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The Written Expression Abilities of Adolescents with Attention-Deficit/Hyperactivity Disorder

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Abstract

Students with Attention-Deficit/Hyperactivity Disorder (ADHD) often experience deficits in academic achievement. Written expression abilities in this population have not been extensively studied but existing prevalence estimates suggest that rates of comorbid writing underachievement may be substantially higher than rates of comorbid reading and mathematics underachievement. The current study examined written expression abilities in a school-based sample of 326 middle school age students with ADHD. The prevalence of written expression impairment, the associations between written expression and academic outcomes, and specific patterns of written expression were investigated. Students with ADHD in this sample experienced written expression impairment (17.2% – 22.4%) at a similar rate to reading impairment (17.0% – 24.3%) and at a slightly lower rate than mathematics impairment (24.7% – 36.3%). Students' written expression abilities were significantly associated with school grades and parent ratings of academic functioning, above and beyond the influence of intelligence. Analyses of patterns suggest that students with ADHD exhibit greater deficits in written expression tasks requiring organization and attention to detail, especially in the context of a complex task.

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder characterized by difficulties with sustained attention and/or hyperactive and impulsive behaviors (American Psychiatric Association, 2013). Prevalence estimates purport that 6–7% of school-age children meet diagnostic criteria for ADHD based on *DSM-IV-TR* standards, although the alteration in age of onset from 7 to 12 years of age for the *DSM-5* may increase these estimates (Vande Voort, He, Jameson, & Merikangas, 2014). Youth diagnosed with ADHD are at high risk of experiencing significant academic impairments (DuPaul & Langberg, 2014). One reason for this is that as many as 45% of students

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diagnosed with ADHD may meet criteria for a comorbid learning disability (DuPaul, Gormley, and Laracy, 2013; Tannock 2013). Currently, it is clear that youth with ADHD are significantly more likely than their peers to have deficits in basic reading and mathematics skills (Spira & Fischel, 2005). However, there is considerably less research on the written expression abilities (i.e., spelling, appropriate grammar/punctuation, and organization of written work) of students with ADHD. Some studies of writing in ADHD samples have estimated prevalence rates above 60% (e.g., Mayes & Calhoun, 2006). Given the importance of writing abilities for academic success (McHale & Cermak, 1992; Poplin, Gray, Larsen, Banikowski, & Mehling, 1980) additional research is needed to evaluate the prevalence of writing impairment in youth with ADHD and the impact of deficits in writing on academic functioning.

Identifying Impairment in Academic Abilities

Written expression is a broad construct that requires the use and management of many skill sets. Writers must coordinate everything from fine motor skills to executive functions to produce a written work. As a result, it can be challenging to accurately capture and quantify written expression impairment. One of the major goals of measuring written expression abilities is to identify students whose abilities do not meet expected milestones or standards. According to the *DSM-5*, a Specific Learning Disorder (SLD) diagnosis requires that skills in reading, mathematics, or written expression are significantly lower than expected and negatively impacting academic performance (American Psychiatric Association, 2013). Written Expression SLD can manifest as impairment in spelling, grammar/punctuation, and/or organization of the written product.

One of the most important steps in evaluating a student for a diagnosis of SLD is to develop operationalized criteria for determining whether the student is exhibiting academic skills that are below what is expected of them. Several methods are available in the current literature. For example, discrepancy models identify students with significant discrepancies between their basic cognitive abilities and their academic achievement (Erickson, 1975; Mercer, Jordan, Allsopp, & Mercer, 1996). Critics of discrepancy models argue that they may under-diagnose students with SLD who also have low intelligence (Stanovich, 1986). An alternative strategy that is particularly popular in educational systems is the Response to Intervention (RTI) approach. RTI follows a continuous pattern of intervention and assessment, and students in this model who do not respond to universal interventions may be eligible for an SLD diagnosis (Fuchs, Mock, Morgan, & Young, 2003). However, there is not a consensus on how to identify when a child is or is not responding to intervention in an RTI model (i.e., what degree of improvement should be observed), and therefore would meet criteria for an SLD diagnosis (Burns, Jacob, & Wagner, 2008).

Other approaches emphasize the role that academic underachievement should play in diagnosing individuals with SLD, (Fletcher et al., 2002; Siegel, 1999). A promising model proposed by Dombrowski, Kamphaus, and Reynolds (2004) is an underachievement model that incorporates a focus on academic impairment and consists of two simple yet important criteria. First, students must exhibit impairment on a norm-referenced measure of academic achievement as evidenced by a standard score at least 1 standard deviation below the

normative group mean (i.e., a score at or below 85). Second, students must demonstrate impairment in the classroom setting through poor grades or parent/teacher report. These criteria maximize the likelihood that children who are experiencing significant impairment in relation to their peers will be identified, but allows that this impairment may be related to low overall cognitive ability.

Written Expression Abilities of Students with ADHD

The available evidence suggests that youth with ADHD generate less organized written work, write fewer words, and make more mechanical errors (e.g., misspelled words and poor handwriting) in comparison to their peers (Casas, Ferrer, & Fortea, 2013; Re, Pedron, & Cornoldi, 2007; Resta & Eliot, 1994). Further, they appear to struggle in comparison to their non-ADHD peers even when they have equivalent knowledge about the basic rules of writing (Re & Cornoldi, 2010). However, there has been minimal research in the area and several significant limitations remain to be addressed.

First, prevalence estimates of written expression SLD vary significantly in this population, with rates ranging from as low as 9% (Del’Homme, Kim, Loo, Yang, & Smalley, 2007) to as high as 63% (Mayes & Calhoun, 2006). Further, the largest prevalence samples were obtained either exclusively or significantly from mental health clinics (DeBono et al., 2012; Mayes & Calhoun, 2007), which typically present with greater overall impairment in comparison to community samples (Gadow, Sprafkin, & Nolan, 2001; Goodman et al., 1997). Examining written expression SLD prevalence in a large school-based sample of students with ADHD may provide a more representative prevalence estimate.

Second, it is unclear whether written expression impairment contributes to the poor academic outcomes associated with a diagnosis of ADHD above and beyond other factors common in students with ADHD that also affect academics. Specifically, intelligence has been associated with many aspects of academic achievement (Mayes, Calhoun, Bixler, & Zimmerman, 2009; Watkins, Lei, & Canivez, 2007) and children with ADHD score 5–6 points lower on average on standardized tests of intelligence than children without the disorder (Frazier, Demaree, & Youngstrom, 2004). The severity and presentation (i.e., primarily inattentive or combined) of ADHD symptoms has also been shown to affect students’ academic performance (Barry, Lyman, & Klinger, 2002; Riccio, Homack, Jarratt, & Wolfe, 2006), and symptoms of oppositionality, which are highly comorbid in children with ADHD, have been found to have negative effects on aspects of academic functioning (Abikoff et al., 2002). Finally, psychostimulant medication – a primary mode of treatment for students with ADHD – may improve aspects of academics and writing in particular, although the evidence is currently mixed (Evans et al., 2001; Langberg & Becker, 2012). Accordingly, research is needed to evaluate whether written expression abilities contribute to the academic functioning of youth with ADHD above and beyond these factors.

Third, research has not investigated whether there are distinct patterns of written expression impairment in youth with ADHD. Previous studies have established that youth with ADHD struggle with several aspects of written expression (Casas et al., 2013; Re et al., 2007; Resta & Eliot, 1994). These results may indicate that a portion of students with ADHD struggle

with all facets of written expression, but it is also plausible that groups of students struggle in different areas. For example, some students may be able to effectively organize their written work, but struggle with grammatical errors while other students may write grammatically correct work that is poorly organized.

Current Study

The current study examined written expression abilities in a large ($N = 326$), school-based sample of adolescents with ADHD and sought to accomplish three main goals. First, the prevalence of written expression impairment was assessed and compared to the prevalence of impairment in other domains (e.g., reading and mathematics impairment). An RTI approach is not plausible in the context of the current study. As a result, prevalence rates were assessed using the remaining methods. The underachievement model was our primary model of interest, as current research suggests that these models are more valid than their discrepancy-based counterparts. Specifically, we followed the recommendations made by Dombrowski and colleagues (2004) to identify students who performed one standard deviation or more below the normative sample on a WIAT Composite score as impaired. Although there are questions about its validity, discrepancy models are still regularly used, so prevalence was also assessed using this method. To follow recommendations of Mercer and colleagues (1996) and to remain consistent with the underachievement model, a one standard deviation discrepancy criterion between performance on the abbreviated WISC-IV and the WIAT-III was used. It was hypothesized that the prevalence rates of written expression impairment in this sample would be lower than rates reported from clinic-referred samples (e.g., Mayes & Calhoun, 2006). Second, regression analyses were conducted to examine the association between written expression abilities and academic performance above and beyond cognitive abilities, ADHD/ODD symptoms, and ADHD medication use. Two follow-up exploratory analyses examined which specific aspects of writing may most prominently impact academics. Due to the increased role of written expression for middle school students, it was hypothesized that written expression abilities would significantly predict academic outcomes above and beyond covariates. Third, a latent profile analysis (LPA) was conducted to determine if distinct patterns of written expression impairment emerged within the sample. To date, no other subject-centered analyses of written expression for students with ADHD have been reported. The LPA is an exploratory analysis, and therefore no a priori hypotheses were made.

Methods

Participants

Participants who provided data for the current study were recruited as part of a larger study evaluating school-based interventions for middle school age adolescents with ADHD. All data evaluated in the present study were collected at baseline, prior to participants receiving any intervention. 326 middle-school students (grades 6–8) from nine public middle schools in the Eastern United States were recruited over three academic years. Participants were recruited using study announcement letters, fliers posted in each school, and direct referral by school staff. The mean household income for participant families was \$63,500 ($SD =$

55,500), and the mean level of maternal education was 14 years ($SD = 2.3$). The majority of the sample (232 participants; 71%) was male and 94 (19% of sample) were female. 77% of the sample self-identified as Caucasian, 12% identified as African American, 8% identified as Biracial, and 2% identified with another race. 101 participants (31%) were receiving accommodations at school through either Individualized Education Programs (IEPs) or 504 plans, and 153 participants (47%) were taking medication for ADHD. The basic cognitive functioning of this sample appeared to be average in relation to the general student population, as evidenced by a mean Estimated IQ score of 100.31 ($SD = 13.62$).

Procedure

Parents (or primary caregivers) who were interested in participating in the study contacted the research team and a brief telephone screen was conducted. A full inclusion/exclusion evaluation was scheduled if on the phone screen parents reported that their child had a previous diagnosis of ADHD or if they endorsed the presence of at least 4 DSM symptoms of inattention at clinically significant levels. During the evaluation, students were comprehensively assessed for an ADHD diagnosis. Each student and at least one parent was administered the Parent Children's Interview for Psychiatric Syndromes (P-ChIPS; Weller, Weller, Fristad, Rooney, & Schecter, 2000) by a doctoral student supervised by a licensed clinical psychologist. The P-ChIPS has shown high internal consistency and test-retest reliability (Fristad, Teare, Weller, Weller, & Salmon, 1998) and high convergent validity in relation to the Diagnostic Interview for Children and Adolescents—Revised—Child Version (Teare, Fristad, Weller, Weller, & Salmon, 1998). Parents and teachers of the students also completed the Disruptive Behavior Disorders rating scales (DBD; Pelham, Evans, Gnagy, & Greenslade, 1992). Finally, students completed a brief battery assessing their cognitive and academic achievement abilities, including four subtests from the Wechsler Intelligence Scale for Children—Fourth Edition (WISC-IV; Wechsler, 2003), and all subtests from the WIAT-III required to generate the Basic Reading, Mathematics, and Written Expression composites (see measures section for more detail). Participants were considered eligible for the study if they met full DSM-IV-TR diagnostic criteria for ADHD—Predominantly Inattentive or Combined presentation, had an estimated FSIQ of at least 80 according to performance on the WISC-IV, and did not meet diagnostic criteria for any pervasive developmental disorder, bipolar disorder, psychosis, or obsessive-compulsive disorder. Students with other comorbid diagnoses were allowed to participate in the study. Enrollment was limited to students with Inattentive and Combined Type because of the questionable validity of the Hyperactive-Impulsive type after elementary school (Willcutt et al., 2012) and because this was a school-based study and ADHD symptoms of inattention largely drive impairment in academic functioning (e.g., Galera et al., 2009; Massetti et al., 2008). Data collected from the evaluation of each student was comprehensively assessed by two doctoral level psychologists to determine study eligibility and any relevant comorbid diagnoses. Within the sample, 49% of students were diagnosed with ADHD, Combined Subtype and the remaining participants were diagnosed with ADHD, Predominantly Inattentive Subtype.

Written Expression/Academic Achievement Measures

Wechsler Individual Achievement Test, third edition (WIAT-III)—The WIAT-III (Wechsler, 2009) is a measure of academic achievement that has been standardized on a

nationally representative sample. The Basic Reading, Mathematics, and Written Expression Composite scores were used in this study, and all demonstrate high internal consistency ($\alpha = .94$) and moderate to strong correlations with comparable composite scores of the previous edition of the WIAT ($r_s = .83$). The subtests of the Written Expression Composite- Spelling, Sentence Composition, and Essay Composition- exhibit high internal consistency ($\alpha = .85$) and strong 2-week test-retest reliability ($\alpha = .79$). The Spelling subtest requires students to accurately write a word provided verbally and produces a single standard score for the subtest. The Sentence Composition subtest first requires students to combine multiple complete sentences (e.g., “Dogs have fur. Cats have fur.”) into a single sentence. Students are then asked to build a sentence from a key word (e.g., “than”). A separate component score is produced from each part of the Sentence Composition subtest. For the Essay Composition Subtest, students are given 10 minutes to write an essay about their favorite game and provide at least three reasons why they like the game. Two component scores are generated for this subtest: one score that evaluates the student’s development and organization of ideas and another that evaluates a student’s productivity (i.e., a word count). A supplemental score can also be generated based on the student’s appropriate use of grammar and mechanics.

For the current study, all subtests of the Written Expression Composite were scored by a team of research assistants supervised by a licensed clinical psychologist. Each scorer was trained by a lead scorer, which involved reading the WIAT manual thoroughly, scoring sample essays simultaneously with the lead scorer until agreement was achieved, and then scoring several essays on their own. The lead scorer then scored the same essays to check for inter-rater agreement. The lead scorer also conducted periodic checks of scored essays throughout the project in order to prevent drift.

Other Measures

Disruptive Behavior Disorders Rating Scale (DBD)—The DBD (Pelham et al., 1992) is a parent-report measure that examines the presence of both inattentive and hyperactive/impulsive symptoms of ADHD as well as the core symptoms of Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD). The 45-item scale asks parents to rate each symptom on a 4-point Likert scale. Internal consistencies for each domain examined by the DBD are strong (α values $\geq .81$). For the current study, the total scores from the inattentive, hyperactive/impulsive, and ODD symptoms domains were examined as potential covariates in the regression analyses.

Grade Point Average (GPA)—GPA is a numerical system commonly used for quantifying letter grades. A four point scale (4.0 = A, 3.0 = B, 2.0 = C, 1.0 = D, 0 = F) was used for the current study. Grades from the core subjects- English, Mathematics, Science, and Social Studies- were collected for each student. For the current study, grades were analyzed from the same semester that the evaluation appointment was conducted. Each grade was converted into a GPA, and then all four course GPAs were averaged into an overall GPA.

Weiss Functional Impairment Rating Scale (WFIRS)—The parent report version of the WFIRS (Weiss, 2000) is designed to assess an individual's overall functioning. This 50 item measure asks parents to rate how frequently or extensively their child's emotional or behavioral difficulties affect their functioning in a variety of life domains. Ratings are made on a 4-point Likert scale (0 = never or not at all, 3 = very often or very much), and it is important to note that higher scores are indicative of greater impairment (i.e., more problems). The WFIRS assesses functioning in 6 different domains: family, school, life skills, self-concept, social activities, and risky activities. Within the school domain, items assess either impairment in learning (e.g., "Needs tutoring") or impairment in behavior (e.g., "Suspended or expelled from school"). The WFIRS demonstrates high internal consistency across subscales, with α values ranging from .75–.93. For the current study, impairment in learning was analyzed as an outcome.

Analytic Plan

Before conducting analyses, Little's Missing Completely at Random (MCAR) test was used to ensure that data were not missing from subjects in a systematic manner (Little, 1988). Additionally, correlations comparing inattentive symptoms, hyperactive/impulsive symptoms, ODD symptoms, and medication status to GPA and WFIRS ratings were examined before conducting analyses. If one of these variables was significantly correlated with an academic outcome, it was controlled for in the hierarchical regression analysis.

To assess the prevalence of written expression impairment, the overall Written Expression Composite score was compared to the Basic Reading and Mathematics Composite scores. Impairment in all three domains was assessed using both the discrepancy model (1 SD difference between cognitive and academic scores) and the underachievement model (1 SD below the mean of the norm-referenced sample (i.e., a composite score below 85). As noted earlier, the one standard deviation threshold was selected in adherence to the recommendations made by Dombrowski et al. (2004) for the underachievement model and Mercer et al. (1996) for the discrepancy model. These thresholds have also been used in multiple other ADHD and LD comorbidity studies (e.g., Langberg, Epstein, Urbanowicz, Simon, & Graham, 2010; Dietz & Montague, 2006), making comparisons between the studies easier. A Chi-Square test of independence was conducted to evaluate whether the underachievement and discrepancy methods identified significantly different groups of students as meeting criteria for written expression impairment.

To identify associations between written expression and academic outcomes, regression analyses were conducted. Because of the strong associations between intelligence and both academic outcomes and written expression abilities, regression analyses included estimated IQ as a covariate. Two hierarchical analyses included IQ and any covariates identified in the correlation matrix in the first step of the model and the Written Expression Composite score in the second step. Two additional exploratory analyses were also conducted, which included each Written Expression component/supplementary score and the Spelling subtest score as simultaneous predictors of the dependent variables. To reduce the number of variables in the models, no covariates were included in the exploratory analyses.

To examine patterns of written expression abilities, WIAT scores were analyzed through a latent profile analysis (LPA), which was conducted using Mplus Version 6.11 (Muthén & Muthén, 1998–2010). Six available standard scores that represent different written expression abilities were used as indicators to build the model. The model included students' estimated IQ scores as a covariate. Five criteria for determining the appropriate number of profiles for this sample were used: theoretical rationale, the presence of profiles that may be reasonably replicated (i.e., no profile contains less than 5% of entire sample), the Bayesian Information Criterion (BIC), the Vuong-Lo-Mendell-Rubin test (LMR), and the bootstrapped parametric likelihood ratio test (BLRT). A model is considered a better “fit” to the data if its BIC value is lower than other models and a model with k profiles is considered better than a model with $k-1$ profiles if the LMR and/or the BLRT are significant (Nylund, Asparouhov, & Muthén, 2007).

Results

Pre-Analysis

All independent variables met the assumptions of normality, so transformation was not necessary, and Little's MCAR test resulted in a nonsignificant p -value ($p = .45$). When correlating academic outcomes with parent reports of ADHD and ODD symptoms, both ADHD symptom domains and ODD symptoms were significantly correlated with WFIRS ratings ($r_s = .27$ to $.39$), but none were correlated with GPA ($r_s = -.06$ to $-.11$). Conversely, medication status was significantly correlated with GPA ($r = .21$), but not with WFIRS ratings ($r = -.105$). Thus, symptoms of inattention, hyperactivity/impulsivity, and oppositionality were included as covariates in the regression for WFIRS ratings, and medication status was controlled for in the GPA regression. The Written Expression Composite score was moderately correlated with both GPA and WFIRS ratings ($.358$ and $-.277$, respectively). These correlations were similar to the correlations between the academic outcomes and the Basic Reading Composite ($.296$ and $-.255$) as well as the Mathematics Composite ($.445$ and $-.273$).

WIAT-III Written Expression Performance and Prevalence of Impairment

Descriptive statistics for students' Written Expression, Basic Reading, and Mathematics Composite scores of the WIAT-III are presented in Table 1. Students' estimated FSIQ scores are also provided in this table. Table 2 presents the rates of reading, mathematics, and written expression impairment in this sample according to the discrepancy model and the underachievement model. Approximately 46% of the sample was identified as impaired in at least one of the three domains according to the underachievement method, a figure which is remarkably consistent with the recent DuPaul and colleagues (2013) review. Students were most commonly impaired in mathematics according to both methods, consistent with other studies documenting high prevalence of math problems among samples of ADHD (e.g., Capano, Minden, Chen, Schacher, & Ickowicz, 2008). After students were classified for written expression impairment via each method, a Chi-Square test of independence was conducted to determine whether knowing a student's diagnostic status based on one method was significantly related to their diagnostic status based on the method. The results of the

Chi-Square test were nonsignificant ($\chi^2 = 2.72, p = .10$), suggesting that different groups of students were identified through the two methods.

Associations Between Writing and Outcomes

Table 3 shows the results of the two hierarchical multiple regression analyses when the Written Expression Cluster score was included as a predictor. For the first model, GPA was the academic outcome of interest. The final model was statistically significant, and Written Expression Composite scores significantly predicted students' GPA above and beyond the effect of IQ and reading abilities. Written Expression scores accounted for an additional 1% of the variance in GPA for this sample. The second regression model used WFIRS School-Learning subscale scores as the outcome. The first step of the model included IQ, inattentive symptoms, hyperactive/impulsive symptoms, and ODD symptoms. The second step included the Written Expression Composite. Like the GPA model, this final model was also statistically significant, and Written Expression Composite score significantly predicted students' GPA above and beyond the effect of the covariates. Written Expression scores accounted for an additional 5% of the variance.

Because both hierarchical regression models were significant, follow-up exploratory multiple regression analyses for GPA and WFIRS scores were conducted. Each of these models included students' component/supplementary scores from the Sentence Composition and Essay Composition subtests and Spelling subtest scores as predictors in each model. These scores were modestly to moderately correlated with one another ($r_s = .13 - .55$) and all variables demonstrated acceptable VIF values (< 10), indicating that the scores were not multicollinear. Together, the component/supplementary scores significantly predicted both student GPA and WFIRS scores in their respective models (p values $< .001$). For the model predicting GPA, the Theme Development and Organization of Text component score was the only significant predictor ($\beta = .17$). In contrast, Spelling scores ($\beta = -.15$) and Grammar and Mechanics scores ($\beta = -.17$) were significant predictors in the model predicting the WFIRS.

Latent Profile Analysis of Written Expression Abilities

The majority of fit statistics for the LPA indicated that either a four-profile or a five-profile solution best fit the data. The four-profile solution met all required model fit criteria. In contrast, the five-profile solution violated two selection criteria. Specifically, the five-profile solution produced a nonsignificant LMR test and included a profile that only consisted of 2.2% ($n = 7$) of individuals from the sample. Therefore, the four-profile solution was determined to be the optimal model for this sample, and the estimated mean scores for each WIAT score are presented in Figure 1. In this model, a general pattern was observed within each profile; specifically, the tasks that required the most organizational skills and attention to detail (e.g., Theme Development/Organization of Text and Grammar/Mechanics) were among the lowest scores in the profiles. The "Poor Writer" profile exhibited this pattern with mean scores generally at or below 90, and the "Average Writer" profile, exhibited this pattern with mean scores within the Average range of the normative sample (90–110). The "Poor Essayist" Profile also exhibits this pattern, although there is a larger discrepancy between the highest and lowest scores. Interestingly, the "Good Writer" profile does not

appear to exhibit this same pattern, but instead shows mean scores above the normative mean in all tasks.

Discussion

This study sought to evaluate the prevalence of written expression impairment in a large sample of middle school age adolescents with ADHD and associations between writing abilities and academic impairment. In addition, specific patterns of writing abilities were explored using Latent Profile Analyses. Approximately 1 in 5 (22%) of students were identified as impaired in their written expression abilities using an underachievement method, and 17% were identified as impaired using a discrepancy method. Importantly, written expression abilities were associated with both school grades and parent perceptions of academic functioning above and beyond the influence of intelligence. Overall, the findings indicate that written expression impairment in ADHD exhibits a global pattern, with a majority of students exhibiting greater difficulty with tasks that require more attention to detail and organizational skills.

In regards to the prevalence of written expression impairment, the results supported the hypothesis that rates would be lower than previously reported estimates from clinic-based samples. Indeed, the prevalence of written expression underachievement in this sample (22%) was significantly lower than clinic-based estimates (e.g., 63%; Mayes & Calhoun, 2006). Previous research has shown that clinic-based samples tend to exhibit greater impairment in a variety of domains in comparison to non-clinic samples (Gadow et al., 2001; Goodman et al., 1997). Therefore, clinic-based prevalence rates likely provide an overestimate of the true prevalence of writing impairment associated with ADHD. The two diagnostic methods also identified different groups of students as impaired, which is consistent with previous literature (Siegel, 1999; Stanovich, 1986). Interestingly, the discrepancy method resulted in a smaller proportion of students in the sample being identified with written expression impairment. This finding supports the hypothesis that differences in prevalence rates found in this study as compared to past research are likely due to sample characteristics, rather than to the methods used to identify impairment. It is important to note that although the rate of written expression impairment in this sample was lower than previous clinic-based ADHD estimates, the rate according to the underachievement model (22%) is still higher than estimates reported in general population samples (8–15%) (Lyon, 1996; Yoshimasu et al., 2011), and is similar to the rate of reading impairment found in this sample (24%).

The results of the hierarchical regression analyses generally supported the hypothesis that written expression abilities are significantly associated with academic outcomes. At the bivariate level, writing was significantly associated with GPA ($r = .358$) and with parent-rated academics ($r = -.277$) at levels comparable to that of reading ($r_s = .296$ and $-.255$) and mathematics ($r_s = .445$ and $-.273$). It should be noted that in the regressions written expression abilities accounted for only a small increase in the predictive ability of the models above and beyond covariates, explaining an additional 1% of the variance for GPA and 5% for WFIRS ratings. In the final model predicting GPA, intelligence accounted for the largest portion of the variance and in the model predicting parent ratings of academics,

inattentive symptoms accounted for the most variance (see Table 3). The results of the exploratory regression analyses with all of the written expression subscales included separately varied depending on the academic outcome of interest. Specifically, students' ability to develop organized and coherent written products was significantly associated with their GPA. In contrast, their spelling and grammar abilities were associated with their parents' perceptions of their learning on the WFIRS. These associations may result from differences in teacher and parent experiences. Given that there is a shift to complex writing tasks as a central form of evaluation as students transition to middle school (Poplin et al., 1980), teachers are likely to place high value on the content of students' work. Parents, on the other hand, are more likely to have spent significant time helping their children with homework by checking for careless mistakes with spelling, punctuation, and capitalization. Specifically, lack of attention to detail and making careless mistakes are core symptoms of ADHD, and parents frequently report that their children with ADHD rush through homework assignments (Power, Werba, Watkins, Angelucci, & Eiraldi, 2006). Indeed, multiple studies have found that students with ADHD made significantly more grammatical mistakes and spelling errors than their non-ADHD peers, and these differences emerge as early as nine years of age (Casas et al., 2013; Re et al., 2007). Thus, although middle school teachers are focused on teaching and evaluating complex writing skills such as theme organization and these skills in turn impact grades (i.e. GPA), careless mistakes with spelling and punctuation are likely to remain most salient from the parent perspective.

The individual writing subscales included in the exploratory regression analyses were also evaluated in an LPA. Of the profiles presented in the model, the majority appears to indicate that students with ADHD have more difficulty with tasks requiring increased attention to detail and organizational abilities. Profiles presented in a graded fashion; for example, mean scores in the "Poor Writer" profile were consistently lower than profiles in the "Average Writer" profile. The "Poor Essayist" profile showed the largest disparity between the scores of the basic writing tasks and the tasks requiring more organizational skills and attention to detail. This is not surprising, given that lack of attention to detail and difficulties with organization are core symptoms of ADHD. The "Good Writer" profile, however, did not fit this global pattern. The estimated mean scores in this profile were consistent across all tasks. This profile may represent a resilient group of students with ADHD who have average to above-average writing abilities in comparison to their non-ADHD peers.

Limitations

Although the current study makes several significant contributions to the literature, its methodology also presents some limitations. The cross-sectional nature of the data precludes causal relationship conclusions from being drawn regarding students' written expression abilities and their academic outcomes. The cross-sectional data also fails to provide information about changes in written expression abilities over time. As a result, it is not clear whether the patterns elicited from the LPA are stable over time. For example, it is possible that the unique group of students struggling to put their skills together to generate a high quality essay may merge with those students who are globally skilled writers as they get more practicing creating complex written products. Finally, this study purposely limited the academic outcomes examined to two; one school-based metric (i.e. GPA) and one based

upon parent perceptions. There are many ways to evaluate academic functioning and it is unclear whether the findings would generalize to other metrics, such as student or teacher perceptions of academics or statewide achievement tests.

Clinical Implications

The results of this study have a number of important clinical implications for educators and clinicians who work with middle school age adolescents with ADHD. First, written expression impairment is clearly a common phenomenon in this population. Therefore, it is important to consider specifically screening students' written expression abilities if they meet criteria for ADHD. However, the methodology used in the current study presents a practical limitation for educators and clinicians. The WIAT Written Expression subtest requires a significant time commitment to administer (30 minutes) and score (30–45 minutes) and may not be feasible to administer for screening purposes. Other, more feasible strategies include using a brief screening tool or evaluating a written assignment using holistic ratings or CBM strategies. Regardless of the method chosen, it is important to note that there are questions about the stability of LD diagnoses when relying on standardized testing. For example, Silver and colleagues (1999) found that only around half of students who met criteria for an LD diagnosis based on testing results met criteria at a 19-month follow-up. These findings suggest that testing from a single time point may be unreliable and that additional evidence is needed for a diagnosis even if students screen positively for LD based on test scores. Schools using the RTI model would likely use a more comprehensive strategy, such as broadly and quickly screening at Tier 1 and following up with those students who are struggling despite evidence-based classroom practices with more intensive screening at Tier 2. Alternatively, educators could first focus on the educational impairment aspect of Dombrowski et al.'s (2004) dual-deficit model. This strategy could involve a systematic review of students' grades and statewide standardized achievement scores and gathering feedback from parents and teachers regarding written expression abilities. Students who are classified as exhibiting writing impairment using those methods would then be assessed using the WIAT or another appropriate tool. It should also be noted that evaluating student performance on standardized tests of academic achievement is only one aspect of a complex process of determining the validity of an SLD diagnosis. The student's academic history should be considered, and a number of alternative explanations for poor academic performance (e.g., sensory/motor deficits, language barriers) should be examined before a diagnosis is given.

The association found in this study between written expression abilities and academic outcomes above and beyond reading and intelligence suggests that targeted writing intervention could lead to improved academic outcomes. Unfortunately, current psychosocial interventions for ADHD do not incorporate writing skills (Evans, Owens, & Bunford, 2014), and evidence for interventions that target written expression abilities is scarce. The few interventions that have been investigated in the literature are varied in their focus. For example, Self-Regulated Strategy Development (SRSD) is an intervention – which can be implemented in a one-on-one, small group, or classroom-wide setting – designed to improve students' planning and organization skills when creating written work (Jacobson & Reid, 2012; Lane et al., 2008). In contrast, assistive technology interventions (e.g., word

processing programs) target the skills necessary to translate a general plan into a written product (Hetzroni & Shrieber, 2004; Quinlan, 2004). For some students, specifically those who appear to struggle with the complex task of composing an essay, using an intervention such as SRSD that focuses on helping students plan and organize their written work is likely to lead to improvement on its own. However, given the results of the current study suggest written expression impairment in students with ADHD is largely global in nature, using interventions that only target a subset of writing skills may leave students impaired in other domains. Finally, writing interventions may need to be tailored to be effective for students with ADHD who often have significant difficulty maintaining focus during academic tasks. Specifically, it seems likely that at a minimum, evidence-based behavior management strategies will need to be incorporated into the writing intervention curriculum.

Future Directions

To expand upon this study's findings, future research should seek to accomplish several goals. To the best of our knowledge, this was the first study to evaluate the association between writing and academic outcomes in a sample of youth with ADHD, above and beyond important covariates. However, the study was cross-sectional and a significantly more compelling case for intervention would exist if there were evidence that written expression abilities at an earlier time point predicted academic outcomes at a later point. Similarly, a longitudinal evaluation of changes in written expression abilities would also advance the literature. It is possible that students with ADHD are simply delayed in their written expression development, and they may eventually catch up to their peers. On the other hand, these patterns may persist over time or worsen as the importance of written expression for academic success continues to increase in high school and postsecondary education settings. In essence, longitudinal studies would shed light on whether there is truly a need for specific writing interventions for students with ADHD. Further research also needs to be conducted to determine how current ADHD treatment options – specifically stimulant medication use – impacts written expression. Current evidence is mixed, but there is some support that stimulant medication may lead to indirect improvement in academic skills, including written expression (Evans et al., 2001). Stimulants may have similar effects on the writing process. Completing a writing assignment requires long periods of sustained attention, and stimulant medication may facilitate students' abilities to maintain their attention throughout the task. However, medication will likely have a smaller impact on students' coherent organization of ideas. Additional work is needed to determine what, if any, improvements can be observed through stimulant medication use.

Conclusions

In summary, in a large school-based sample of adolescents with ADHD, approximately 1 in 5 students exhibited written expression impairment. Further, written expression abilities were found to be associated with both grades and parent perceptions of academic success above and beyond intelligence and other relevant covariates. The majority of students in the sample exhibited competence in basic writing tasks (e.g., spelling and sentence composition) and worse performance in more complex tasks (e.g., essay composition). One group, labeled "poor essayist" (16% of sample), demonstrated above average competence in basic writing

tasks but had average scores on the essay composition tasks that were nearly two standard deviations below their basic writing scores. Future longitudinal research is needed to uncover the full impact of writing abilities on the academic success of students with ADHD, especially as the importance of writing continues to increase as students move through middle school and into high school.

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Highlights

- Written Expression impairment examined in sample of 326 adolescents with ADHD
- Rates of written expression impairment were similar to reading and math impairment
- Rates in this school sample were lower than previously reported clinical samples
- Writing abilities predicted GPA and parent ratings beyond IQ and other covariates
- Organization and attention to detail were most difficult aspects of writing process

Figure 1.

4-class Solution for Latent Profile Analysis of Written Expression Abilities

Note. Percentages displayed next to class names indicate total proportion of sample whose scores are best represented by the estimated mean scores of that particular class.

Table 1

Descriptive Statistics of Students' FSIQ, Reading, Mathematics, and Written Expression Scores

Variable	Mean $\pm$ SD	Median Score
Estimated FSIQ	100.31 $\pm$ 13.62	98
Basic Reading	95.30 $\pm$ 14.19	97
Mathematics	90.93 $\pm$ 14.85	89
Written Expression	95.29 $\pm$ 13.17	93

Table 2

Prevalence Rates of Academic Impairment in Reading, Mathematics, and Written Expression

Academic Domain	<i>Underachievement Model</i>		<i>Discrepancy Model</i>	
	Total Students	Percent of Sample	Total Students	Percent of Sample
Reading	79	24.3	55	17.0
Mathematics	118	36.3	80	24.7
Written Expression	73	22.4	56	17.2
<i>Number of Impaired Domains</i>	--	--	--	--
None	174	53.5	198	60.7
One	72	22.1	71	21.8
Two	39	12.0	30	9.5
Three	40	12.3	19	6.0

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