175	127	0.60
More Females	5	66	127	0.27	5	66	127	0.60	4	56	101	-0.19

Figure 1. PRISMA flow diagram of included studies.

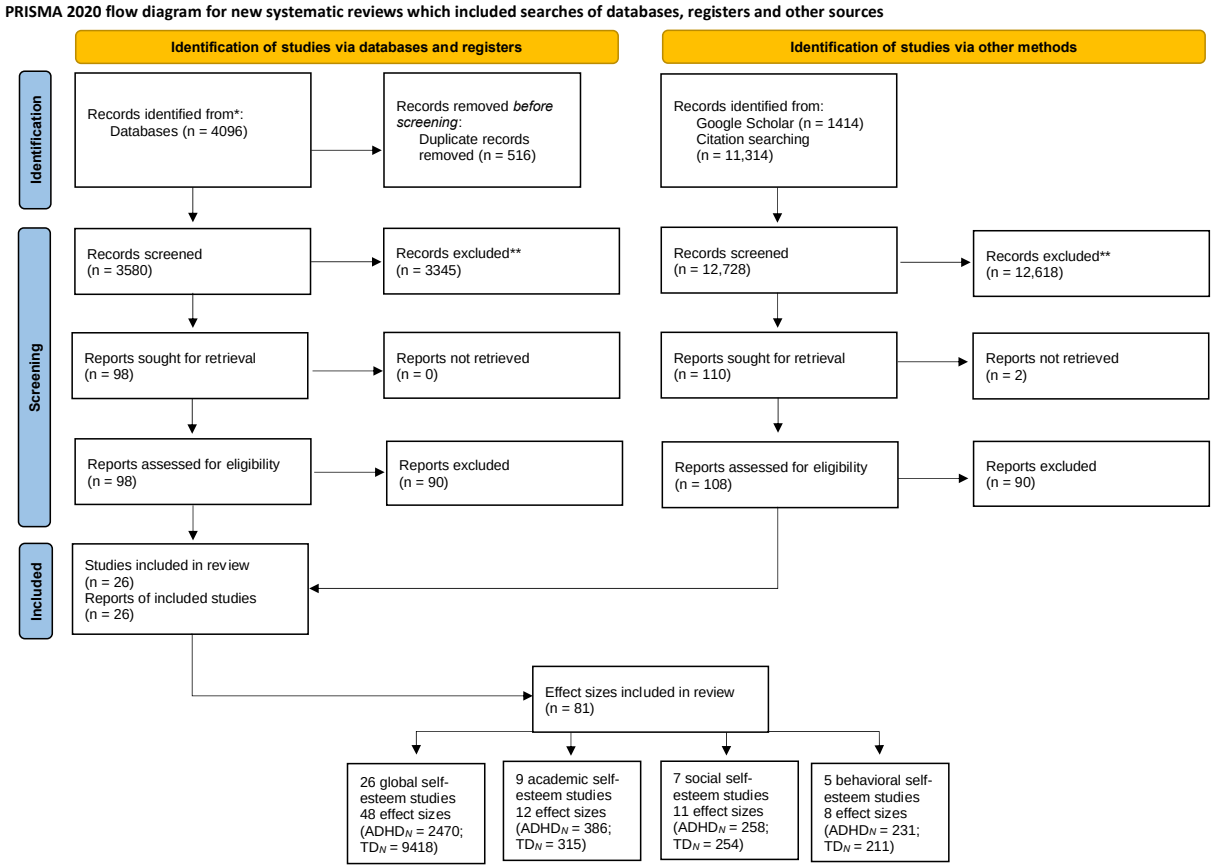


Figure 2. Global Self-esteem Forest Plot

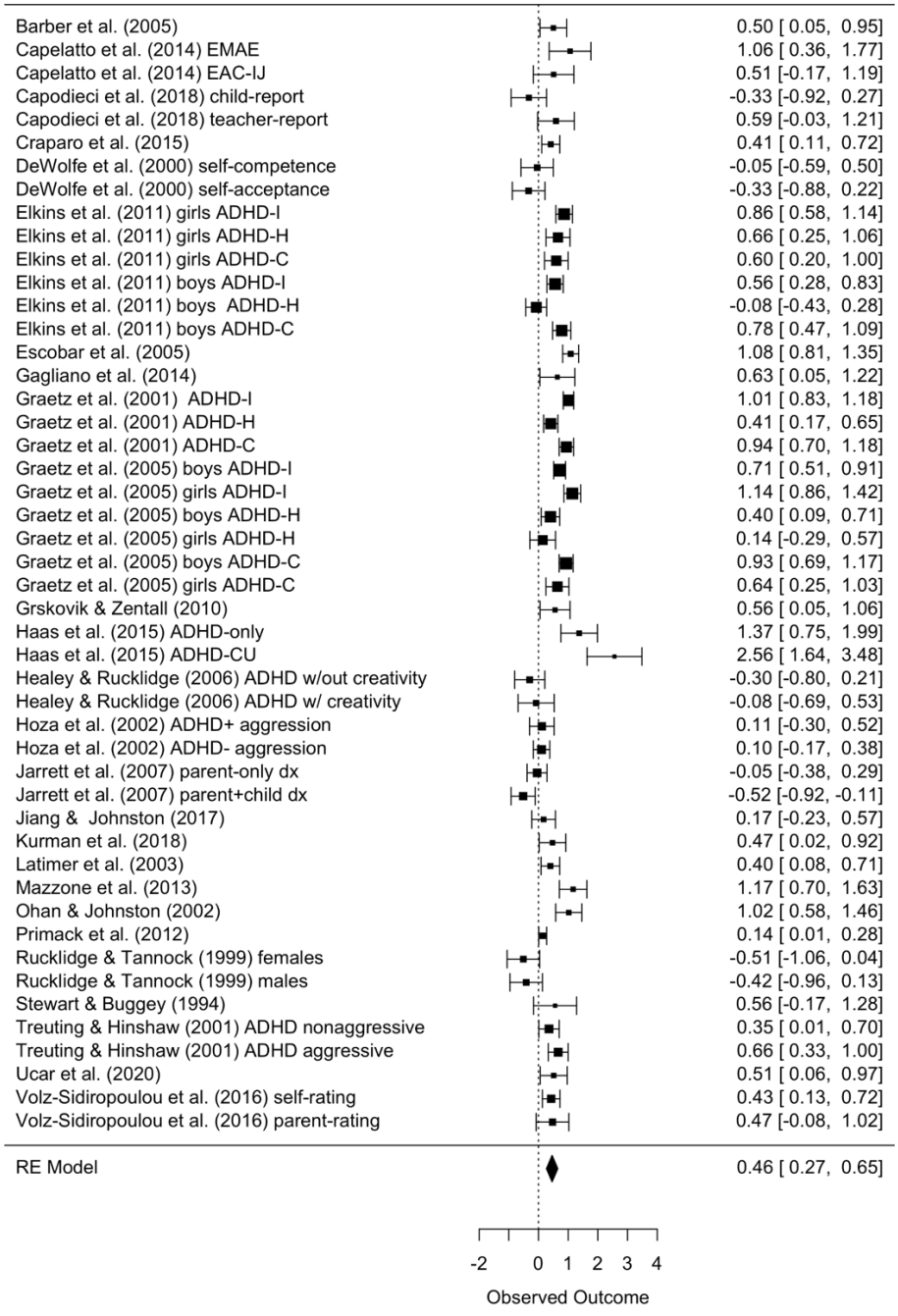


Figure 3. Academic Self-esteem Forest Plot

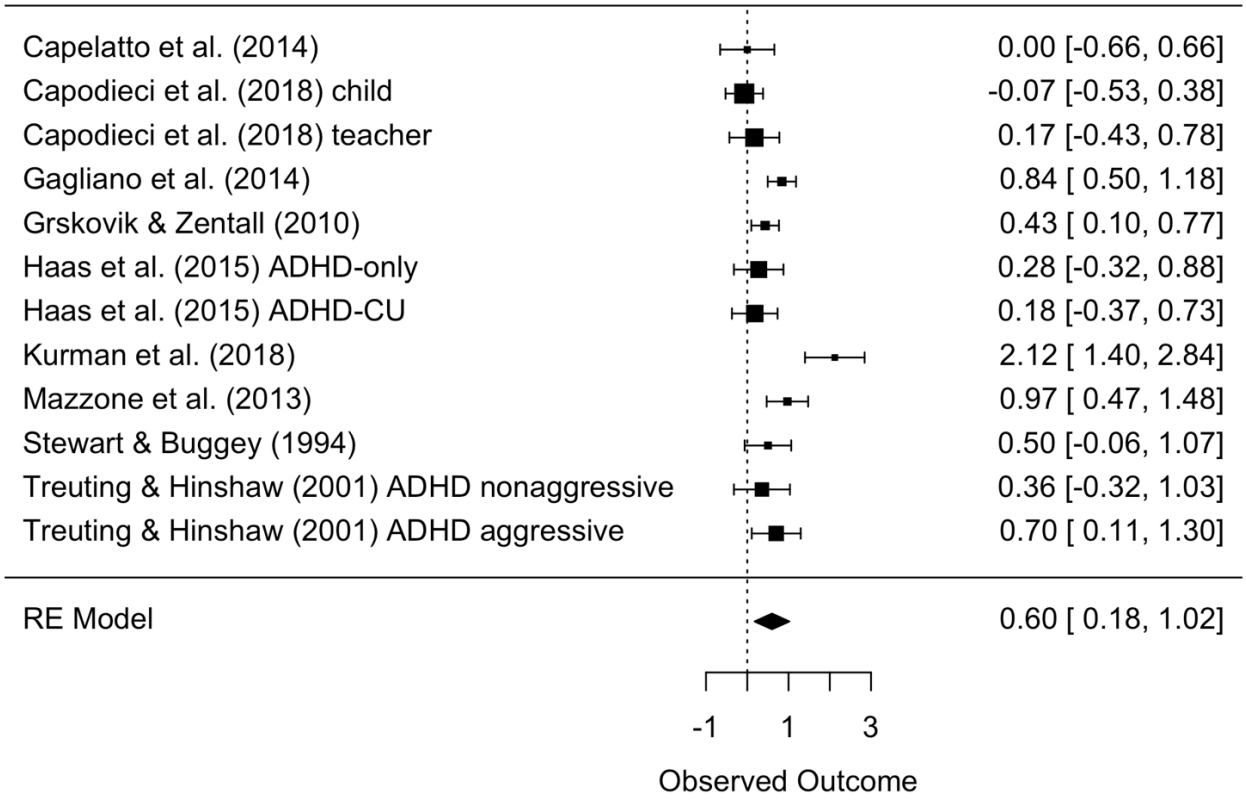


Figure 4. Social Self-esteem Forest Plot

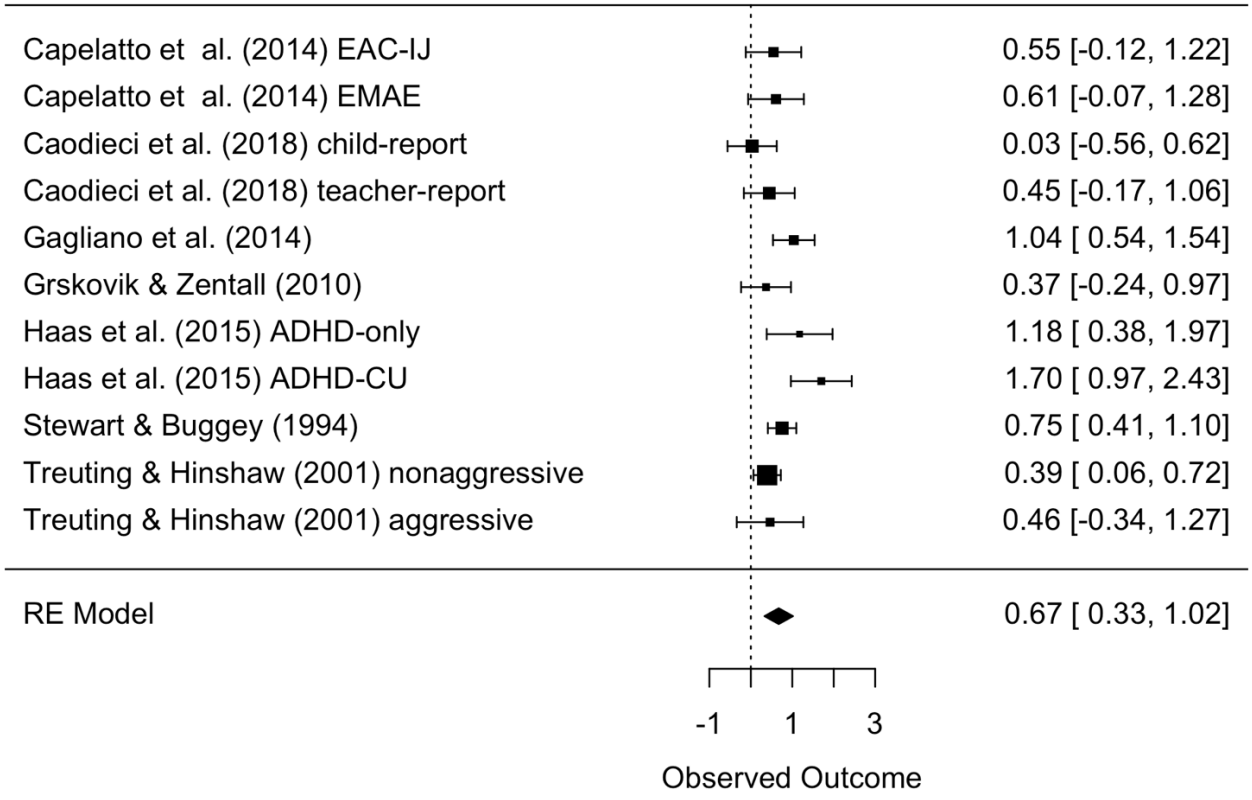


Figure 5. Behavioral Self-esteem Forest Plot

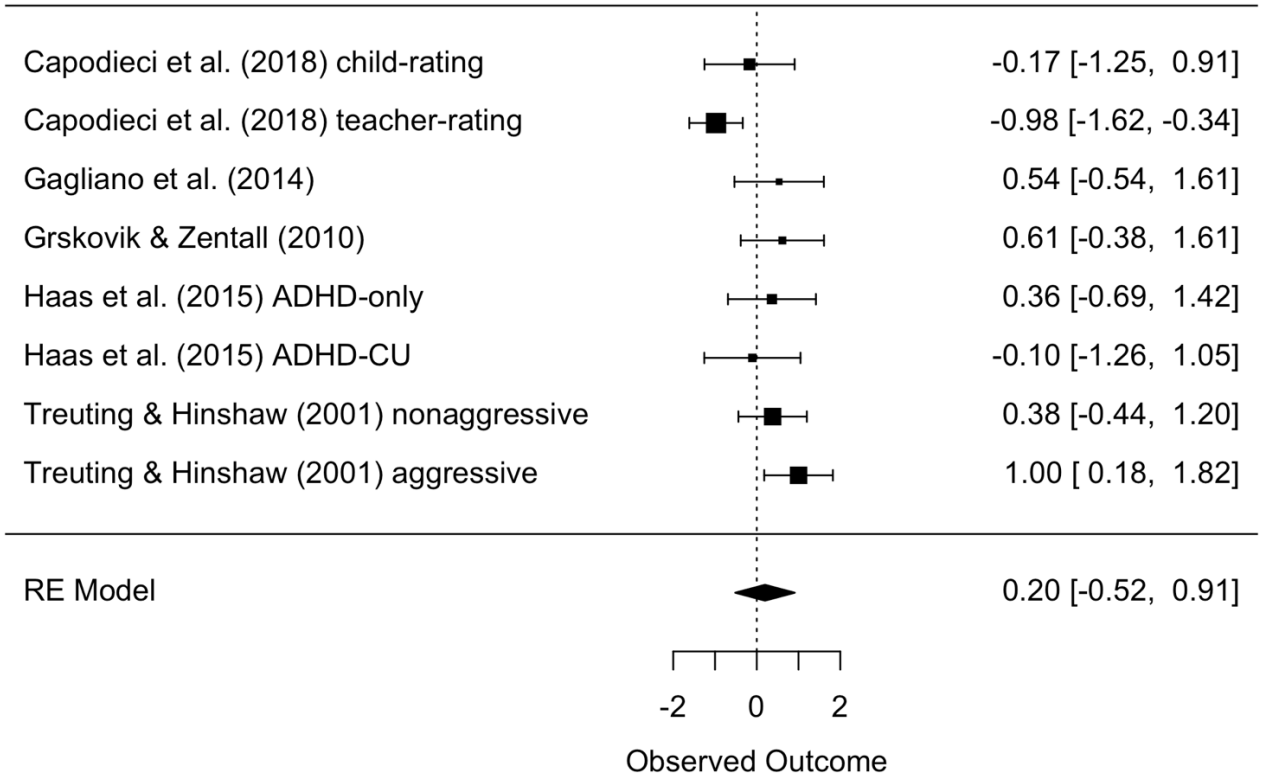
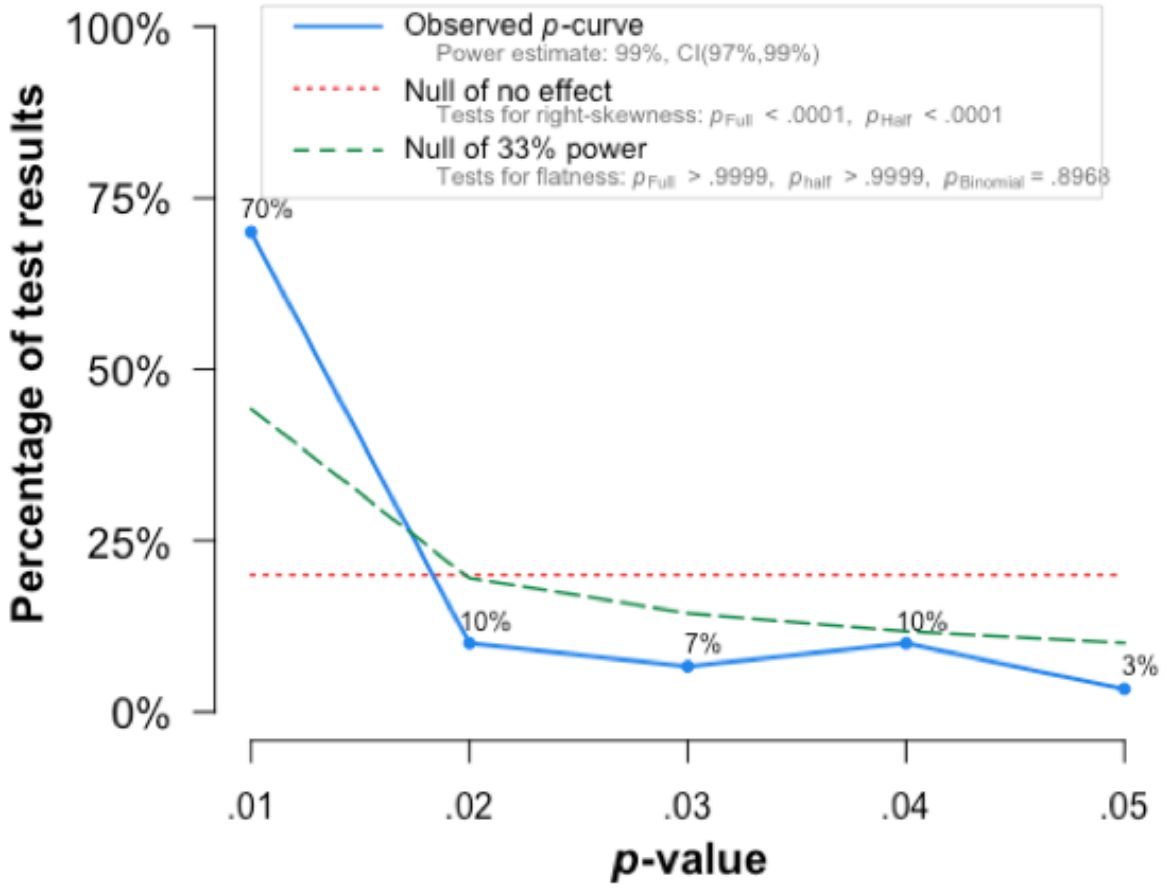
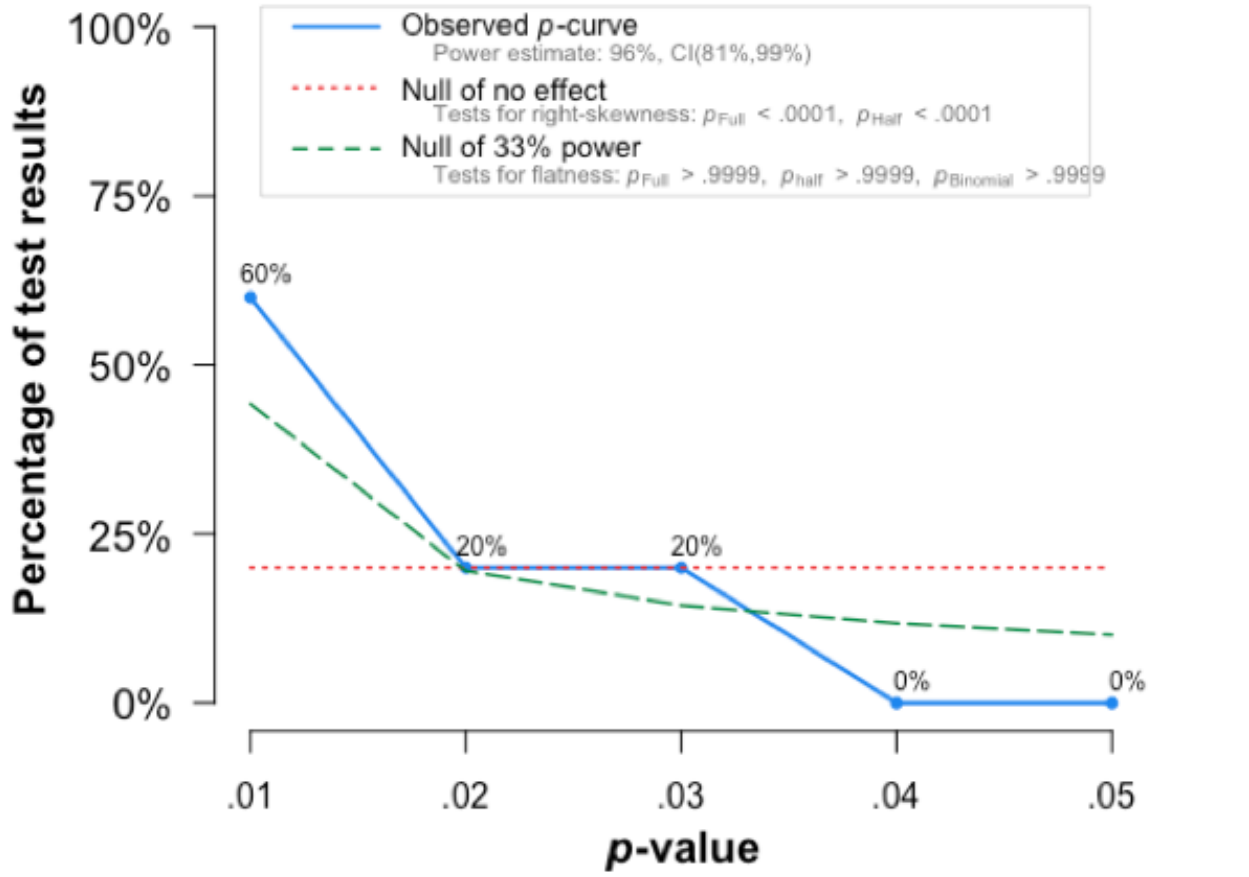


Figure 6. Global Self-esteem P-curve



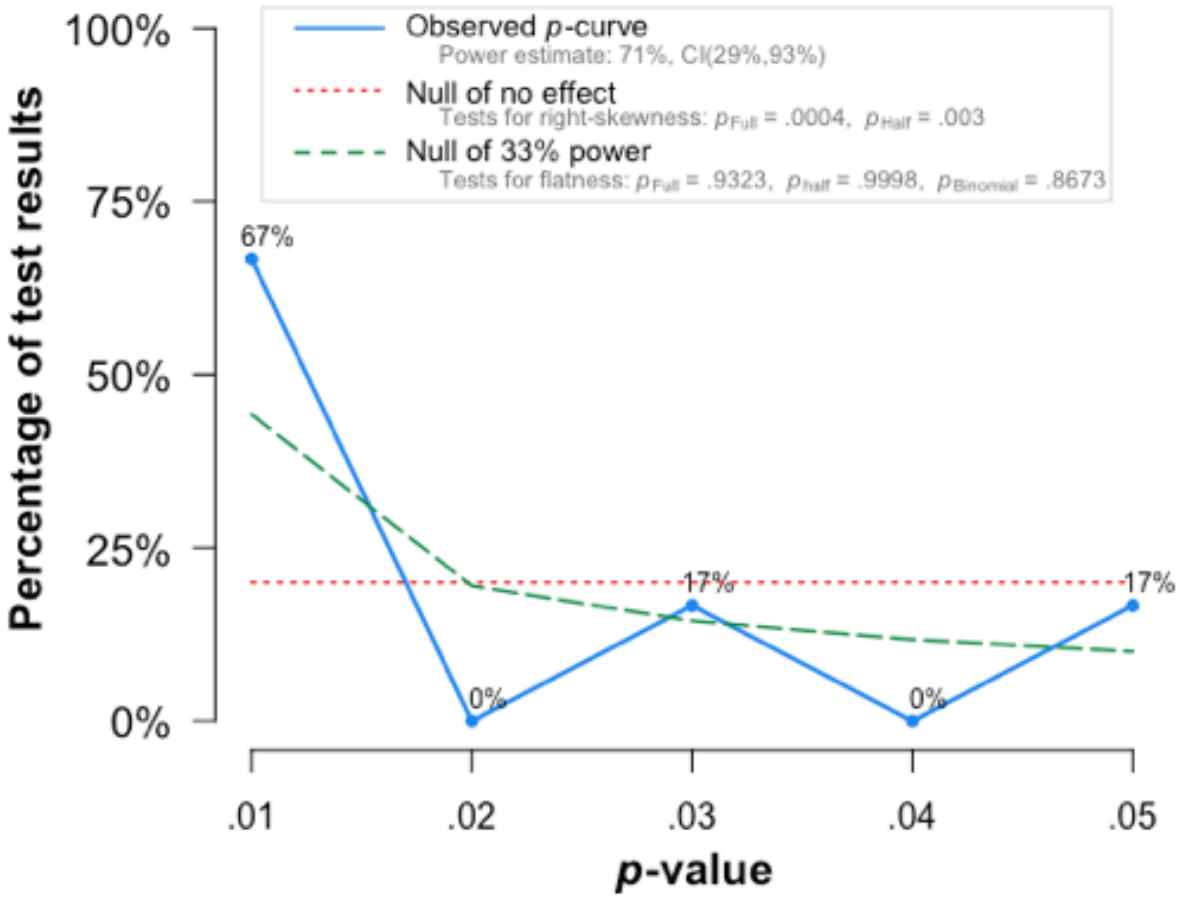
Note: The observed *p*-curve includes 30 statistically significant ($p < .05$) results, of which 24 are $p < .025$. There were 16 additional results entered but excluded from *p*-curve because they were $p > .05$.

Figure 7. Academic Self-esteem P-curve



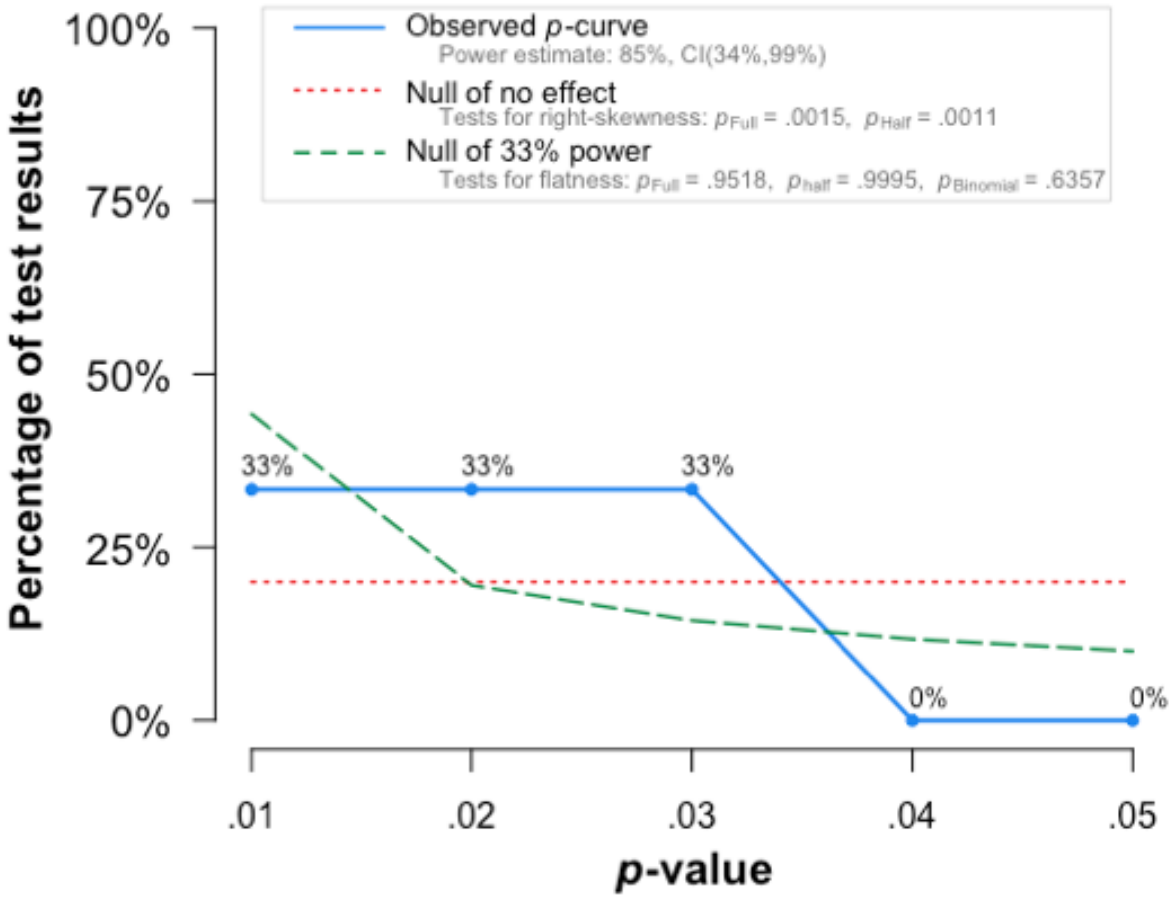
Note: The observed *p*-curve includes 5 statistically significant ($p < .05$) results, of which 5 are $p < .025$. There were 6 additional results entered but excluded from *p*-curve because they were $p > .05$.

Figure 8. Social Self-esteem P-curve



Note: The observed *p*-curve includes 6 statistically significant ($p < .05$) results, of which 5 are $p < .025$. There were 4 additional results entered but excluded from *p*-curve because they were $p > .05$.

Figure 9. Behavioral Self-esteem P-curve



Note: The observed *p*-curve includes 3 statistically significant ($p < .05$) results, of which 2 are $p < .025$.
There were 3 additional results entered but excluded from *p*-curve because they were $p > .05$.

VITA

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