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Multi-Informant Assessment of ADHD Symptom-Related Impairments Among Children and Adolescents

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Existing methods of assessing attention-deficit/hyperactivity disorder (ADHD) are limited because they do not examine impairments in relation to symptoms of ADHD. This study investigated parent and teacher ratings of multiple domains of impairment, assessed in relation to the symptom dimensions of ADHD using the ADHD Rating Scale–5. Nationally representative samples of children rated by parents and teachers were recruited through commercial research firms. One sample included 2,079 parents who rated one of their children of age 5 to 17 years. The second sample included 1,070 teachers in grades K to 12 who rated 2 randomly selected students on their class rosters. Informants rated the extent to which each child displayed the 18 behaviors symptomatic of ADHD over the previous 6 months, as well as symptom-related impairments in the areas of family/teacher relationships, peer relationships, academics, behavior problems, homework, and self-esteem. Respondents were asked to complete the 6 impairment items after rating each of the Inattention and Hyperactivity/Impulsivity symptom items. For both informants a 6-factor model that combined impairment items across source of impairment was adequate and superior to a 2-factor structure based on source of impairment (i.e., impairment due to Inattention vs. Hyperactivity-Impulsivity). Impairment ratings were impacted by child demographic factors, but effect sizes were low. In contrast, impairment ratings were strongly related to ratings on the ADHD symptom dimensions. The study provides support for assessing 6 symptom-related domains of impairment but does not support differentiating whether Inattention or Hyperactivity-Impulsivity is the source of impairment.

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Mental health disorders are characterized by a set of symptoms as well as symptom-related distress to the person and/or impairment in one or more important domains of functioning (American Psychiatric Association [APA],

2013). Specifically, the diagnosis of attention-deficit/hyperactivity disorder (ADHD) is characterized by (a) elevated levels of inattention and/or hyperactivity/impulsivity symptoms, and (b) symptom-related impairments "that interfere with, or reduce the quality of, social, academic, or occupational functioning" (American Psychiatric Association, 2013, p. 60). Based upon this conceptualization and diagnostic framework, guidelines for clinical practice stipulate that the assessment of ADHD ought to consist of an evaluation of both symptoms and associated impairments as reported by multiple informants (American Academy of Child and Adolescent Psychiatry, 2007; American Academy of Pediatrics, 2011). The assessment of impairment is essential for diagnostic decision making but is also important in developing intervention plans and evaluating outcomes. Historically, the focus of ADHD assessment has been on examining symptoms; the development of measures of impairment has lagged substantially (Fabiano et al., 2006; Pelham, Fabiano, & Massetti, 2005).

Many approaches have been used to assess impairments related to ADHD. A commonly used method is to administer a measure of global impairment, such as the Columbia Impairment Scale (Bird et al., 1993). Also, the Global Assessment of Functioning scale, recommended in previous versions of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*), has been used by clinicians to rate overall level of functioning on a continuum of mental health and illness. This scale was omitted from the *DSM-5* because of lack of conceptual clarity of the measure and questionable psychometric properties (American Psychiatric Association, 2013).

A second approach has been to administer multiple measures to assess a range of impairments, such as homework performance, academic performance, and behavior problems. A limitation of this approach is that it may be inefficient to administer several scales, and the use of this approach does not examine symptom-specific impairment.

A third approach is to use a measure that assesses multiple domains of impairment that commonly arise among children with ADHD (e.g., Impairment Rating Scale [IRS]; Fabiano et al., 2006). This method is highly useful in that it provides a multi-informant assessment of impairment in an efficient manner (i.e., seven items). A limitation is that although cut-points for scoring have been identified, normative information is not provided. In addition, the IRS does not provide an integrated assessment of both ADHD symptoms and related impairments.

A fourth method has been to rely on broad-band measures of symptoms and areas of impairment or adaptive functioning, such as the Child Behavior Checklist and Teacher Report Form (Achenbach & Rescorla, 2001) or the Behavior Assessment System for Children–Second Edition (Reynolds & Kamphaus, 2004). These methods assess multiple domains of impairment and examine both symptoms and impairment. A limitation is that they are inefficient for screening because they are lengthy and tap domains not relevant in all cases. Further, these approaches do not yield an assessment of symptom-related impairment.

Another approach is to use a measure of ADHD symptoms that includes impairment items, such as the Vanderbilt ADHD Rating Scale (Wolraich et al., 2003) and the Conners 3 (Conners, 2008). A disadvantage is that some important domains may not be included (e.g., Conners 3 does not include items about classroom behavior and self-esteem; the Vanderbilt scales do not include items pertaining to homework and self-esteem). In addition, these methods do not assess symptom-related impairment.

A problem with all of the existing measures is that they do not assess impairments specifically related to ADHD symptoms as opposed to other conditions that can either co-occur with or mimic ADHD. Further, existing measures do not specify impairment related to each ADHD dimension, which may be important for children with ADHD who have elevations in only one symptom dimension. In addition, many of the existing measures do not provide a sufficiently comprehensive assessment of domains of impairment pertinent to youth with ADHD.

The recently developed ADHD Rating Scale–5 (ARS-5; DuPaul et al., 2015) allows for simultaneous assessment of ADHD symptoms and symptom-related impairment for purposes of assessment, treatment development, and outcome evaluation. The ARS-5 was designed to address the limitations of existing measures in that it (a) provides a broad assessment of impairments associated with ADHD, (b) integrates the assessment of symptoms and impairments in the same measure, (c) focuses on impairments specifically related to ADHD symptoms, and (d) differentiates impairment related to each ADHD symptom dimension.

The overall purpose of this study was to examine the psychometric properties of the impairment items of the ARS–5. More specifically, the goals of this study were the following:

1. Explore the factor structure of the ARS-5 impairment items. Given that this was the first study of ADHD symptom-related impairment, it was unknown whether the scale would consist of two global factors, one pertaining to impairment related to Inattention symptoms and the other pertaining to impairment related to Hyperactivity-Impulsivity, or multiple factors aligned with the various areas of impairment assessed.
2. Examine the relationship between ratings of impairment and symptom dimensions. Based on prior research, it was expected that the Inattention dimension would have particularly strong bivariate correlations with academic and homework functioning and the Hyperactivity-Impulsivity dimension would have particularly strong correlations with behavior and peer

problems (Massetti et al., 2008; Nigg, 2001; Willcutt et al., 2012).

3. Examine whether impairment ratings vary as a function of child demographic factors. It was expected that boys would receive higher impairment ratings than girls (Evans et al., 2013) and impairment ratings would decline with advancing age, consistent with lower ADHD symptom ratings as children mature (DuPaul et al., 2015). There has been insufficient research to formulate hypotheses for race/ethnicity.
4. Examine whether ratings of impairment vary as a function of ratings of symptom frequency on each ADHD symptom dimension, and examine whether ratings of impairment vary as a function of clinically elevated symptom counts for Inattention, Hyperactivity-Impulsivity, and both dimensions. Controlling for demographic factors, we expected the frequency of Inattention symptoms, and clinical elevations on this dimension, to be especially related to academic impairment and the frequency of Hyperactivity-Impulsivity symptoms, and clinical elevations on this dimension, to be particularly related to behavioral and peer problems (Massetti et al., 2008; Nigg, 2001; Willcutt et al., 2012).
5. Generate normative data for each impairment scale for parent and teacher informants.

METHOD

Participants

Two samples were recruited. One sample included 2,079 parents and guardians (1,131 female, 948 male) who completed the ARS-5 for one of their children selected at random. Parents and guardians were predominantly White non-Hispanic (64.1%) and ranged in age from 20 to 77 years old (M = 41.57, SD = 8.23). Most parents were married (79.7%), had at least high school education or greater (89.9%), and were employed (72.3%). Median household income was between $60,000 and $74,999. English was spoken in most (89.4%) households. The children (N = 2,079; 1,037 male, 1,042 female) rated by the parents ranged in age from 5 to 17 years old (M = 10.68, SD = 3.75). Children were from White non-Hispanic (53.9%), Black non-Hispanic (13.1%), Asian non-Hispanic (5.7%), Hispanic (23.4%), and other (3.9%) backgrounds.

The second sample included 1,070 teachers (766 female, 304 male) who completed the ARS-5; each teacher rated two randomly selected students (one male, one female) on their class rosters. Teachers were predominantly White non-Hispanic (87.3%) and reported a mean of 17.88 years of teaching experience. The teacher sample included general (83.5%) and special (16.5%) education teachers. The students (N = 2,140; 1,070 male, 1,070 female) rated by the teachers ranged in age from 5 to 17 years old (M = 11.53, SD = 3.54) and attended Kindergarten through 12th grade. Most students attended general education classrooms (83.2%) and were from White non-Hispanic (54.8%), Black non-Hispanic (12.7%), other non-Hispanic (7.0%), Hispanic (24%), or biracial non-Hispanic (1.5%) backgrounds.

Measures

ADHD symptom ratings. Parents and teachers reported the frequency with which each child displayed the 18 symptomatic behaviors of ADHD over the previous 6 months using the ARS-5 Home and School versions, respectively. With permission from the APA, items were created based on the wording of ADHD symptoms from the *DSM-5*. Parents and teachers indicated the frequency of each behavior on a 4-point Likert scale: 0 (*never or rarely*), 1 (*sometimes*), 2 (*often*), and 3 (*very often*). The nine inattention items were listed separately from the nine hyperactivity-impulsivity items and were summed to arrive at separate scores for each factor. Parents whose primary language was Spanish (n = 236; 11.4%) completed a version of the ADHD RS-5 that included 18 symptom items using wording from the Spanish edition of the *DSM-5*. The two-factor structure (inattention, hyperactivity-impulsivity) of the 18 ADHD symptom items was confirmed by factor analyses and found to be invariant across child demographic factors (DuPaul et al., 2015).

ADHD impairment ratings. The ARS-5 also included items reflecting six domains of impairment that are common among children with ADHD and included on many measures that assess impairment/adaptive functioning (e.g., Achenbach & Rescorla, 2001; Conners, 2008; Fabiano et al., 2006; Wolraich et al., 2003). One domain assessed by the ARS-5 is relationships with significant others (family members for the home version and teachers for the school version). A second domain is peer relationships, which are frequently impaired among children with ADHD (Barkley, 2015). A third domain is academic functioning, which is perhaps the most common impairment among children with ADHD, especially for those with the Inattentive and Combined presentations of the disorder (DuPaul & Stoner, 2014). A fourth domain is behavioral functioning; impairment due to disruptive behavior has been universally recognized and is extremely common among children with the Hyperactive-Impulsive and Combined presentations of ADHD (Barkley, 2015). A fifth domain assessed is homework functioning. Although items pertaining to homework are not included on most existing measures of ADHD, homework problems represented a significant area of impairment for children and teens with ADHD (DuPaul & Stoner, 2014). A sixth domain is self-

esteem, which is often impaired among children with ADHD due to the disproportionate amount of punitive feedback these children receive from adults and peers (Barkley, 2015). Although not included on most impairment scales, an item pertaining to self-esteem is included on the IRS (Fabiano et al., 2006).

Each of these six domains was assessed using the parent and teacher versions of the ARS-5. Respondents completed each set of six impairment items twice, first after rating the inattention symptom items and again after rating the hyperactivity-impulsivity items. They were asked, "How much do the above behaviors cause problems for your child (this student)." Items were rated on a 4-point scale (*no, minor, moderate, severe* problem). Parents whose primary language was Spanish (n = 236; 11.4%) completed the items in Spanish. The translation process involved (a) initial translation into Spanish, (b) independent review by two specialists trained in language elements of diverse cultures, (c) collaboration between independent reviewers, and (d) involvement of a senior translator/researcher, if necessary, to resolve differences.

Procedures

Parents were recruited through GfK, a national research firm. All parent (N = 2,079) respondents were recruited through the GfK KnowledgePanel to provide a sample of children representative of the U.S. population in terms of race, ethnicity, and geographic distribution. Panelists were selected using address-based sampling that allows probability-based sampling of addresses from the U.S. Postal Service's Delivery Sequence File. Individuals residing at randomly sampled addresses were invited to join KnowledgePanel through a series of mailings (in English and Spanish); nonresponders were phoned when a telephone number could be matched to the sampled address. A total of 4,219 individuals were initially contacted to participate, with 2,708 (64.2%) completing ratings and 2,079 (76.8%) qualifying based on desired quotas for child demographics. If more than one child between the ages of 5 and 17 was present in a given household, then parents were asked to provide ratings for one randomly selected child such that the number of cases was balanced across gender and age range.

Teacher data were collected via two national research firms: GfK Knowledge Panel and e-Rewards. Initially, 1,509 teachers on the KnowledgePanel were assigned to complete ratings. Of these, 1,019 (67.5%) completed ratings and 474 (46.5%) qualified on the basis of meeting targets for demographic variables based on census data. To obtain the desired sample size of 2,000 students, additional teachers were recruited through e-Rewards Market Research; e-Reward panelists are selected based on having a relationship with a business (e.g., Pizza Hut, Hertz, Macy's). Respondents answer a profiling questionnaire when enrolling and provide information regarding employment status. The e-Rewards respondents indicated employment as a full-time, regularly employed (i.e., not substitute) teacher. A total of 12,610 teachers were invited to participate; 1,399 (11.1%) completed ratings, with 596 (42.6%) qualified for inclusion on the basis of student demographics (i.e., child grade, race, ethnicity, and geographic region). All teachers were asked to provide ratings for one randomly selected boy and girl on their class roster. Each student was selected based on a randomly generated number provided in the instructions. Secondary school teachers were instructed to provide ratings for one randomly selected male and female in a randomly selected class. The sample was recruited such that the number of cases was balanced across age and grade range.

Ratings were completed using a web-based survey. Respondents received stipends (less than $5) for completing ratings. Complete data sets were produced for more than 99% of child ratings.

Data Analyses

Only 11 cases were missing data from the parent sample; no cases were missing data from the teacher sample. Given the miniscule amount of missing data, listwise deletion was used (Parent, 2013). Impairment ratings were categorical (i.e., derived from a 4-point scale) and non-normally distributed, so their use as dependent variables would violate assumptions of parametric linear models (DeMaris, 2013). Consequently, analyses of impairment ratings were conducted with nonparametric methods.

Factor structure. Confirmatory factor analysis (CFA) was implemented with Mplus 7.2 (Muthén & Muthén, 2014). Given the ordered categorical data, polychoric correlations and a weighted least squares estimator with mean- and variance-adjusted chi-square test statistics were used to estimate factor models (DiStefano & Morgan, 2014). It was theorized that the six Inattention impairment items and six Hyperactivity-Impulsivity impairment items would cluster into two correlated symptom-related factors (i.e., separate factors reflecting impairment for each symptom dimension). Alternatively, six factors reflecting the domains of impairment (i.e., Teacher/Family Relationships, Peer Relationships, Homework, Academics, Behavior Problems, and Self-Esteem) might emerge, or all 12 impairment items might collapse into a single factor. Thus, three different models were examined for parent and teacher ratings.

Model fit was evaluated with the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). Criteria for adequate model fit were CFI $\geq$ .90 and RMSEA $\leq$ .08, whereas good fit required CFI $\geq$ 0.95 and RMSEA $\leq$ 0.06 (Hu & Bentler, 1999). For a model to be considered superior, it had to exhibit adequate to good

overall fit and display meaningfully better fit (ΔCFI > .01 and ΔRMSEA > .015) than other models (Cheung & Rensvold, 2002).

Generalizability of the superior model for each respondent was investigated with the configural (same pattern of loadings across groups), metric (equal loadings across groups), and scalar (equal indicator thresholds across groups) invariance routines of Mplus. Scalar invariance is required for the comparison of factor means across groups (Dimitrov, 2010). For parents, scalar invariance was tested across child gender, age, parent gender, and ethnicity/race (sample sizes were sufficient for White non-Hispanic, Black non-Hispanic, and Hispanic groups). For teachers, invariance was tested across child gender, age, and ethnicity/race (sample sizes were sufficient for White non-Hispanic, Black non-Hispanic, and Hispanic groups). Chi-square difference tests were supplemented with CFI difference values (ΔCFI > .01) to ensure that any statistically significant differences were meaningful (Cheung & Rensvold, 2002).

Relationships between impairment and symptom ratings. The bivariate relationships between impairment ratings and summed ADHD symptom dimension scores were quantified with Spearman rank-order correlations.

Variations in impairment ratings. Relationships between child demographic characteristics, ratings of ADHD symptoms, and impairment ratings were explored via logistic regression. Unlike linear regression, logistic regression makes no distributional, linearity, or homoscedasticity assumptions. Alternatively, logistic regression is sensitive to data sparseness (DeMaris, 2013), that is, data cells (created by the cross-tabulation of independent and dependent variables) with few or no members. To reduce sparseness, response options for each impairment item were collapsed into two categories (presented next). Alpha levels were set at $p < .001$ to partially compensate for the multiple significance tests conducted in this study.

In testing logistic regression models, discrimination can be quantified by the area under the receiver operating characteristic curve (AUC) where values smaller than 0.70 represent poor discrimination, values of 0.70–0.79 represent adequate discrimination, values of 0.80–0.89 represent excellent discrimination, and values above 0.89 represent outstanding discrimination (DeMaris, 2013). Predictive effect size can be quantified by odds ratios and McFadden's pseudo R^2. Odds ratios estimate the effect of individual predictors on the criterion; values of 1.5, 2.5, and 4.0 are generally considered to reflect small, medium, and large effect sizes, respectively (Rosenthal, 1996). The pseudo R^2 is useful in comparing models as additional predictors are added. Higher pseudo R^2 values indicate better prediction accuracy, with R^2 values less than 0.1 considered weak (Garson, 2014) and values of 0.2–0.4 deemed satisfactory (Petrucci, 2009).

The multivariate relationships of child gender, age, ethnicity/race, ADHD symptom ratings, and impairment ratings were examined with Stata 13. Only main effects were tested to reduce sparseness, but logistic models are inherently interactive because the effects of each variable depend on the effects of other variables (DeMaris, 2013). Independent variables in the regression analyses included the demographic characteristics of child gender (male as reference level), age (continuous), and ethnicity/race (White non-Hispanics as reference level), as well as mean item scores on the two ADHD symptom factors.

Given the findings from the CFA analyses (presented next) indicating that the optimal model had six factors, each consisting of two items pertaining to impairment due to Inattention and Hyperactivity-Impulsivity, the dependent variables in the logistic models were the six impairment factors. To reduce sparseness, the "or" rule, commonly used to resolve discrepancies in ratings (e.g., Shemmassian & Lee, 2012), was applied to determine an individual's score on each impairment factor. The child's score was one if either the Inattention *or* Hyperactivity-Impulsivity impairment item indicated moderate to severe impairment (i.e., rating of 2 or 3). The score was zero if the Inattention and Hyperactivity-Impulsivity impairment items were both rated as none to minor impairment (i.e., rating of 0 or 1). Using the "or" rule was justified given the high correlation between the Inattention and Hyperactivity-Impulsivity impairment items for each of the factors ($\rho = .76–.86$) and their strong loadings on each factor (see Figure 1).

Impairments associated with elevations in ADHD symptom counts. Given that symptom counts often are used clinically in the assessment of ADHD, the relationship of impairment ratings and elevations in ADHD symptom counts was also examined with logistic regression. Logistic models were fitted with the six binary impairment indicators serving as dependent variables and elevations in symptom counts serving as the sole predictor. Elevations in symptom counts were determined by classifying children into the (a) Inattention category if they received ratings of often or very often on six or more Inattention items, (b) Hyperactivity-Impulsivity category if they received ratings of often or very often on six or more Hyperactivity-Impulsivity items, and (c) Combined category if they received ratings of often or very often on six or more items on each symptom dimension.

Normative data. Frequency distributions for each impairment factor for each respondent type were computed with SPSS version 19 using its weighted data option.

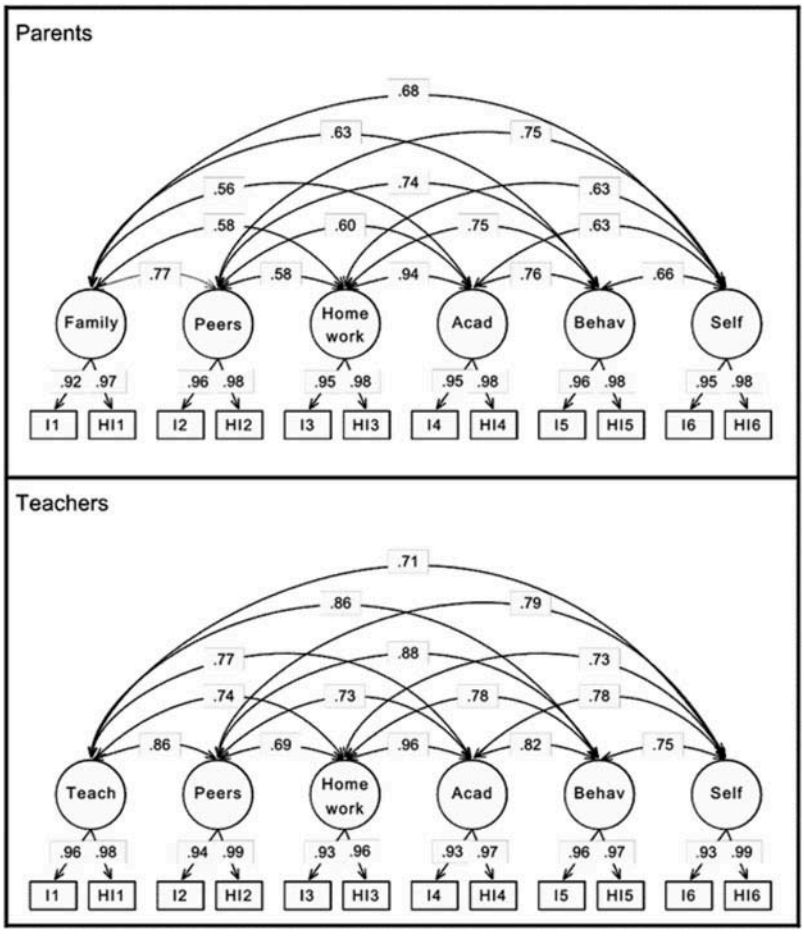

FIGURE 1 Six-factor structure of parent and teacher impairment items. *Note*: Acad = academic dimension; Behav = behavioral dimension; Self = self-esteem dimension; I = Inattention; HI = Hyperactivity-Impulsivity; Teach = teacher relations dimension.

RESULTS

Factor Structure

CFA results are presented in Table 1. The one- and two-factor models were roughly equivalent in fit. Contrary to expectations, the two-factor structure based on source of impairment (i.e., due to Inattention, due to Hyperactivity-Impulsivity) was inferior to the six-factor structure that combined items (e.g., Peer Relationships, Behavior Problems) across source of impairment for both respondents. For both parents and teachers, the six-factor model exhibited adequate to good fit and was both statistically and practically superior to the one- and two-factor models. These results are illustrated in Figure 1. For the parent six-factor model, the 12 invariance comparisons (configural, metric, and scalar across child gender, age, parent gender, and ethnicity/race) produced three statistically significant results at $p < .01$, but none that were of practical significance (ΔCFI > .01 and ΔRMSEA > .015). For the teacher six-factor model, none of the invariance comparisons were statistically significant at $p < .01$.

TABLE 1
Confirmatory Factor Analysis of Impairment Models

Model	χ^2	df	*CFI*	*ΔCFI*	*RMSEA*	*90% CI*	*ΔRMSEA*
Parents							
One Factor	2,779.88	54	.959	—	.156	[.151, .161]	—
Two Factors	2,559.98	53	.962	.003	.151	[.146, .156]	.005
Six Factors	240.46	39	.997	.035	.050	[.044, .056]	.101
Teachers							
One Factor	2,900.58	54	.971	—	.157	[.152, .162]	—
Two Factors	2,707.72	53	.973	.002	.153	[.148, .158]	.004
Six Factors	517.86	39	.995	.022	.076	[.070, .082]	.077

Note: CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval.

Relationships Between Impairment and Symptom Ratings

The bivariate relationships between impairment ratings and symptom ratings on the ADHD dimensions (Inattention,

TABLE 2
Spearman Correlations Between Ratings of ADHD Symptom Dimensions and Impairment Dimensions

Impairment Dimensions	*ADHD Symptoms*		
	Inattention	*Hyperactive-Impulsive*	*Total*
Parent			
Family Relations	.48 [.45, .51]	.43 [.39, .46]	.51 [.47, .54]
Peer Relations	.43 [.39, .46]	.46 [.43, .50]	.49 [.45, .52]
Homework*	.64 [.61, .66]	.39 [.35, .43]	.59 [.57, .62]
Academics*	.61 [.58, .63]	.35 [.32, .39]	.56 [.53, .59]
Behavior	.51 [.48, .55]	.53 [.50, .56]	.57 [.54, .60]
Self-esteem*	.46 [.42, .49]	.35 [.31, .39]	.46 [.42–49]
Teacher			
Teacher Relations	.63 [.60, .66]	.64 [.62, .67]	.67 [.65, .69]
Peer Relations	.62 [.59, .64]	.66 [.64, .69]	.67 [.65, .69]
Homework*	.78 [.76, .80]	.59 [.56, .62]	.76 [.74, .77]
Academics*	.84 [.83, .85]	.62 [.59, .65]	.81 [.79, .82]
Behavior*	.73 [.71, .75]	.80 [.78, .81]	.80 [.78, .81]
Self-Esteem*	.64 [.62, .67]	.54 [.51, .57]	.65 [.62, .67]

Note: All correlations significant at $p < .001$. 95% confidence intervals for Spearman coefficients in brackets. ADHD = attention-deficit/hyperactivity disorder.

*Difference in correlations between the impairment dimension and the symptom dimensions (Inattention vs. Hyperactivity-Impulsivity) significant at $p < .001$.

Hyperactivity-Impulsivity, and Combined) were quantified by Spearman correlations, presented in Table 2. Both parents and teachers reported stronger relationships between Inattentive symptoms and impairments than between Hyperactive-Impulsive symptoms and impairments on the Academic, Homework, and Self-Esteem impairment factors. Regardless of symptom dimension, correlations between symptom and impairment dimensions were stronger for teachers than for parents ($p < .001$ for all comparisons; median of .61 for teachers vs. .49 for parents).

Variations in Impairment Ratings Due to Demographic Factors and ADHD Symptom Ratings

As detailed in Table 3, parent and teacher impairment ratings were significantly associated with child demographic factors (including gender, age, and ethnicity/race); however, the effect sizes were weak (pseudo-R^2 = .01–.09) and group discrimination (AUC = .47–.69) was poor. The incremental effect of ADHD symptom scores (over and above the effect of demographic variables) was analyzed with a second logistic regression model (Table 3). All logistic regression models were significantly improved by the addition of ADHD ratings as predictors. The resulting effect sizes were satisfactory (pseudo-R^2 = .23–.55) and group discrimination (AUC = .88–.95) was excellent to outstanding.

Unique contribution of each child demographic variable. The unique contribution of each demographic factor to binary ratings of impairment is presented in Table 4. The findings indicated a significant effect of gender (male > female) for parent ratings of Homework and Behavior Problems and teacher ratings for all areas of impairment. The odds ratios ranged from 0.37 to 0.57, suggesting effect sizes in the small to medium range. The effect of age was less striking (small effect sizes); the

TABLE 3
Global Comparison of Models With Demographic Factors Only (Child Gender, Age, and Ethnicity/Race) to Models With Demographic Factors and ADHD Symptom Scores (Inattention and Hyperactivity-Impulsivity) Across Binary Impairment Ratings

	Demographic Factors				*+ ADHD Symptoms*				*Difference*	
Criterion	χ^2	df	R^2	*AUC [95% CI]*	χ^2	df	R^2	*AUC [95% CI]*	$\Delta\chi^2$	df
Parent										
Family Rel.	1199.5*	2069	.01	.56 [.51, .60]	850.9*	2064	.30	.89 [.87, .91]	348.6*	5
Peer Rel.	956.0	2069	.01	.58 [.53, .62]	712.8*	2064	.26	.90 [87, .92]	243.2*	5
Homework	1344.1*	2069	.03	.55 [.50, .59]	854.1*	2064	.38	.93 [.91, .94]	490.0*	5
Academic	1322.8*	2069	.03	.55 [.51, .59]	809.0*	2064	.41	.93 [91, .94]	513.8*	5
Behavior	931.5	2069	.03	.47 [.42, .52]	553.1*	2064	.42	.94 [.92, .96]	378.4*	5
Self-Esteem	972.1	2069	.01	.57 [.53, .62]	754.2*	2064	.23	.88 [.86, .91]	217.9*	5
Teacher										
Teacher Rel.	1395.8*	2134	.03	.63 [.59, .66]	904.5*	2132	.37	.91 [.90, .93]	491.3*	2
Peer Rel.	1497.3*	2134	.06	.66 [.62, .69]	880.1*	2132	.45	.92 [.91, .94]	617.2*	2
Homework	2292.3*	2134	.03	.61 [.59, .64]	1331.6*	2132	.44	.91 [.90, .92]	960.7*	2
Academic	2417.1*	2134	.03	.62 [.59, .64]	1179.7	2132	.53	.94 [.93, .95]	1237.4*	2
Behavior	1948.1*	2134	.09	.69 [.66, .71]	946.0*	2132	.56	.95 [.94, .96]	1002.1*	2
Self-Esteem	1551.4*	2134	.03	.62 [.58, .65]	1118.4*	2132	.30	.88 [.86, .89]	433.0*	2

Note: R^2 is McFadden's pseudo-R^2, area under the receiver operating characteristic curve (AUC) is the area under the receiver operating characteristic (ROC), and $\Delta\chi^2$ is the difference in the likelihood-ratio test of the demographic model versus the demographic + attention-deficit/hyperactivity disorder (ADHD) symptoms model. 95% confidence interval (CI) of AUC in brackets. Rel. = relations.

*$p < .001$

TABLE 4
Effects of Child Gender, Age, and Race/Ethnicity on Binary Impairment Ratings

					Ethnicity/Race					
	Gender		*Age*		*Black*		*Hispanic*		*Other*	
Criterion	z	*OR*	z	*OR*	z	*OR*	z	*OR*	z	*OR*
Parent										
Family Rel.	1.45	1.31 [0.91, 1.88]	1.67	1.04 [0.99, 1.09]	0.51	1.18 [0.62, 2.25]	–1.08	0.76 [0.46, 1.25]	–0.44	0.88 [0.49, 1.56]
Peer Rel.	–1.00	0.80 [0.53, 1.23]	1.31	1.04 [0.98, 1.10]	1.29	1.58 [0.79, 3.14]	–1.27	0.72 [0.43, 1.20]	–0.71	0.77 [0.37, 1.60]
Homework	–3.19*	0.57 [0.41, .081]	4.26*	1.10 [1.05, 1.15]	0.48	1.15 [0.64, 2.07]	–1.16	0.77 [0.50, 1.20]	–1.02	0.75 [0.43, 1.31]
Academic	–2.14	0.68 [0.48, 0.97]	3.61*	1.09 [1.04, 1.14]	2.18	1.82 [1.06, 3.13]	–0.76	0.84 [0.54, 1.31]	–0.73	0.81 [0.46, 1.43]
Behavior	–2.66*	0.55 [0.35, 0.85]	–2.41	0.94 [0.89, 0.99]	2.44	2.14 [1.16, 3.95]	0.25	1.07 [0.62, 1.84]	–0.11	0.96 [0.48, 1.90]
Self-Esteem	–0.42	0.92 [0.62, 1.36]	2.01	1.05 [1.00, 1.10]	–0.07	0.97 [0.45, 2.10]	–0.63	0.86 [0.54, 1.38]	–0.19	0.94 [0.50, 1.77]
Teacher										
Teacher Rel.	–3.83*	0.52 [0.37, 0.73]	–1.20	0.97 [0.93, 1.02]	2.66	1.81 [1.17, 2.80]	1.06	1.24 [0.83, 1.86]	–2.26	0.42 [0.19, 0.89]
Peer Rel.	–3.85*	0.51 [0.36, 0.72]	–5.06*	0.89 [0.85, 0.93]	3.03	1.95 [1.26, 2.99]	–0.19	0.96 [0.63, 1.46]	–2.12	0.38 [0.16, 0.93]
Homework	–5.51*	0.50 [0.39, 0.64]	–0.04	1.00 [0.97, 1.03]	2.91	1.72 [1.19, 2.49]	2.49	1.44 [1.08, 1.92]	–1.24	0.72 [0.43, 1.21]
Academic	–4.93*	0.55 [0.44, 0.70]	–2.01	0.97 [0.94, 1.00]	4.44*	2.18 [1.54, 3.07]	2.30	1.39 [1.05, 1.85]	–0.63	0.86 [0.53, 1.38]
Behavior	–7.04*	0.37 [0.28, 0.48]	–6.03*	0.89 [0.85, 0.92]	4.09*	2.21 [1.51, 3.24]	–0.36	0.94 [0.67, 1.32]	–2.77	0.39 [0.20, 0.76]
Self-Esteem	–3.31*	0.59 [0.43, 0.81]	–2.89	0.94 [0.90, 0.98]	1.71	1.44 [0.95, 2.18]	1.10	1.23 [0.85, 1.78]	–2.41	0.41 [0.20, 0.85]

Note: Male is the reference category for gender. Ethnicity/Race = White non-Hispanic (the reference category), Black non-Hispanic, Hispanic, and Other. *OR* = odds ratio; IN = Inattention; HI = Hyperactivity-Impulsivity. 95% confidence interval of OR in brackets. Rel. = relations.

*$p \leq .001$.

findings indicated that higher age was associated with significantly *higher* impairment for parent ratings of Homework and Academic Problems and significantly *lower* impairment for teacher ratings of Peer Relationships and Behavior Problems. Racial/ethnic group membership generally did not have an effect on ratings of impairment, with the exception that Black children were rated significantly higher than non-Hispanic White children for Academic and Behavior Problems with small to moderate effect sizes.

Unique contribution of each ADHD symptom dimension. Given that the global models exhibited predictive and discriminative utility, the multivariate effects of each symptom dimension were subsequently analyzed (see Table 5). In contrast to child demographic factors, which generally had weak effects on ratings of impairment, parent and teacher ratings of ADHD symptoms were powerful predictors of impairment.

Parent ratings of Inattention symptoms were significantly (positively) related to all six impairment dimensions and ratings of Hyperactivity-Impulsivity symptoms were significantly (positively) related to Family Relationship, Peer Relationship, and Behavior impairments. Inattention had particularly strong negative effects on Homework and Academic impairment. For example, for every unit increase in ratings of Inattention symptoms, the odds of a child being rated as academically impaired were 16.60 times greater, holding all other variables constant.

Teacher ratings of Inattention symptoms were significantly (positively) related to all six impairment dimensions, whereas ratings of Hyperactivity-Impulsivity symptoms were significantly (positively) related to only Teacher Relationship, Peer Relationship, and Behavior impairments. Similar to parent reports, ratings of Inattention symptoms had particularly strong negative effects on Homework and Academic impairment dimensions. As an example, for every unit increase in ratings of Inattention symptoms, the odds of a child being rated as academically impaired were 35.92 times greater, holding all other variables constant.

Impairments Associated With Elevations in ADHD Symptom Counts

The effect of clinically relevant elevations in symptom counts on impairment ratings are presented in Table 6.

Effect of parent-reported elevations in ADHD symptoms. For parents, all impairment dimensions were significantly predicted by elevated ADHD symptom counts (i.e., $\geq$ six symptoms endorsed on an ADHD symptom dimension) with satisfactory effect sizes (pseudo-R^2 = .13–.31) and adequate to excellent group discrimination (AUC = .72–.83). Elevations in symptom counts were associated with significant increases in all impairment dimensions with Homework and Academic impairments dimensions most powerfully affected. In contrast, the Behavior dimension of impairment was most powerfully affected by the Hyperactive-Impulsive and Combined dimensions. The odds of being rated as having a behavioral impairment were 93.01 times larger if there were parent-rated elevations on both symptom dimensions

TABLE 5
Effects of Inattention and Hyperactivity-Impulsivity Symptom Scores on Binary Impairment Ratings With Child Demographic Variables in the Model

	Gender		*Age*		*Ethnicity/Race*						*ADHD Symptom Score*			
					Black		*Hispanic*		*Other*		*IN*		*HI*	
Criterion	z	*OR*	z	*OR*	z	*OR*	z	*OR*	z	*OR*	z	*OR*	z	*OR*
Parent														
Family Rel.	3.22*	2.14 [1.35, 3.40]	3.82*	1.12 [1.06, 1.19]	0.14	1.06 [0.50, 2.24]	–0.24	0.93 [0.54, 1.61]	–0.01	1.00 [0.47, 2.10]	5.86*	3.12 [2.13, 4.56]	5.77*	4.17 [2.57, 6.77]
Peer Rel.	0.19	1.05 [0.62, 1.78]	2.89*	1.12 [1.03, 1.21]	1.16	1.57 [0.73, 3.36]	–0.49	0.83 [0.39, 1.76]	–0.43	0.82 [0.33, 2.02]	4.26*	2.65 [1.68, 4.09]	4.80*	3.66 [2.15, 6.21]
Homework	–2.36	0.58 [0.37, 0.91]	3.78*	1.13 [1.06, 1.21]	0.96	1.42 [0.69, 2.91]	–0.18	0.94 [0.49, 1.80]	–0.80	0.74 [0.36, 1.54]	10.80*	14.91 [9.13, 24.34]	–1.18	0.75 [0.47, 1.21]
Academic	–1.19	0.76 [0.50, 1.19]	3.30*	1.12 [1.05, 1.19]	3.38*	2.85 [1.55, 5.24]	0.23	1.08 [0.56, 2.11]	–0.42	0.84 [0.38, 1.86]	10.95*	16.60 [10.04, 27.45]	–1.02	0.78 [0.49, 1.26]
Behavior	–1.25	0.71 [0.41, 1.22]	–0.41	0.99 [0.92, 1.06]	2.40	2.71 [1.20, 6.10]	1.42	1.60 [0.84, 3.07]	0.32	1.19 [0.41, 3.51]	5.86*	4.00 [2.52, 6.36]	6.28*	5.42 [3.20, 9.18]
Self-Esteem	0.71	1.19 [0.74, 1.93]	2.43	1.08 [1.01, 1.14]	–0.02	0.99 [0.42, 2.37]	0.08	1.02 [0.54, 2.24]	0.24	1.09 [0.53, 2.24]	7.87*	4.40 [3.04, 6.36]	2.07	1.59 [1.02, 2.47]
Teacher														
Teacher Rel.	0.93	1.24 [0.79, 1.96]	2.98	1.10 [1.03, 1.17]	0.26	1.08 [0.60, 1.93]	0.55	1.16 [0.69, 1.94]	–1.26	0.58 [0.25, 1.36]	9.77*	4.40 [3.27, 5.92]	5.51*	2.81 [1.95, 4.06]
Peer Rel.	1.09	1.29 [0.81, 2.07]	–0.70	0.98 [0.92, 1.04]	0.68	1.22 [0.68, 2.21]	–0.63	0.84 [0.50, 1.43]	–1.10	0.52 [0.17, 1.66]	7.19*	3.49 [2.48, 4.91]	8.60*	5.12 [3.53, 7.43]
Homework	–0.04	0.99 [0.97, 1.43]	4.65*	1.12 [1.07, 1.18]	–0.05	0.99 [0.62, 1.57]	1.70	1.43 [0.95, 2.16]	–0.62	0.81 [0.42, 1.57]	13.27*	13.43 [9.15, 19.71]	0.30	1.06 [0.73, 1.53]
Academic	1.29	1.25 [0.89, 1.76]	2.11	1.05 [1.00, 1.11]	1.99	1.59 [1.01, 2.50]	1.44	1.36 [0.89, 2.08]	0.24	1.09 [0.53, 2.25]	13.59*	35.92 [21.43, 60.22]	–2.21	0.64 [0.42, 0.95]
Behavior	–1.70	0.70 [0.46, 1.06]	–0.60	0.98 [0.92, 1.04]	1.17	1.43 [0.79, 2.59]	–1.19	0.75 [0.46, 1.21]	–1.42	0.47 [0.17, 1.33]	8.53*	3.52 [2.64, 4.70]	11.80*	13.31 [8.66, 20.47]
Self-Esteem	0.87	1.19 [0.81, 1.74]	0.02	1.00 [0.95, 1.06]	–0.51	0.87 [0.50, 1.51]	0.48	1.11 [0.72, 1.73]	–1.71	0.45 [0.18, 1.12]	11.72*	4.83 [3.71, 6.29]	2.03	1.40 [1.01, 1.94]

Note: Male is the reference category for Gender. Ethnicity/Race = White non-Hispanic (the reference category), Black non-Hispanic, Hispanic, and Other. ADHD = attention-deficit/hyperactivity disorder; IN = Inattention; HI = Hyperactivity-Impulsivity; *OR* = odds ratio; Rel. = relations. 95% confidence interval of OR is in brackets.

*$p < .001$.

TABLE 6
Logistic Regressions Predicting Binary Impairment Dimension Scores From Clinically Relevant Elevations in ADHD Symptom Counts (Inattention, Hyperactivity-Impulsivity, and Combined) for Parents and Teachers

				ADHD Dimension[a]					
				IN		*HI*		*Combined*	
Criterion	χ^2	R^2	*AUC*	z	*OR*	z	*OR*	z	*OR*
Parent									
Family Rel.	996.4*	.18	.72 [.69, .76]	7.60*	7.64 [4.52, 12.90]	4.81*	8.48 [3.55, 20.25]	11.54*	31.62 [17.52, 56.85]
Peer Rel.	818.7*	.15	.75 [.71, .80]	6.64*	7.46 [4.12, 13.49]	5.11*	11.48 [4.51, 29.27]	9.64*	20.34 [11.03, 37.54]
Homework	1114.9*	.20	.76 [.73, .79]	11.60*	16.90 [10.48, 27.25]	1.22	1.99 [0.66, 6.01]	10.15*	22.27 [12.23, 40.56]
Academic	1077.9*	.21	.77 [.73, .80]	11.94*	19.21 [11.82, 31.21]	1.45	2.24 [0.76, 6.63]	10.22*	22.23 [12.27, 40.30]
Behavior	663.0*	.31	.83 [.78, .87]	7.54*	10.40 [5.66, 19.11]	7.04*	24.34 [10.00, 59.21]	13.26*	93.01 [47.60, 181.73]
Self-Esteem	848.4*	.13	.73 [.69, .77]	8.50*	9.52 [5.66, 16.01]	2.63*	4.10 [1.43, 11.73]	8.68*	13.89 [7.67, 25.16]
Teacher									
Teacher Rel.	1052.8*	.27	.84 [.81, .86]	10.77*	13.02 [8.16, 20.77]	5.76*	9.59 [4.45, 20.70]	13.78*	34.33 [20.76, 56.77]
Peer Rel.	1053.1*	.34	.83 [.81, .86]	9.66*	10.47 [6.50, 16.87]	8.63*	28.93 [13.47, 62.14]	15.73*	62.73 [37.46, 105.07]
Homework	1744.3*	.26	.77 [.75, .79]	14.47*	20.42 [13.57, 30.73]	4.62*	5.54 [2.68, 11.44]	13.41*	28.66 [17.55, 46.80]
Academic	1687.6*	.32	.78 [.76, .80]	14.10*	50.87 [29.46, 87.84]	3.58*	3.97 [1.87, 8.44]	12.56*	45.29 [24.98, 82.13]
Behavior	1356.9*	.36	.83 [.81, .85]	10.81*	8.46 [5.75, 12.46]	8.66*	36.40 [16.14, 82.09]	11.99*	275.69 [110.04, 690.73]
Self-Esteem	1229.8*	.23	.78 [.75, .81]	11.92*	12.08 [8.02, 18.19]	4.15*	5.53 [2.47, 12.41]	13.24*	22.83 [14.37, 36.28]

Note: df = 2,071 for Parent and 2,136 for Teacher scale; R^2 is McFadden's pseudo-R^2. 95% confidence intervals for both the area under the receiver operating characteristic (AUC) and the odds ratio (OR) are in brackets. ADHD = attention-deficit/hyperactivity disorder; *OR* = odds ratio; IN = Inattention; HI = Hyperactivity-Impulsivity; Rel. = relations.

[a]Reference level is non-ADHD.

*$p < .001$.

than if the child did not meet symptom criteria for ADHD, holding all variables constant.

Effect of teacher-reported elevations in ADHD symptoms. For teachers, all impairment dimensions were significantly predicted by clinical elevations in ADHD symptom count with satisfactory effect sizes (pseudo-R^2 = .23–.34) and adequate to excellent group discrimination (AUC = .77–.84). As with parent ratings, Homework and Academic impairments were most powerfully affected by elevations on Inattention. In contrast, all impairment dimensions were strongly affected by elevations on both ADHD dimensions. Holding all other variables constant, children meeting symptom criteria for Combined had a much higher risk of impairment than those not meeting criteria for ADHD: 275.69 times larger for Behavior Problems, 62.73 times larger for Peer Relationships, 45.29 times larger for Academic, and 34.33 times larger for Teacher Relationships. For both parents and teachers, children with symptom ratings consistent with ADHD diagnosis were statistically and clinically different on all impairment dimensions when compared to children whose symptom ratings were not consistent with ADHD diagnoses.

Normative Data

Frequency distributions for scores on each impairment dimension are presented in Table 7 for parents and Table 8 for teachers. Scores for each impairment factor were created by selecting the higher of the two ratings on each factor. Most children had no or minor impairment problems, resulting in positively skewed distributions. Parent ratings indicated that between 6.2% and 10.5% of the sample displayed moderate to severe problems on at least one impairment dimension. For teachers, 10.5%–27.0% of the sample was identified as showing moderate to severe problems on at least one impairment dimension. The tendency for teachers to provide higher impairment ratings than parents was also evident when considering the total number of impairments in the moderate to severe range. As shown in Table 9, 92.7% of the sample rated by parents displayed 0 to 2 total impairments; for teachers, this range increased, with 0 to 4 impairments accounting for a comparable percentage (92.6%) of the sample.

DISCUSSION

Contrary to expectations, a six-factor structure emerged for both parent and teacher impairment ratings, which was invariant across child gender, age, parent gender, and ethnicity/race, wherein each factor represented a specific functioning area (e.g., Homework) impacted by both Inattention and Hyperactive-Impulsive symptoms. This finding indicates that although areas of impairment are correlated, they

TABLE 7
Percentage Distribution of Parent-Rated Impairment Dimension Scores for Total Sample, for Male and Female Participants, and for Age Groups

			Gender		Age Group in Years			
Impairment	*Score*	*Total*	*Male*	*Female*	*5–7*	*8–10*	*11–13*	*14–17*
Family Rel.	0–None	66.4	67.0	65.9	67.9	69.2	65.5	63.8
	1–Minor	25.0	25.4	24.5	24.4	24.3	25.5	25.7
	2–Moderate	6.9	5.9	7.9	6.1	5.2	7.9	7.8
	3–Severe	1.7	1.7	1.7	1.7	1.3	1.0	2.6
Peer Rel.	0–None	74.3	73.8	74.8	74.1	72.7	75.1	75.1
	1–Minor	19.4	19.3	19.6	20.6	21.5	18.6	17.5
	2–Moderate	5.0	5.6	4.5	4.4	4.3	5.2	5.8
	3–Severe	1.2	1.3	1.1	0.8	1.5	1.0	1.5
Homework	0–None	64.9	59.1	70.9	73.7	66.6	63.7	58.3
	1–Minor	24.6	27.9	21.1	19.1	26.7	23.9	27.5
	2–Moderate	7.8	9.4	6.3	4.6	5.6	9.9	10.3
	3–Severe	2.6	3.6	1.6	2.5	1.1	2.5	3.8
Academic	0–None	69.3	64.4	74.4	77.7	71.6	66.5	63.6
	1–Minor	20.5	23.7	17.2	14.9	21.3	22.0	22.9
	2–Moderate	7.1	7.9	6.2	4.6	5.0	8.4	9.7
	3–Severe	3.1	3.9	2.2	2.7	2.2	3.1	3.8
Behavior	0–None	76.8	72.4	81.4	71.8	76.1	77.8	80.3
	1–Minor	17.0	19.8	14.1	19.8	17.8	14.7	16.2
	2–Moderate	4.2	5.3	3.1	5.9	4.3	5.5	1.8
	3–Severe	2.0	2.6	1.4	2.5	1.7	2.1	1.7
Self-Esteem	0–None	73.0	74.3	71.6	79.4	74.6	69.2	70.0
	1–Minor	20.7	19.1	22.4	16.8	19.1	22.6	23.2
	2–Moderate	5.0	5.5	4.5	2.5	5.8	6.9	4.8
	3–Severe	1.3	1.0	1.6	1.3	0.4	1.3	2.0

Note: Scores on each impairment factor were created by selecting the higher score on the two items of the factor (i.e., impairment related to Inattention and impairment related to Hyperactivity-Impulsivity). Rel. = relations.

TABLE 8
Percentage Distribution of Teacher-Rated Impairment Dimension Scores for Total Sample, for Male and Female Participants, and for Age Groups

			Gender		Age Group in Years			
Impairment	*Score*	*Total*	*Male*	*Female*	*5–7*	*8–10*	*11–13*	*14–17*
Teacher Rel.	0–None	69.6	62.5	77.1	67.5	65.6	71.2	72.9
	1–Minor	19.9	24.0	15.5	21.4	22.9	18.8	17.3
	2–Moderate	9.0	11.4	6.5	9.4	10.1	8.2	8.6
	3–Severe	1.5	2.1	0.9	1.7	1.4	1.8	1.2
Peer Rel.	0–None	63.0	57.3	69.0	51.3	56.2	67.3	72.8
	1–Minor	24.8	27.1	22.4	31.3	28.3	21.1	20.4
	2–Moderate	10.0	12.9	7.0	15.5	12.2	8.6	5.6
	3–Severe	2.2	2.7	1.6	1.9	3.2	2.9	1.2
Homework	0–None	49.3	41.8	57.2	49.7	50.2	45.2	51.4
	1–Minor	26.6	28.0	25.1	28.0	23.3	29.2	26.3
	2–Moderate	15.9	18.7	12.8	16.6	16.7	15.3	15.8
	3–Severe	8.2	11.5	4.8	5.8	9.8	10.4	8.2
Academic	0–None	49.6	42.0	57.6	48.2	47.5	50.8	51.5
	1–Minor	23.4	25.4	21.2	26.1	18.1	22.5	26.0
	2–Moderate	17.3	20.3	14.3	15.4	21.5	16.3	16.2
	3–Severe	9.7	12.4	6.9	10.3	12.9	10.4	6.3
Behavior	0–None	58.3	47.7	69.4	48.3	52.6	59.0	69.0
	1–Minor	21.9	25.3	18.4	24.0	21.4	25.8	17.9
	2–Moderate	14.2	19.2	8.9	19.5	18.1	10.7	9.9
	3–Severe	5.6	7.8	3.3	8.2	7.9	4.5	3.2
Self-Esteem	0–None	65.0	60.1	70.0	59.0	59.8	66.3	71.8
	1–Minor	22.8	24.8	20.6	25.8	25.1	22.1	19.4
	2–Moderate	9.6	12.2	7.0	11.4	11.8	9.8	6.8
	3–Severe	2.6	2.8	2.4	3.9	3.2	1.8	2.1

Note: Scores on each impairment factor were created by selecting the higher score on the two items of the factor (i.e., impairment related to Inattention and impairment related to Hyperactivity-Impulsivity). Rel. = relations.

TABLE 9
Frequency and Percentage of Impairments as Rated by Parents and Teachers

	Parents		*Teachers*	
No. of Impairments	*%*	*Cumulative*	*%*	*Cumulative*
0	80.5	80.5	64.0	64.0
1	7.1	87.6	8.6	72.6
2	5.1	92.7	7.9	80.5
3	2.7	95.4	6.9	87.4
4	1.8	97.2	5.2	92.6
5	1.4	98.6	4.4	97.0
6	1.4	100.0	3.0	100.0

Note: An impairment was recorded as present if the informant rated the item as a moderate or severe problem; an impairment was recorded as absent if the informant rated the item as no or a mild problem. The "or" rule was applied if there was a discrepancy in ratings of the two items on the impairment dimension; the higher of the two ratings was determined to be the child's score.

represent separate domains, each of which is impacted by both Inattention and Hyperactivity-Impulsivity symptoms. The results further indicate that more variance in impairment is accounted for by ADHD as a whole rather than by each separate symptom dimension. It appears that respondents are able to identify the existence of impairment in separate domains but less able to identify the primary source of the impairment.

Each area of impairment was found to have moderate to high correlations with Inattention symptom ratings according to both parent and teacher report. Not surprisingly, Academic and Homework impairments had the strongest correlations with Inattention for both respondents. Correlations between Inattention and Academic/Homework impairment were higher than found for Hyperactivity-Impulsivity and Academic/Homework impairment. This is consistent with numerous prior investigations showing a strong link between Inattention and academic performance (e.g., Massetti et al., 2008; Willcutt et al., 2012). Moderate to high correlations between impairment and Hyperactivity-Impulsivity symptoms were also found for teacher ratings, with strongest correlations obtained for Behavior Problems, Peer Relations, and Teacher Relations. Thus, as has been found previously, Hyperactivity-Impulsivity is particularly impactful on behavior control and social interactions (Nigg, 2001; Willcutt et al., 2012). Alternatively, correlations were in the small to moderate range for impairment and Hyperactivity-Impulsivity symptoms based on parent ratings. Overall, correlations between ADHD symptoms and impairment were stronger for teacher than parent ratings, especially with respect to Hyperactivity-Impulsivity symptoms. This pattern differs from research using the IRS (Fabiano et al., 2006) that revealed similar correlations for parents and teachers between ratings of symptoms and impairments. A difference between studies is that the IRS does not differentiate impairment due to ADHD versus associated comorbidities, whereas the ARS-5 provides an assessment of ADHD symptom-specific impairment. Considered together, the findings of these studies suggest that the overall impact of ADHD and its comorbidities on adaptive functioning may be similar across school and home settings, whereas the impact of ADHD itself (especially the Hyperactivity-Impulsivity dimension), as opposed to the comorbidities associated with the disorder, may be greater in the school than the home setting. The relative strength of symptom-impairment correlations for teacher ratings found in this study suggest that ADHD symptoms are more impairing in the structured school environment where self-regulation demands are higher and students are expected to complete academic tasks and follow classroom rules for extended periods. Further, teachers may be more sensitive to problems posed by students with ADHD because of increased instructional demands being placed on teachers with the emphasis on high-stakes testing.

Although associations between child characteristics and impairment ratings were relatively weak, they were generally consistent with the results of prior investigations, especially for gender and race/ethnicity. Child gender significantly predicted all areas of impairment rated by teachers and Homework and Behavior Problems rated by parents. These findings confirm the results of other studies showing relatively large differences in ADHD symptom frequency between boys and girls (e.g., Polanczyk, De Lima, Horta, Biederman, & Rohde, 2007), as well as recent findings that high school teachers rate boys as having more impairment than girls (Evans et al., 2013). In contrast, race/ethnicity generally was not a significant predictor of any area of impairment other than teacher ratings of Academics and Behavior Problems for Black versus non-Hispanic White children. Follow-up sensitivity analyses further revealed that socioeconomic status, assessed by parental level of education, was not related to level of impairment as rated by parents. The findings for teacher ratings are consistent with those of prior studies showing differences in ADHD symptom ratings across racial/ethnic groups (e.g., Reid, DuPaul, Power, Anastopoulos, & Riccio, 1998), higher teacher impairment ratings for African American versus Caucasian high school students (Evans et al., 2013), and previous studies highlighting racial/ethnic differences in academic achievement (e.g., Fryer & Levitt, 2004).

Child age was a significant predictor of impairment ratings in two areas (Homework, Academics) for parents and two different areas (Peer Relations, Behavior Problems) for teachers. Consistent with typical findings of higher Inattention, Hyperactivity-Impulsivity, and Total ADHD symptom ratings for younger children (e.g., DuPaul et al., 1997; Reynolds & Kamphaus, 2004), older age in this study was associated with lower teacher ratings of symptom-related impairment. In contrast to previous findings for symptom ratings, older age was associated with higher

parent ratings of symptom-related impairment. These findings suggest that although ADHD-related behaviors may be more frequent among younger children, the impact of symptomatic behaviors is of greater concern to parents for older children and adolescents, especially in the areas of Homework and Academic functioning. In conclusion, child demographic factors demonstrated an association with ratings of impairment, but the relationships generally were weak. These associations were reduced when symptom ratings were included in multivariate models.

Normative data gathered for this study provide important information regarding the extent to which parents and teachers perceive the impact of Inattentive and Hyperactive-Impulsive symptomatic behaviors on critical areas of functioning in a sample representative of the general population. Teacher-rated impairments appear more common than parent-rated impairments, as 81% of children have two or fewer areas of impairment according to teachers, whereas 93% of children are reported by parents to exhibit impairment across two or fewer domains. To further support this point, approximately 7% of children and adolescents exhibit more than four areas of impairment according to teachers, whereas parents report only about 2% of children display more than four areas of impairment. Given the self-regulation deficits associated with ADHD, symptoms of this disorder are more likely to negatively impact child functioning in the more structured school setting than in the less demanding home environment.

The findings have several implications for clinical practice. First, it is critically important to assess impairment specifically related to ADHD symptoms. That is, clinicians should evaluate the degree to which Inattention and Hyperactivity-Impulsivity symptoms are associated with deficits academic and social functioning. Further, clinicians should not assume that ADHD symptoms impact all areas of functioning in an equivalent fashion. Rather, the impact on each impairment domain should be assessed separately. If one employs a typical percentile cutoff (i.e., 93rd percentile) for establishing clinical significance, then parent report of three or more areas of impairment and teacher report of five or more areas of impairment would be indicative of significant impairment. Alternatively, given that the *DSM-5* requires evidence of multiple impairments in addition to elevations in symptom counts, use of a less stringent criterion (i.e., at least one parent-rated impairment *and* at least two teacher-rated impairments) may be justified.

Conclusions based on these findings are limited by several factors. A limitation of the teacher sample was the need to include two participant panels to obtain nationally representative data because one panel (e-Rewards) had a relatively low response rate. It is important to note that this lower response rate was due, in part, to the large number of teachers recruited in order to meet census targets linked to demographic variables. Thus, the teacher sample generally was representative of national census targets for most child demographic areas including gender, race, and ethnicity. A limitation of the teacher sample, however, is that students from the Northeast and Midwest were slightly overrepresented (by approximately 5%) and students from the South were underrepresented (by approximately 10%).

The parent sample generally reflected demographic characteristics of the U.S. population. Specific efforts were made to include Spanish-speaking families and those with and without Internet access. Despite these efforts, sampling methods may have resulted in an underrepresentation of families who were highly mobile, those who did not speak English or Spanish, and those with the lowest socioeconomic status.

Other measures of impairment were not included in the study, thus no data are available regarding the criterion-related validity of the impairment ratings. Future studies should assess the degree to which reports of symptom-related impairment in each of the domains tapped by the ARS-5 are correlated with established measures of academic, social, and behavioral functioning. Finally, although the ARS-5 explicitly requests informants to rate ADHD symptom-related impairment, it is unclear how well they are able to differentiate ADHD-related impairment from impairment due to comorbid conditions. Research is needed to investigate this issue.

In conclusion, the current findings provide support for a six-factor structure for parent and teacher ratings of impairment secondary to ADHD symptoms, indicating that it is important to assess symptom-related impairment separately for each impairment domain. Further, it is clear that symptoms are at least moderately associated with impairment in multiple domains particularly in school and especially for Inattention symptoms. Although the effect of child demographic characteristics on ratings of impairment generally was low, the findings indicated a pattern of greater symptom-related impairment for boys and greater parent-rated impairment as children grow older, especially in homework and academic functioning. To address cross-informant differences that commonly occur as a result of the situational variability of ADHD symptoms (Barkley, 2015), separate normative tables derived from a large nationally representative sample are provided for parent and teacher ratings. These data provide researchers and clinicians with an accurate appraisal of the degree to which impairments secondary to ADHD symptoms are developmentally deviant, a requirement for diagnosing ADHD in *DSM-5*. Additional studies are needed to explicate the contributions of symptom-related impairment ratings in the screening, assessment, and diagnosis of children and teens with ADHD.

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