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Pragmatic Deficits in Attention-Deficit/Hyperactivity Disorder: Systematic Review and Meta-Analysis

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PRAGMATIC DEFICITS IN ATTENTION-DEFICIT/HYPERACTIVITY DISORDER: SYSTEMATIC REVIEW AND META-ANALYSIS

by
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ABSTRACT

Background: Most studies have found pragmatic language skills to be poorer in attention-deficit/hyperactivity disorder (ADHD) populations, but there is no conclusive evidence.

Aim: Our aim was to conduct a meta-analysis of pragmatic language abilities in ADHD populations to more definitively demonstrate the extent of pragmatic language deficits in these populations as compared to typically developing (TD) populations.

Methods and procedures: Journal articles were identified using the search terms ((attention deficit) OR (adhd)) AND (pragmatics). Identified studies were screened and reviewed for inclusion criteria, descriptive information, and outcome variables. A meta-analysis was conducted, and individual effect sizes and overall effect size were calculated.

Outcomes and results: 14 studies (5772 participants) met inclusion criteria for quantitative synthesis. Meta-analysis results demonstrated that ADHD populations showed significantly poorer pragmatic language skills than TD populations, with a very large overall effect size of -1.55.

Conclusions and implications: Pragmatic language is clearly significantly affected in people with ADHD, as shown by the overall effect size from our results. Considering the recognized importance of pragmatic language in socio-emotional development, daily life, and academic success, such skills should be regularly addressed within ADHD management.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

ADHD	Attention-Deficit/Hyperactivity Disorder
ASD	Autism-Spectrum Disorder
CELF-4	Clinical Evaluation of Language Fundamentals 4th edition
CCC-2	Children's Communication Checklist 2nd edition
DBD	Disruptive Behavior Disorder
KASLAT	Korean Autism Social Language Test
LI	Language Impairment
ODD	Oppositional Defiant Disorder
POM	Pragmatics Observational Measure
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
TASIT	The Awareness of Social Inference Test
TD	Typically Developing

1. Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a common yet complex neuropsychiatric disorder of development with a prevalence rate of around 5% of school-aged children and around 8% of preschool children (Froehlich et al., 2007, as cited in Gremillion & Martel, 2014; Polanczyk et al., 2007, as cited in Rints et al., 2015). ADHD is characterized by developmentally inappropriate levels of hyperactivity-impulsivity and inattention, it presents early on in development, and it causes impairments across a variety of contexts (APA, 2000, as cited in Rints et al., 2015). Social functioning difficulties in children with ADHD are commonly reported by these children's parents, peers, and teachers as early as the preschool years. (DuPaul et al., 2001, as cited in Staikova et al., 2013). Anywhere from 52% to 82% of children with ADHD are reported as having social issues, leading to progressively increasing agreement that they are a significant aspect of the disorder (Barkley et al., 1990; Landau et al., 1998, as cited in Staikova et al., 2013). Such deficits in social functioning are considered to be related to deficits in pragmatic language, something regularly seen in ADHD populations even without any diagnosed language disorder (Green et al., 2014; Väisänen et al., 2014). The connections among ADHD, social problems, and pragmatic language deficits have prompted much research on the specific relationship between ADHD and pragmatic language, resulting in multiple studies that show significantly lower pragmatic language abilities in ADHD populations than in typically developing (TD) populations. Therefore, the purpose of this study was to conduct a meta-analysis of previous research on pragmatic language in ADHD in order to determine how large

of an effect ADHD and its hallmark traits have on pragmatic language abilities as compared to TD peers.

1.1 Pragmatic Language

Pragmatic language is a domain of language that is commonly defined as "behavior that encompasses social, emotional, and communicative aspects of social language" (Adams et al., 2005, as cited in Cordier, Munro, Wilkes-Gillan, Speyer, Parsons, et al., 2019, p. 2). In general terms, it is the appropriate use of language in a social context (Grzadzinski et al., 2011, as cited in Parke et al., 2018; Bryant, 2009, as cited in Miller et al., 2015). Pragmatics, as one of the five domains of language, manages the use of the other four domains (phonology, morphology, syntax, semantics) within conversation (Russel 2007, as cited in Staikova, et al., 2013). While it manages these other language domains, it is still distinguished from them as they are considered relatively independent of context while pragmatics is not (Camarata & Gibson, 1999, as cited in Green et al., 2014). The concept of pragmatics incorporates a wide range of abilities both verbal and nonverbal (Hart, et al., 2004, as cited in Wilkes-Gillan et al., 2017). It is central to general social interaction skills, which include abilities such as initiating interactions, communicating using speech or gesture, regulating one's emotions and behavior, and maintaining interactions by replying or asking questions (American Occupational Therapy Association, 2014, as cited in Wilkes-Gillan et al., 2017). Other specific skills associated with pragmatic language include maintaining conversation topics, avoiding excessive talking, engaging in turn-taking during conversation, interpreting others' nonverbal cues, not interrupting, controlling intensity (tone and volume) of speech, displaying appropriate facial expressions, and maintaining appropriate eye contact and physical proximity (Bishop et al., 2001; Bishop 2000, as cited in Hawkins et al.,

2016; Prutting & Kirchner, 1987, as cited in Leonard et al., 2011). Pragmatic language milestones in typically developing (TD) children begin as early as age two, with TD children able to adapt messages to listeners and react to feedback by this age (Furrow, 1984, as cited in Leonard et al., 2011). From then on, they can maintain conversations with adults and by age five can repair mistakes made in turn-taking (Ervin-Tripp, 1979, as cited in Leonard et al., 2011). The "ability to reflect on one's own communication," or metapragmatic skills, typically emerge by six to seven years, and these along with countless other pragmatic abilities develop and mature throughout the upper elementary years and on (Andersen-Wood & Smith, 1997; McLaughlin, 1998, as cited in Leonard et al., 2011).

Assessment of pragmatic language often poses problems and developing one single measure for it is difficult because it is such a "complex and multifaceted" concept that includes various verbal and nonverbal skills (Cordier, Munro, Wilkes-Gillan, Speyer, Parsons, et al., 2019, p. 2; Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014). Observation in a natural social context, especially in the context of play with peers, is the most promising possibility for assessment, as it gives a perspective into the child's communication in everyday life (Adams, 2002, as cited in Cordier, Munro, Wilkes-Gillan, & Docking, 2013; Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014). However, very few measures that accomplish this actually exist (Adams, 2002, as cited in Cordier, Munro, Wilkes-Gillan, Speyer, Parsons, et al., 2019). A much more common method of assessment, standardized tests, do not capture this dependence on context and instead focus on pragmatic knowledge rather than actual pragmatic performance ability. Another common assessment method, parent or teacher reports, can help capture more of the context but can often be biased (Cordier, Munro, Wilkes-Gillan, Speyer, Parsons, et al., 2019). Because of these relative weaknesses of each individual method, it has been suggested

that the best way to approach assessment is to use a combination of discourse analysis (from observation), standardized tests, and parent/teacher reports/questionnaires (Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014).

1.1.1 Importance of Pragmatic Language

The importance of pragmatic language is difficult to overstate, as it is shown to be crucial for many developmental outcomes. For instance, pragmatic language skills are essential in both academic situations, especially those involving group cooperation, and social situations. (Westby & Cutler, 1994, as cited in Leonard et al., 2011). They encourage participation in such contexts and are central to success in interactions with peers and to socio-emotional development (Hart et al., 2004, as cited in Wilkes-Gillan et al., 2017). Due to this centrality, children who develop these pragmatic language skills are more successful within social interactions (Bierman, 2004, as cited in Leonard et al., 2011). On the other hand, children who lack these skills are at a social disadvantage. Pragmatic language deficits can occur even in the absence of structural or semantic language deficits, as seen on traditional language tests (Bishop & Baird, 2001, as cited in Green et al., 2013). Children with these problems may have good expressive language yet have difficulty understanding implied meaning (Ryder et al., 2008, as cited in Väisänen et al., 2014). They may also use too much stereotyped language (Bishop & Norbury, 2002, as cited in Väisänen et al., 2014). In general, these children may not fully understand contextual norms of peer group-dominated interactional situations, often leading to disrupted development of appropriate social skills (Leonard et al., 2011). Because they negatively affect children's functioning in so many ways, it is not surprising that these pragmatic language problems have been linked to a higher risk of various emotional and social issues throughout life (Jerome et al.,

2002, as cited in Cordier, Munro, Wilkes-Gillan, & Docking, 2013). These issues can be both internalizing and externalizing, encompassing problems in academic performance, peer relationships, and overall psychiatric adjustment, and are even associated with multiple psychiatric disorders (Ketelaars et al., 2010, as cited in Miller et al., 2015; Landa, 2005, as cited in Staikova et al., 2013). Considering the importance of pragmatic language in everyday life and development along with the negative consequences of deficits in this area, it is therefore important to understand the extent of deficits in populations that struggle in social contexts, such as children with ADHD.

1.2 Pragmatic Language in ADHD

Children with ADHD are consistently shown to have problems with pragmatic language when compared with TD children. For example, one study found that parents and teachers rated children with ADHD as much lower in pragmatic language and social skills than TD children, yet only marginally different than children with Autism Spectrum Disorder (Bishop & Baird, 2001, as cited in Staikova et al., 2013). In another study by Parke et al. (2018), children with ADHD had lower scores on various measures of pragmatic language, with moderate to large effect sizes. Finally, a study on Disruptive Behavior Disorders (DBD) that included both ADHD and Oppositional Defiant Disorder (ODD) found that children with ADHD with or without comorbid ODD had significantly worse pragmatic language skills than TD children, and children with both ADHD and ODD had significantly worse pragmatic language than those with ODD only. These results indicate that ADHD children are at an especially high risk for language problems when compared to TD and even ODD-only children (Gremillion & Martel, 2014).

In everyday life, these known pragmatic deficits are exhibited in various ways. Social skills issues like poor eye contact and difficulty developing friendships are common and are likely due to impaired social cognition, which includes pragmatic language (Martin & McDonald, 2003; Vekermann et al., 2010; Vekermann at al., 2013, as cited in Parke et al., 2018). Theoretically, children with ADHD struggle with pragmatic language because ADHD involves poor behavioral inhibition and is related to difficulties with attention, hyperactivity, and impulsivity (Barkley, 1997; 1999, as cited in Leonard et al., 2011). It has been suggested that these problems are associated with deficits in executive function common to children with ADHD (Perkins, 2010; Tannock & Schacher, 1996; Westby & Cutler, 1994, as cited in Green et al., 2014). The term "executive function" describes a concept that encompasses multiple related neurocognitive processes that work together to help a person to behave in ways that are goal-driven and purposeful (Green et al., 2014). Its connection with pragmatic language ability is said to involve allowing individuals to "respond adaptively and flexibly to the dynamic demands of social communication" (Martin & McDonald, 2003, as cited in Green et al., 2014, p. 17). When considering ADHD pragmatic language deficits in relation to hallmark ADHD traits, three of these main aspects of the disorder can be said to relate specifically to individual issues with pragmatic language. First, inattention can interfere with a person's ability to do things like focus on a conversation, maintain attention in conversation, and read others' social cues (Marshall et al., 2014, as cited in Parke et al., 2018). Additionally, the issue of poor inhibition in ADHD can lead to deficient abilities in having empathy and taking the perspective of others (Barkley, 2014, as cited in Parke et al., 2018). Finally, impulsivity often involves the traditional ADHD behavior of interrupting conversations or interactions (Abikoff et al., 2002, as cited in Parke et al., 2018). These difficulties in ADHD are understandable from a neurobiological perspective, as evidence

has shown that social cognition (which includes pragmatic language) is mediated by the prefrontal cortex in the brain, an area where dysfunction has regularly been found in people with ADHD (Amodio & Frith, 2006; Friedman & Rapoport, 2015, as cited in Parke et al., 2018). Regarding specific behaviors of children with ADHD, many have been found that display the deficits in pragmatic language that have just been discussed. For example, these children struggle to play cooperatively, respond to social cues, and self-regulate their emotions and behaviors, and such issues often lead to poor interactions with peers (Wilkes-Gillan et al., 2017). Other problems seen in children with ADHD include excessive talking (particularly at times when listening is required), difficulties producing fluent and organized elicited speech (as opposed to spontaneous speech), problems adhering to speaker vs. listener roles, dominating conversations, not responding to verbal cues from others, and struggling with higher level language tasks like understanding implications and complex elements of stories (Rints et al., 2015). Further, they may use mazes (repetitions, fillers, false starts, and revisions) that are longer and more frequent than do TD children, they might not give enough feedback to conversational partners, they may talk too familiarly to strangers, and they often use private speech (speaking out one's actions while doing them, especially as a method of controlling them) for far longer than TD children (Bishop, 2003; Redmond, 2004; Winsler et al., 2000, as cited in Väisänen et al., 2014). Because so much research has shown deficits in the pragmatic language of children with ADHD, it is important to consider this broad base of research all together.

1.2.1 Importance of Pragmatic Language in ADHD

Children with ADHD consistently experience social difficulties including regular conflicts, peer rejection, and eventually few, if any, friendships (Nijmeijer et al., 2008, as cited in

Green et al., 2014). In general, they are less skilled at adapting their social communication behavior to the specific context. As a result, these children may get bullied and rejected by their peers (Bierman, 2004; Landau & Milich, 1988, as cited in Leonard et al., 2011). Unfortunately, this kind of peer rejection occurs often for children with ADHD, as they are disliked more strongly early on, are less preferred socially, and have fewer friends (Bickett & Milich, 1990; Erhard & Hinshaw, 1994; Hoza et al., 2005, as cited in Staikova et al., 2013). Rejection by peers is then associated with higher risks for outcomes like substance abuse, dropout, delinquency, school issues, and psychopathology (Greene et al., 1997; Klein & Mannuzza, 1991, as cited in Staikova et al., 2013). Such exclusion caused by their ADHD traits prevents these children from engaging socially and learning from social environments, which then worsens their pragmatic language and social problems (Parke et al., 2018). The poor relationships that result from this cycle predict many problems later in life, including social anxiety, antisocial conduct, absenteeism, and generally more of a need for mental health help (Parker & Asher, 1987, as cited in Leonard et al., 2011). Related to mental health, children with pragmatic language deficits often experience comorbid disorders (Leonard et al., 2011). In general, it can clearly be said that children with ADHD and pragmatic language deficits are at risk for problems in social and emotional functioning that negatively affect their participation in regular childhood activities along with their overall well-being and health (Brinton & Fujiki, 2006; Hart et al., 2004, as cited in Wilkes-Gillan et al., 2017). Finally, many of these effects are not limited to childhood, with issues in adulthood such as higher rates of divorce and more frequent job loss seen in adults with ADHD. Therefore, it is important to have a more robust understanding of pragmatic language in ADHD in order to more effectively help people with this disorder experience better development and more positive life outcomes.

1.3 Present Study

Despite the seemingly strong base of research demonstrating significant pragmatic language deficits in ADHD populations, there is no conclusive evidence for deficits in the pragmatic language skills of people with ADHD. A more robust understanding of the specific relationship between these skills and ADHD can help people like researchers, clinicians, teachers, and parents to better understand the needs and relative weaknesses of people, especially children, diagnosed with the disorder. As a result, ADHD populations can be given the resources, assistance, and support that they need most in order to succeed in all aspects of life. One effective method to elucidate the overall effect of ADHD on pragmatic language is a meta-analysis, a process that statistically combines results of prior studies that may include different comparison groups and measures and gives stronger evidence than can be provided by individual studies (American Speech-Language Hearing Association, n.d., as cited in Hahn et al., 2018). Therefore, the purpose of this study was to conduct a meta-analysis of pragmatic language abilities in ADHD to more accurately determine the difference between the pragmatic skills of ADHD populations as compared to their TD counterparts.

2. Materials and Methods

This systematic review and meta-analysis were performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA) (Moher et al., 2009).

2.1. Data collection and identification of studies

Papers were identified through Ole Miss One Search and PubMed. The search terms ((attention deficit) OR (adhd)) AND (pragmatics) were used in both search engines. We also examined references from papers identified through the online search for any other studies on pragmatic language in ADHD.

2.2. Inclusion criteria

Inclusion criteria for the present study were as follows:

1. Studies had to measure pragmatic language in ADHD populations compared to non-ADHD populations.
2. Studies had to be original studies (not reviews).
3. Studies had to include both an ADHD group and a typically developing (TD) group (>1 participant in each group).
4. If a study was an intervention, it had to report pre-intervention measures.
5. Studies had to be written or available in English.

2.3. Reasons for exclusion

Two stages of screening and review were conducted to determine inclusion or exclusion of studies. The first stage, in which the titles and abstracts of articles were screened, was conducted after one duplicate was removed. In this stage, 95 of the remaining 141 studies were excluded. All of these 95 articles were excluded because they did not meet our first criterion of measuring pragmatic language in ADHD populations. In the second stage, during which the remaining 46 articles were assessed in full, a total of 32 articles were excluded. The reasons for exclusions in this stage were as follows: 11 were reviews, nine had no TD comparison group, five were unable to be accessed, three did not report straightforward scores, two did not measure pragmatic language within ADHD populations, and one was an intervention that did not report pre-intervention measures.

2.4. Included studies

All identified articles underwent an initial review of their titles and abstracts. Any articles that did not meet the inclusion criteria were excluded from further review. Articles that either seemed to meet the inclusion criteria or had abstracts that did not provide sufficient information for an inclusion/exclusion decision were then read and reviewed in full. Articles that, after further review, no longer met the inclusion criteria were excluded from further analysis. Reasoning for exclusion of any article was noted. For articles that did meet the inclusion criteria after being reviewed in full, ADHD measure, pragmatics measure, participant age information, and pragmatic language scores were all documented.

All studies included in our meta-analysis used a measure or test of pragmatic language that provided numerical results and age information. One study only provided a range of TD

participant ages without a mean and standard deviations, so these had to be calculated. Further, a high score meant higher abilities in the results of some studies, while in others, a high score meant lower abilities. Therefore, scores had to be reversed for any study in which a high score was worse.

2.5. Pragmatic language variables included in data analysis

For all studies that used more than one measure or test of pragmatic language skills, we have noted in Table 1 which measure was ultimately used in the final meta-analysis. In these cases, CCC-2 was chosen when a pragmatic measure for both the ADHD and TD groups was reported. If CCC-2 pragmatics scores were not reported for both groups, other scores, such as Pragmatics Observational Measure (POM), were used.

2.6. Meta-analytic procedures

A meta-analysis was conducted with the *metafor* R package (Viechtbauer, 2010). Effect sizes for each study were calculated using Hedge's G, which was employed as an indicator of the standardized mean difference. Overall effect size was calculated by employing the random effects model (Borenstein et al., 2009). Three tests were conducted to estimate the potential influences of publication bias. A rank correlation test was performed for the funnel plot asymmetry by examining representation of study distribution. To detect funnel plot asymmetry, Egger's regression test was used (Egger et al., 1997). Unpublished studies were estimated by the trim and fill method (estimation of unpublished studies) (Duval & Tweedie, 2000).

3. Results

Of the 142 results we obtained from our literature search, 14 studies (5772 total participants) met the inclusion criteria. The following studies were excluded: 95 studies after a review of abstract and title, 32 after a review of full text (see Figure 1 for PRISMA). One was excluded because it was a duplicate.

Table 1

List of Studies Included in the Meta-Analysis

Study	ADHD n	TD n	ADHD age M(SD)	TD age M(SD)	PL measure	ADHD PL score M(SD)	TD PL score M(SD)
Caillies et al. (2014)	15	15	108(15)	108(15)	Ice Cream Story, Birthday Story	4.7967(3.6683)	9.1133(4.4410)
Cordier et al. (2017)	9	9	98(13)	105(19)	POM[a]	22.42(48.06)	38.9(39.81)
Geurts & Embrechts (2008)	29	29	122.24(18.23)	121.62(19.16)	CCC-2: sum D, E, F, G, H	-24.6(14.1)	-13.1(9.1)
Gremillion & Martel (2014)	18	30	60.36(11.4)	51.36(12.84)	CELF-4[b] Preschool 2nd ed. Descriptive Pragmatic Profile	82.78(6.89)	92.76(8.33)
Helland et al. (2016)	169	5050	96(6)	96(6)	Bergen Child Study Screening Questionnaire #4	-0.4(0.68)	-0.03(0.2)
Kuijper et al. (2017)	34	36	107(19)	107(20)	CCC-2: sum E, F, G, H	-26.62(13.23)	-6.37(5.19)
Lee et al. (2015)	16	10	96(19.08)	111.6(21.12)	KASLAT[c]	29.44(4.1)	40.5(3.68)
Ludlow et al. (2017)	22	22	155.73(17.74)	154.36(12.92)	TASIT[d] pt. 2: Social Inference Minimal Test	2.645(0.8674)	3.27(0.391)
Nilsen et al. (2013)	27	27	96.12(12.95)	99.05(11.09)	CCC-2: sum D, E, F, G, H	-42.35(15.36)	-10.81(7.26)
Parke et al. (2018)	25	25	120.84(22.8)	126.84(25.08)	CCC-2: sum E, G, H, I, J	-29.6(9.6)	-9.8(6.7)
Staikova et al. (2013)	28	35	103.44(22.32)	108.96(12.96)	CCC-2: sum D, E, F, G	32(6)	45.67(6.07)
Timler (2014)	32	12	80.88(7.89)	80(13.56)	CCC-2: mean E, F, G, H, I, J	51.27(11.6)	60.83(9.91)
Väisänen et al. (2014)	19	19	115(25.68)	97(10.32)	CCC-2: mean E, F, G, H	-7.6925(4.8839)	-1.2325(2.0188)
Wilkes-Gillan et al. (2017)	5	5	105(18)	103(19)	CCC-2: mean D, E, F, G, H, I, J	14.4286(19.5763)	52(35.0897)

Note: CCC-2 subtests are (A) Speech, (B) Syntax, (C) Semantics, (D) Coherence, (E), Inappropriate Initiation, (F), Stereotyped Language, (G), Use of Context, (H), Nonverbal Communication, (I) Social Relations, (J) Interests.

a: POM = Pragmatics Observational Measure

b: CELF-4 = Clinical Evaluation of Language Fundamentals- 4th ed.

c: KASLAT = Korean Autism Social Language Test

d: TASIT = The Awareness of Social Inference Test

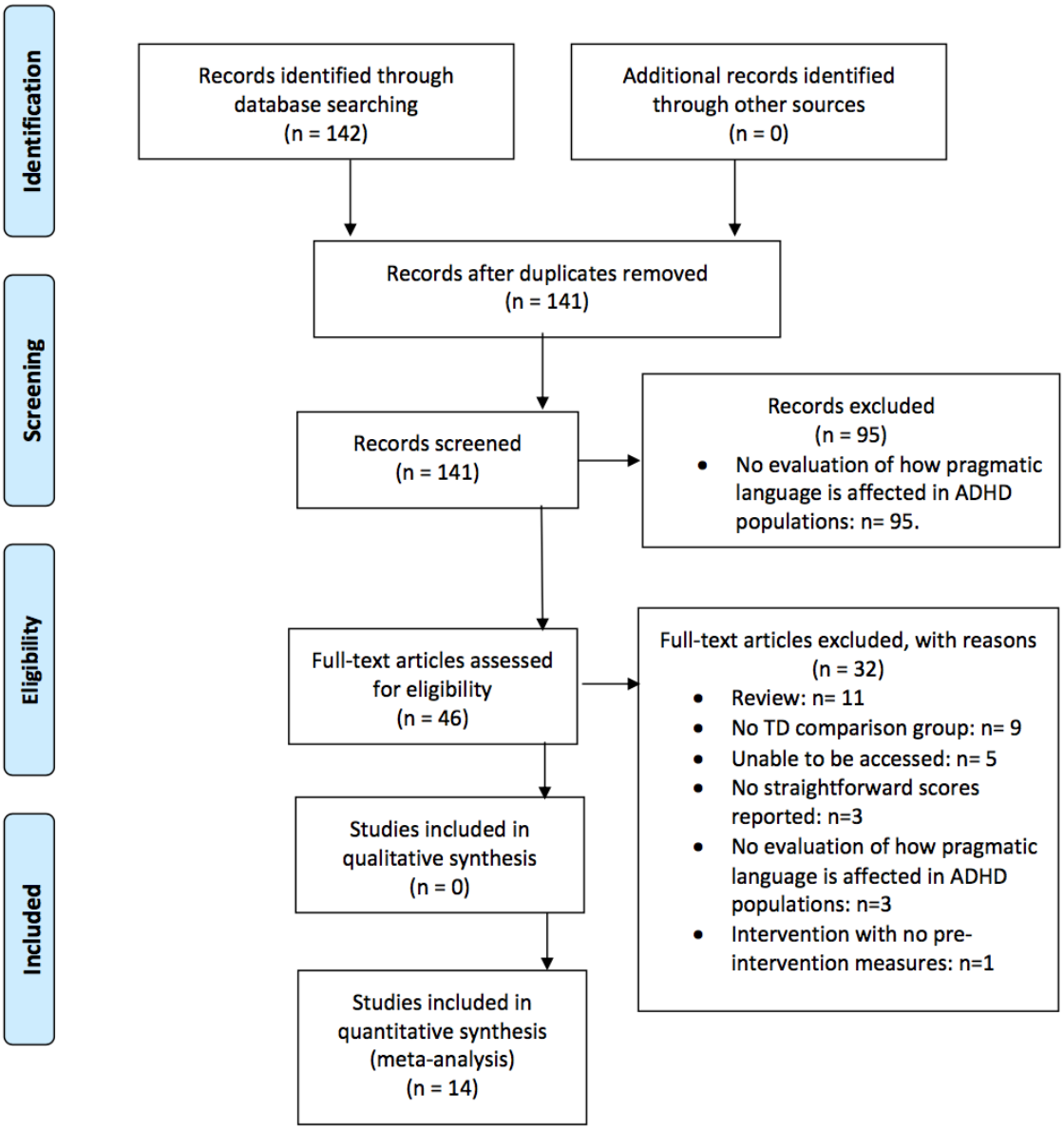

Figure 1: PRISMA Flow Diagram Pragmatic Language in ADHD Meta-analysis

3.1. Meta-analysis of pragmatic language in ADHD

Meta-analysis showed that populations with ADHD demonstrated significantly lower pragmatic ability (Standard Mean Difference [Hedge's *G*] = -1.55; 95% Confidence Intervals

[CIs] = -1.93: -1.18; $p < 0.0001$; see Figure 2). No publication bias was detected by rank correlation, Egger's regression and trim and fill tests.

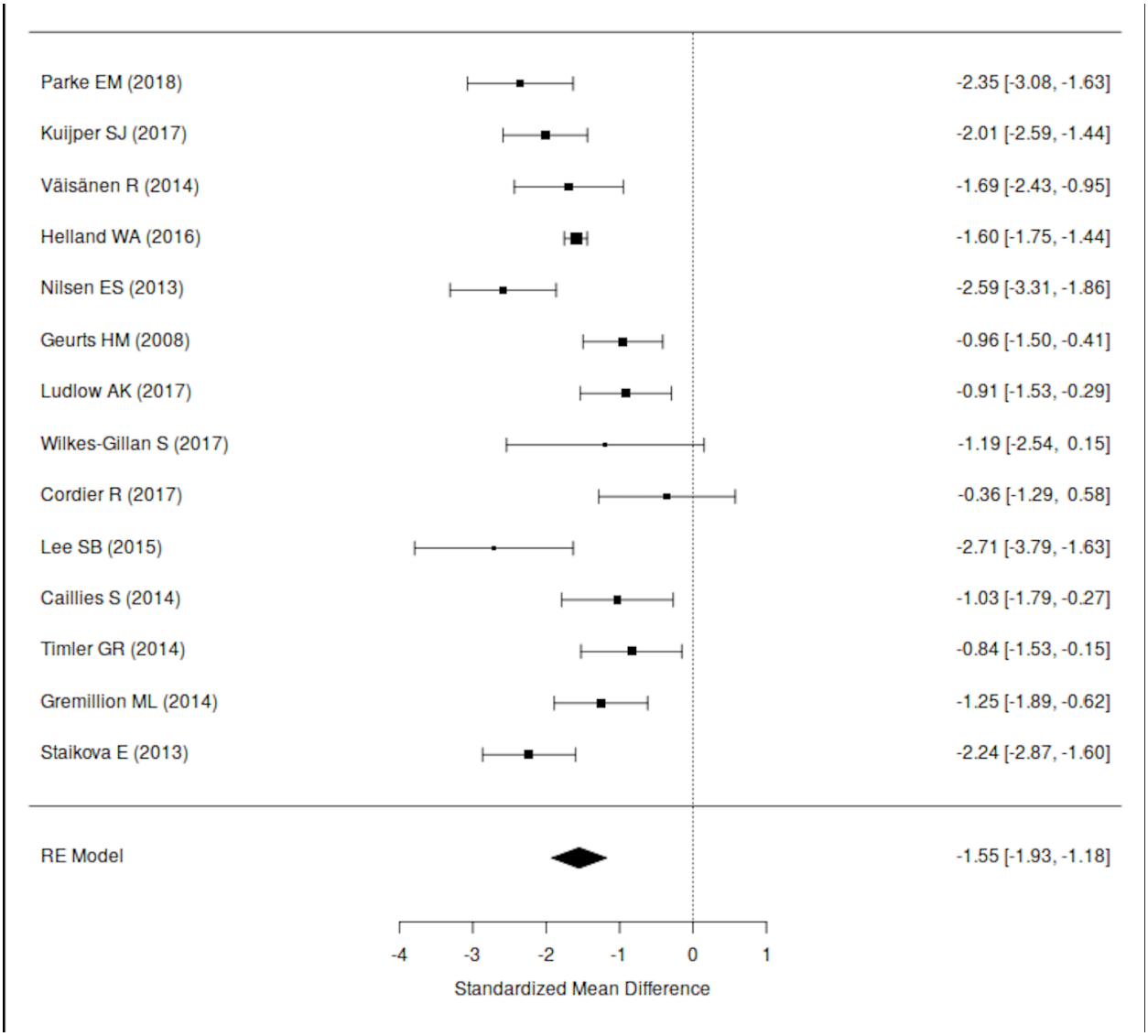

Figure 2: Overall average effect size for pragmatic language is displayed by the <> and effect size with confidence interval for each study comparing ADHD and TD populations. The size of the square indicates the sample size (i.e., smaller square = smaller sample size). The bar represents the confidence interval. If the bar does not touch the center line, this indicates a significant difference between groups. The diamond (<>) at the bottom is the combination of all studies, determining if they are significant. If the diamond is to the left, it indicates that pragmatic language is worse in ADHD groups. If it is to the right, it indicates that pragmatic language is better in ADHD groups. If it is touching the center line it indicates no significant difference. The diamond is very far to the left, indicating that pragmatic language is severely worse in ADHD groups.

4. Discussion

The purpose of this study was to conclusively determine pragmatic language deficits in ADHD populations as compared to TD populations by conducting a meta-analysis of previous studies on the topic. Previous research provides a base of results in agreement of support of such deficits but there has been no overall evidence that unequivocally verifies all of their claims. Therefore, it is important to quantify just how strong the connection is between ADHD and pragmatics across all the studies. Results of our meta-analysis gave an effect size of -1.55, a magnitude classified as very large, which conclusively demonstrated that ADHD populations show significantly lower pragmatic language abilities than their TD counterparts.

In every study included in the meta-analysis, at least some difference between the pragmatic skills of ADHD and TD populations was found. While two of the studies had results that did not reach statistical significance, both still found that ADHD pragmatic skills were worse to some degree. Further, these two studies had the smallest numbers of participants of all studies included in the analysis, which may well have negatively affected the results and their reliability. All other studies included in the meta-analysis had results that reached significance.

The fact that our effect size reached very large with multiple different pragmatic language measures being used in the studies and despite the results of two studies not reaching statistical significance provides conclusive evidence that pragmatic language is indeed significantly and negatively affected in ADHD populations. These results support and expand upon many of the results found in the studies in our analysis, including the study by Parke et al. (2018) that found moderate to large effect sizes characterizing ADHD children's lower scores on

a range of pragmatic language measures and the finding from Bishop & Baird (2001) of ADHD children being rated lower in pragmatics by parents and teachers than TD children and only slightly better than children with ASD (as cited in Staikova et al., 2013).

4.1. Implications

Our findings have important implications with regard to the assessment, evaluation, and treatment of populations with ADHD considering that they confirm the extent of pragmatic language difficulties these people face. Emphasizing pragmatic language abilities is undeniably important due to the necessity of these skills in everyday life, in both social and academic situations (Westby & Cutler, 1994, as cited in Leonard et al., 2011). Addressing any deficits in this domain is therefore essential because of the link between these deficits and a higher risk of various socio-emotional issues throughout life (Jerome et al., 2002, as cited in Cordier, Munro, Wilkes-Gillan, & Docking, 2013). Considering the crucial role these skills play in everyday life and socio-emotional well-being, along with the confirmation from our results that ADHD populations struggle significantly with them, it is clear that they should be addressed as a regular component of ADHD management.

Firstly, pragmatic language skills should be evaluated and assessed as part of routine diagnostic procedures for ADHD. They should also be examined in any children and adults who have already been diagnosed with ADHD who have not yet had their pragmatic language assessed. Treatment plans for ADHD should address pragmatic skills and should be tailored to the specific client's needs in this area using a variety of methods to help them best succeed. Finally, our results emphasize the general need for better awareness of the pragmatic language deficits in ADHD populations so that these recommendations can be carried out effectively.

4.2. Limitations and future research

Given the specific focus of our meta-analysis, one main limitation is that we did not look into or consider the treatment of ADHD and its deficits in our study. Therefore, it would be beneficial for future research to focus on this aspect. Additionally, our meta-analysis includes studies that examine pragmatic language only at one point in the participants' lives or only over a short period of a few months. Therefore, there seems to be a need for longitudinal research to more fully examine the quality of these skills in ADHD populations over the lifespan.

5. Conclusion

The present study represents the first meta-analysis, to our knowledge, of pragmatic language abilities in ADHD. Even though there are multiple studies on this topic, the results of our study are unique. They provide definitive evidence that there are significant pragmatic language weaknesses in ADHD despite differences in measures used and degrees of deficit found across multiple individual studies. The magnitude of these deficits has implications for the understanding and management of ADHD, including assessment throughout all stages of diagnosis and treatment, client-centered methods tailored to individual needs, and better awareness of these complications in general. More research is needed to determine best treatment practices to address pragmatic language in ADHD along with longitudinal patterns of these skills in ADHD.

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