Assessing ADHD symptomatic behaviors and functional impairment in school settings: Impact of student and teacher characteristics

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DuPaul, G.J., Reid, R., Anastopoulos, A.D., Power, T.J. (2014). Assessing ADHD symptomatic behaviors and functional impairment in school settings: Impact of student and teacher characteristics. *School Psychology Quarterly*, *29(4)*, 409-421. doi:10.1037/spq0000095

Abstract:

The purpose of the present study was to examine (a) the teacher-reported prevalence of attention-deficit/hyperactivity disorder (ADHD) symptoms and associated impairment in a nationally representative sample of children and adolescents and (b) the degree to which prevalence varied as a function of student and teacher characteristics. Teacher-reported symptoms of ADHD based on *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (*DSM-5*) criteria and teacher-rated impairment were used to estimate prevalence using symptoms and impairment either alone or in combination, and to assess predictors of ADHD using a diverse, nationally representative sample (n = 2,140; 1,070 males, 1,070 females; 54.8% White, non-Hispanic) between 5 to 17 years old (M = 11.53; SD = 3.54). The combination of symptom and impairment ratings yielded the prevalence rate most consistent with prior epidemiological findings. Students' age, gender, racial, and special education status were significant predictors of symptom count and level of symptom-related impairment. It is critically important to simultaneously consider symptoms and symptom-related impairment when identifying students with ADHD. Student and teacher characteristics may affect ratings and identification results.

Keywords: ADHD | assessment | impairment ratings | symptom ratings | teacher ratings

Article:

Attention-deficit/hyperactivity disorder (ADHD) is a common neurodevelopmental disorder characterized by behavioral symptoms of inattention and/or hyperactivity-impulsivity (American Psychiatric Association [APA], 2013) that affects approximately 5.9% to 7.1% of children and adolescents (Willcutt, 2012). ADHD symptoms are associated with impairment in

academic, behavioral, social, and emotional functioning, generally resulting in substantial difficulties in school settings. Specifically, students with ADHD are at significantly higher risk for academic underachievement, grade retention, identification for special education services, and school drop-out (Barkley, Fischer, Smallish, & Fletcher, 2006; Frazier, Youngstrom, Glutting, & Watkins, 2007; Kent et al., 2011).

Meta-analytic findings indicate that the academic achievement of students with ADHD is .60 to .75 standard deviations below their non-ADHD classmates (Frazier et al., 2007). Further, children and adolescents with this disorder have difficulties interacting with peers and adult authority figures, have problems building and sustaining friendships, are more likely to be rejected by peers than their classmates without ADHD, and may have emotional difficulties related to coping with this disorder (Hodgens, Cole, & Boldizar, 2000; Stormont, 2001). The purpose of the current study was to examine the teacher-reported prevalence of ADHD symptoms and associated impairment, as well as the impact of child and teacher factors on prevalence, in a large, nationally representative sample of U.S. students.

Assessment and Identification of ADHD

Given the ubiquitous and potentially chronic academic and social impairment associated with ADHD, it is critical to accurately identify students with ADHD to design appropriate school-based interventions (Evans, Owens, Mautone, DuPaul, & Power, 2014). Comprehensive diagnostic assessment involves multiple respondents (e.g., teachers, parents) and multiple measures (e.g., diagnostic interview, behavior rating scales, direct observations of classroom behavior) to determine whether a student's behavior and functioning meet *Diagnostic and Statistical Manual of Mental Disorders,* fifth edition (*DSM-5*; APA, 2013) criteria for ADHD (Anastopoulos & Shelton, 2001; Barkley, in press; DuPaul & Stoner, 2014). Thus, mental health practitioners need information regarding the frequency and developmental deviance of symptomatic behaviors as defined by *DSM-5* and the degree to which symptoms are associated with functional impairment.

Teacher report regarding the frequency and severity of inattentive and hyperactive-impulsive behaviors in classroom settings is a critical component of multimethod assessment (Anastopoulos & Shelton, 2001; Barkley, in press; DuPaul & Stoner, 2014). Children and adolescents spend a minimum of 30 hours per week in school, and schools are arguably the most challenging environment for individuals with ADHD given expectations for sustained attention, inhibition of impulsive behaviors, and requirements to stay seated for much of the day (Reid, 2012). Thus, teachers have the unique opportunity to observe (a) children's behavior in the classroom context across an extended time period and (b) the degree to which symptomatic behaviors impair academic performance and interpersonal relationships. From a diagnostic perspective, teachers can provide important information regarding not only the frequency of symptomatic behaviors, but also the degree to which behaviors deviate from developmental expectations and impact children's academic and social functioning.

Children and adolescents who receive an ADHD diagnosis from a medical or mental health practitioner do not necessarily receive school-based support services. In fact, most students diagnosed with ADHD are served in general education settings and many do not have an educational support plan in place (Schnoes, Reid, Wagner, & Marder, 2006). Decisions regarding the need for specific support services (e.g., special education) typically are made through a multitiered, response-to-intervention (RTI) process (Burns & Gibbons, 2008). Having rating scales that can be used within prevention-oriented systems could help identify and support students with ADHD as well as those children and adolescents at-risk for ADHD.

A variety of broad-band (i.e., ratings of symptoms of multiple disorders such as the Behavior Assessment System for Children-2nd edition or *BASC-2*; Reynolds & Kamphaus, 2004) and narrow-band (i.e., ratings of symptoms of a specific disorder such as the *Conners-3*; Conners, 2008) behavior rating scales have been developed to obtain teacher perceptions of behaviors reflective of ADHD and related disorders (e.g., oppositional defiant disorder, conduct disorder). Although rating scales can provide reliable and valid information regarding the frequency and/or severity of symptomatic behaviors, they rarely include items focused on functional impairment, and to date have not included items regarding symptom-related impairment (i.e., academic or social impairment that is a result of inattention, impulsivity, and/or hyperactivity). Because symptom-related impairment is a critical criterion for the diagnosis of ADHD, practitioners often include measures that directly assess academic impairment (e.g., permanent products of assigned classwork, norm-referenced achievement tests). Teacher ratings of academic (e.g., *Academic Competence Evaluation Scale*, DiPerna & Elliott, 2000) and social (e.g., *Social Skills Improvement System*; Gresham & Elliott, 2008) functioning can also be used to assess impairment. Unfortunately, because data regarding symptoms and impairment are gathered through separate measures, it is difficult to determine whether impairment is attributable to ADHD symptoms or other factors.

Twenty-four prior studies including a total of 56,970 participants have examined the prevalence of ADHD based exclusively on teacher symptom ratings (for meta-analytic review, see Willcutt, 2012). The mean prevalence rate for ADHD from these studies was 13.3% (95% CI: 11.6 to 15.2%) with 4% (95% CI: 3.4 to 4.8%) identified with ADHD Combined (ADHD C), 2.6% (95% CI: 2.1 to 3.2%) ADHD Hyperactive-Impulsive (ADHD HI), and 6.6% (95% CI: 5.6 to 7.8%) ADHD Inattentive (ADHD IA). Willcutt also found that ADHD prevalence is consistently higher when based on teacher symptom ratings relative to parent symptom ratings (parent-reported prevalence M = 8.8%; 95% CI: 7.7 to 9.9%). Four studies have examined ADHD prevalence based on teacher report using the full *Diagnostic and Statistical Manual of Mental Disorders, fourth edition* (*DSM–IV*) criteria (i.e., including impairment). There was a 47% reduction in teacher-reported prevalence relative to report based on symptoms alone. When symptoms and impairment were considered together, mean total prevalence of ADHD was 7.1% (95% CI: 6.6 to 7.5%), 2.3% (95% CI: 1.7 to 3.2%) identified with ADHD C, 1.1% (95% CI: −0.5 to 2.3%) with ADHD HI, and 3.4% (95% CI: 3.1 to 3.7%) with ADHD IA. Impairment

related to ADHD C may be greater than other subtypes because the former were more likely to be referred for clinical services despite not being as prevalent as the ADHD IA subtype (Willcutt, 2012).

Factors Affecting Teacher Report

Behavior ratings completed by teachers are impacted by factors beyond symptomatic behaviors, including student (e.g., age, gender, race, ethnicity, special education status) and, possibly, informant (e.g., gender, years of teacher experience) characteristics. For example, DuPaul and colleagues (1997) collected teacher ratings of *DSM–IV–TR* (APA, 2000) symptoms of ADHD for 4,009 children and adolescents who attended kindergarten through 12th grade. Boys, younger children, and Black students received significantly higher symptom ratings than girls, older children and adolescents, and White students. In similar fashion, boys, Black children, and younger students have been found to receive significantly higher ratings of ADHD-related impairment from both elementary (Murray et al., 2009) and secondary (Evans et al., 2013) teachers. Prior studies have also found higher ADHD symptom prevalence among students in special education relative to those in general education (e.g., Schnoes et al., 2006). Far fewer studies have examined the impact of teacher characteristics on ADHD symptom and impairment ratings. Nevertheless, there is preliminary evidence that experience working with students with ADHD (Busing et al., 2002; Reid, Vasa, Maag, & Wright, 1994) may affect teacher perceptions of child ADHD symptoms such that teachers with more experience with this population may provide lower symptom ratings. No previous studies have examined the impact of teacher gender on ADHD symptom or impairment ratings.

Although prior studies have explicated how teacher report of ADHD symptoms may vary as a function of various student and informant characteristics, the degree to which these findings hold true for recently published *DSM-5* criteria is unknown. For example, one significant change to ADHD diagnostic criteria has been the addition of symptom descriptions specific to adolescents. Research is required to document the base rate of teacher-reported *DSM-5* ADHD symptoms in a general population sample as well as the prevalence of this disorder based on teacher report. Ratings of both symptoms and impairment should be used to determine identification rates because ratings based on symptom report alone may inflate prevalence estimates (e.g., Gathje, Lewandowski, & Gordon, 2008; Willcutt, 2012) and the combination of symptom and impairment report is consistent with *DSM-5* requirements. Thus, we sought to ascertain the prevalence of ADHD presentations (i.e., predominantly inattentive, predominantly hyperactive-impulsive, combined) as a function of teacher report of symptoms, impairment, and their combination.

Purpose of Study

The purpose of the current study was to address gaps in the extant literature by collecting reports of ADHD symptoms and related impairment from a nationally representative sample of teachers

who rated one randomly selected boy and girl from their class rosters. Teachers reported the frequency of 18 *DSM-5* ADHD behaviors as well as the severity of six impairment items (e.g., performing academically in school, getting along with other children) related to each symptom category (i.e., inattention and hyperactivity-impulsivity). We addressed the following research questions. First, to what degree do ADHD identification rates vary based on symptom report alone, symptom-related impairment report alone, or the combination of symptoms and impairment? We hypothesized that identification rates would be highest for symptom report alone and lowest for the combination of symptom and impairment report. Second, to what degree do student (e.g., age, gender, special education status, race, ethnicity) and informant (e.g., gender, years of teaching experience) characteristics account for variance in symptoms, impairments, and ADHD identification rates based on teacher report? We hypothesized that symptoms, impairments, and ADHD identification rates would be significantly higher for boys, elementary school–age children, Black students, and those receiving special education services. Further, we expected that teachers with more years of experience would report lower levels of symptoms, impairment, and ADHD identification. Because prior studies have not examined the impact of teacher gender on ADHD symptom ratings, this study explores whether such differences are present.

Method

Participants

The participants in this study were 1,070 teachers (766 female, 304 male) who completed ADHD symptom and impairment ratings for two 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 (*SD* = 10.7). The teacher sample was recruited from all regions of the US and included general and special education teachers (see Table 1). The student sample (*n* = 2,140; 1,070 males, 1,070 females) 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 backgrounds (54.8%) (see Table 1). The sample size was selected in order to provide a nationally representative sample of students across 13 grade levels that would provide adequate power and be sufficiently large to allow for analysis of subgroups.

Table 1. Demographic Characteristics of Teachers and Students

Characteristic	
Teachers (*n* = 1,070)	
Gender	
Male	304 (28%)
Female	766 (71.6%)
Age	

18–29	11.2%
30–44	32.5%
45–59	41.8%
60+	14.6%
Race/ethnicity	
White, non-Hispanic	87.3%
Black, non-Hispanic	3.1%
Other, non-Hispanic	3.2%
Hispanic	5.0%
2+ races, non-Hispanic	1.5%
M years of teaching experience	17.88 (10.7)
U.S. geographic region	
Northeast	23.2%
Midwest	27.1%
South	26.6%
West	23.1%
General education	891 (83.3%)
Special education	176 (16.4%)
Students (*n* = 2,140)	
Gender	
Male	1,070 (50%)
Female	1,070 (50%)
M age	11.53 (3.54)
Race/ethnicity	
White, non-Hispanic	54.8%
Black, non-Hispanic	12.7%
Other, non-Hispanic	7.0%
Hispanic	24%
2+ races, non-Hispanic	1.5%
Grade level	
K–2	510 (23.8%)
3–5	517 (24.2%)
6–8	517 (24.2%)
9–12	596 (27.9%)
General education	1,782 (83.3%)
Special education	352 (16.4%)

Measures

Demographic characteristics

Teachers reported their gender, age, race, ethnicity, years of teaching experience, and primary teaching assignment (i.e., general education or special education). In addition, teachers provided

the following information for the two students selected from their class rosters: gender, age, race, ethnicity, grade, and primary classroom placement (i.e., general education or special education).

ADHD symptom ratings

Teachers reported the frequency with which each student displayed the 18 symptomatic behaviors of ADHD over the previous 6 months. With the permission of the APA,[1] items were created based on the wording of ADHD symptoms from the *DSM-5*. Items were presented separately for the nine inattention and nine hyperactivity-impulsivity symptoms consistent with the conceptual model presented in *DSM-5*. For students in Grades 6 through 12, additional wording (from the *DSM-5*) was provided for some items to make these developmentally relevant. For example, the inattention item "has difficulty sustaining attention in tasks or play activities" was amended to include the following parenthetical text "(e.g., has difficulty remaining focused during lectures, conversations or lengthy reading)." Teachers indicated the frequency of each behavior on a four-point Likert scale including 0 (*never or rarely*), 1 (*sometimes*), 2 (*often*), and 3 (*very often*). For the purposes of this study, symptoms were considered "present" based on ratings of "2" or "3" and were considered "absent" based on ratings of "0" or "1," a procedure widely used in practice and supported by research (Power, Costigan, Leff, Eiraldi, & Landau, 2001; Willcutt, 2012). Reliability for the IA, HI, and combined symptom scales (Cronbach's alpha) were .96, .94, and .96, respectively.

ADHD impairment ratings

Teachers also reported the degree to which ADHD symptoms caused problems for each student with respect to getting along with school professionals, getting along with other students, completing or returning homework, performing academically in school, controlling behavior in school, and feeling good about himself/herself. Responses were made in the context of a 4-point Likert scale including 0 (*no problem*), 1 (*minor problem*), 2 (*moderate problem*), and 3 (*severe problem*). These six items were completed twice, once regarding the nine IA symptoms and again regarding the nine HI symptoms. Reliability for the IA, HI, and combined impairment scales were .90, .91, and .95, respectively. For the purposes of this study, impairment for any given item was considered "present" based on ratings of "2" or "3" and was considered "absent" based on ratings of "0" or "1."

Procedures

Two national research firms were used to collect data: GfK and e-Rewards. GfK teacher respondents (n = 474) were recruited through KnowledgePanel to provide a sample of students that was representative of the US population in terms of race, ethnicity, and geographic distribution. KnowledgePanel is a large national, probability-based panel that provides online research for measurement of public opinion, attitudes, and behavior. Panelists were selected using address-based sampling (ABS) 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. Household members who were randomly selected indicated their willingness to join the panel by returning a completed acceptance form in a postage-paid envelope, calling a toll-free hotline and speaking to a bilingual recruitment agent, or accessing a dedicated recruitment website. Only individuals who indicated that they were regularly employed (not substitute) K–12 teachers were allowed to participate. Initially, 1,509 teachers on the panel were assigned to complete ratings. Of these, 1,019 (67.5%) completed ratings and of the 1,019 completes, 474 (46.5%) qualified on the basis of meeting targets for demographic variables (e.g., student grade, race/ethnicity, geographic distribution) 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). A double opt-in is required; panelists must reply to the initial email invitation and then to a follow-up confirmation email. Potential panelists' physical addresses are then verified against postal records. All respondents are required to have a valid and unique email address. Respondents answer a profiling questionnaire when enrolling and provide information regarding employment status. The e-Rewards respondents indicated being a regularly employed K–12 teacher. A total of 12,610 teachers were invited to participate; 1399 (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).

To ensure equal gender representation, all teachers were asked to provide symptom and impairment ratings for one randomly selected boy and one randomly selected girl on their class roster. Teachers were explicitly requested to refer to their class roster and provide the number of boys and number of girls on this roster. Then a student was selected based on a randomly generated number provided in the instructions. Thus, for example, the teacher might be asked to select the 7th girl on the class roster. This procedure was used for both students rated. Secondary school teachers were instructed to provide ratings for one randomly selected male and one randomly selected female in a randomly selected class. Further, the sample was recruited such that the number of cases was balanced across age and grade range. Ratings were completed through a web-based survey that took approximately 9 minutes to complete (i.e., less than 5 minutes per student). Respondents received small stipends (less than $5) for completing ratings. If respondents left one or more items blank, they were prompted to complete missing items. Thus, complete data sets were produced for >99% of student ratings. Missing data (0.3%) were deleted casewise. All ratings were collected during April and May, 2014.

Data Analyses

First, the prevalence of teacher-reported ADHD was determined based on symptom counts alone, impairment counts alone, and the combination of symptoms plus impairment. For the analyses based on symptom counts alone, the presence of the three ADHD presentations (combined, predominantly inattentive, predominantly hyperactive-impulsive) was based on whether

inattention and/or hyperactivity-impulsivity symptom counts met or exceeded *DSM-5* criteria (e.g., six or more inattention plus six or more hyperactivity-impulsivity symptoms present for combined presentation). For analyses based on impairment ratings alone, evidence of pervasive, cross-situational inattention-related and/or hyperactivity-impulsivity-related impairment was indicated when at least two of the six impairment items for inattention and/or hyperactivity-impulsivity were counted as "present." Second, the degree to which teacher-reported ADHD symptoms and impairment varied by student age, gender, and primary placement, as well as teacher gender and years of teaching experience was examined. Regression analyses were conducted using student age, gender, and primary placement (general vs. special education) as well as teacher gender and years of teaching experience as predictor variables. These were conducted separately for (a) inattention symptom count, (b) hyperactivity-impulsivity symptom count, (c) combined symptom count, (d) inattention-related impairment, (e) hyperactivity-related impairment, and (f) combined impairment. All predictors were entered simultaneously and the unique contribution of each was examined. Third, to assess the effects of student race/ethnicity, gender by race/ethnicity ANOVAs were conducted separately for symptom and impairment counts. For this analysis, we used five orthogonal categories (described below). Finally, to assess the effects of student gender, race/ethnicity, and special education status on identification rates, 2 × 2 chi-square analyses were conducted using the combination of symptom and impairment count. To control for multiple testing, we divided our nominal alpha (.05) by the number of tests. In all cases, observed significance was lower than adjusted alphas. We used Scheffé post hoc tests, which are conservative and control for multiple comparisons.

Results

Table 2 shows the diagnostic status for no ADHD, ADHD Inattentive presentation, ADHD Hyperactive-Impulsive presentation, and ADHD Combined presentation using symptom counts (≥6) and impairment counts (at least 2 for IA and/or HI). Using symptom count alone, 18.9% of the sample would screen positive for any ADHD presentation. Using impairment count alone, 31.4% of the sample would screen positive for any ADHD presentation. Using the combination of symptom plus impairment count, 7.3% of the sample would screen positive for ADHD. Thus the hypothesis that the combination of symptom and impairment count would result in lower rates of ADHD identification was confirmed.

Table 2. Diagnostic Status Based On Symptom Count, Impairment Count, and Combined

Condition	No ADHD	ADHD IA	ADHD HI	ADHD C
Symptom	1,735 (81.1%)	236 (11.0%)	39 (1.8%)	130 (6.1%)
Impairment	1,469 (68.6%)	131 (6.1%)	42 (2.0%)	498 (23.3%)
Symptom + Impairment	1,984 (92.7%)	32 (1.5%)	2 (0.09%)	122 (5.7%)

Note. Individual symptom and impairment percentages and counts are based on 2,140 students. IA = Inattentive presentation; HI = Hyperactive/Impulsive presentation; C = Combined presentation.

All overall models examining effects of teacher and student factors on symptom counts were statistically significant: Inattention (IA), $F(5, 2134) = 63.56$, $p < .001$, adjusted $R^2 = .128$; Hyperactivity/Impulsivity (HI), $F(5, 2134) = 51.92$, $p < .001$, adjusted $R^2 = .106$; and Combined (C), $F(5, 2134) = 70.38$, $p < .001$, adjusted $R^2 = .140$. Table 3 shows the results of the regression analyses for teacher and student predictors of symptom counts for IA, HI, and C. A consistent pattern emerged across dimensions. Teacher gender was not a significant predictor for any dimension. In contrast, teachers' years of experience was significant for all dimensions; more experienced teachers tend to report fewer symptoms. Student age was a significant predictor for all dimensions, with the negative slope indicating a decline in the number of symptoms across the age range. Special education status was also significant with special education students having higher symptom counts than general education students across all dimensions. Finally, student gender was statistically significant indicating that boys had higher symptom counts than girls across all dimensions.

Table 3. Teacher and Student Predictors for Symptom Counts

	Inattention		Hyperactive/Impulsive		Combined	
Factor	Beta	*t* (R^2)	Beta	*t* (R^2)	Beta	*t* (R^2)
Teacher factors						
Gender	.036	1.66 (.001)	.008	.379 (<.0001)	.026	1.232 (.0006)
Experience	-.43	-2.15*(.002)	-.063	-3.074**(.004)	-.057	-2.825** (.003)
Student factors						
Age	-.09	-4.50*** (.008)	-.168	-7.709***(.025)	-.140	-6.529*** (.017)
Special education	.291	14.31*** (.083)	.213	10.375*** (.045)	.283	14.006*** (.079)
Gender	-.175	-8.65***(.030)	-.179	-8.775*** (.032)	-.194	-9.662*** (.038)

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

All overall models examining effects of teacher and student factors on impairment counts were statistically significant: IA, $F(5, 2134) = 55.29$, $p < .001$, adjusted $R^2 = .113$; HI, $F(5, 2134) = 48.06$, $p < .001$, adjusted $R^2 = .099$; and C, $F(5, 2134) = 55.37$, $p < .001$, adjusted $R^2 = .113$. Table 4 shows the results of the regression analyses for teacher and student predictors of impairment counts for IA, HI, and C. Once again teacher gender was not a significant predictor. In contrast to the symptom count models, teacher experience was not a significant predictor. Consistent with the symptom count models, student age, special education status, and gender were statistically significant. Impairment counts decreased with age for all dimensions; special education students received higher impairment counts; and boys received higher impairment counts than girls.

Table 4. Teacher and Student Predictors for Impairment Counts

	Inattention		Hyperactive/Impulsive		Combined	
Factor	Beta	*t* (R^2)	Beta	*t* (R^2)	Beta	*t* (R^2)
Teacher factors						
Gender	.039	1.775 (.001)	.019	.884 (.0003)	.030	1.382 (.0007)
Experience	-.003	-.125 (< .0001)	-.002	-.078 (< .0001)	-.002	-.105 (< .0001)
Student factors						
Age	-.084	-3.844*** (.006)	-.105	-4.775***(.009)	-.097	-4.462*** (.008)
Special education	.282	13.762*** (.078)	.262	12.692*** (.068)	.281	13.712*** (.078)
Gender	-.158	-7.735 (.025)	-.147	-7.143*** (.022)	-.157	-7.712*** (.025)

*** $p < .001$.

Follow-up χ^2 tests related to the student predictor variables were all statistically significant at the .0001 level, showing that identification rates for IA, HI, and C presentations based on both symptom and impairment counts were significantly affected by student gender, special education status, and age level (see Table 5). Specifically, boys were significantly more likely to screen positive than girls for all three presentations of ADHD, special education students were more likely to screen positive than general education students, and students ages 11 and younger were more likely to screen positive than those 12 and older. Teacher gender was not significant.

Table 5. Relative Risk Ratios (Confidence Intervals) for Gender, Special Education Status, and Age Level by IA, HI, and C

	IA	HI	C
Symptom count			
Male vs. Female	1.77 (1.45–2.15)	2.75 (1.98–3.83)	2.61 (1.79–3.79)
Special education vs. General education	4.19 (3.25–5.42)	3.15 (2.24–4.42)	3.63 (2.51–5.30)
Age < 12 vs. Age ≥ 12	1.54 (1.27–1.86)	2.25 (1.64–3.08)	1.95 (1.37–2.78)
Impairment count			
Male vs. Female	1.58 (1.38–1.82)	1.58 (1.36–1.84)	1.58 (1.34–1.85)
Special education vs. General education	4.44 (3.50–5.63)	4.16 (3.27–5.28)	4.15 (3.26–5.28)
Age < 12 vs. Age ≥ 12	1.29 (1.13–1.48)	1.44 (1.24–1.67)	1.45 (1.24–1.70)

Note. Comparison groups are male, special education, and age , 12. IA = inattentive type ADHD; HI = hyperactive impulsive type; C = Combined type.

All ANOVA models examining effects of student race/ethnicity on symptom counts were statistically significant. We included gender as a factor to guard against the possibility of a gender by race/ethnicity interaction. Because no significant gender by race/ethnicity interactions were found for symptom or impairment counts, we report only main effects for race/ethnicity. Results for symptom counts were as follows: IA, $F(4, 2130) = 8.05$, $p < .001$, adjusted $R^2 = .041$; HI, $F(4, 2130) = 8.92$, $p < .001$, adjusted $R^2 = .045$; and C, $F(5, 2130) = 9.96$, $p < .001$, adjusted $R^2 = .051$. ANOVA models for impairment count were also statistically significant:

IA, $F(4, 2130) = 13.26$, $p < .001$, adjusted $R^2 = .045$; HI, $F(4, 2130) = 10.37$, $p < .001$, adjusted $R^2 = .036$; and C, $F(5, 2130) = 12.51$, $p < .001$, adjusted $R^2 = .043$. Table 6 shows means and results of post hoc Scheffé tests. Black non-Hispanic students exhibited significantly higher symptom and impairment counts than White non-Hispanic, Other non-Hispanic, and Hispanic groups. Effect sizes (Cohen's *d*) for symptom count for Black non-Hispanic versus White non-Hispanic, Other non-Hispanic, and Hispanic groups, respectively were as follows: HI, .35, .45, and .25; C, .37, .46, and .22.; and for IA symptoms (Black non-Hispanic vs. White non-Hispanic and Other non-Hispanic), .33, .39. Effect sizes (Cohen's *d*) for impairment count for Black non-Hispanic versus White non-Hispanic, Other non-Hispanic, and Hispanic groups respectively were as follows: HI, .37, .46, and .22; IA, .42, .57, and .29; and C, .41, .53, and .26. Hispanic students were significantly higher than Other non-Hispanics for IA ($d = .30$) and C ($d = .29$) impairment count. No other between-groups differences were evident.

Table 6. Race/Ethnicity by Mean Symptom Count and Impairment Count

Condition	White, non-Hispanic	Black, non-Hispanic	Other, non-Hispanic	Hispanic	2+ races, non-Hispanic	Post hoc test results
Inattention symptom	1.74 (2.82)	2.69 (3.16)	1.52 (2.58)	2.20 (3.13)	1.33 (2.43)	BNH > WNH, & ONH
Hyperactive/Impulsive symptom	0.99 (2.09)	1.76 (2.68)	0.67 (1.75)	1.14 (2.24)	0.57 (1.34)	BNH > WNH, ONH, & HSP
Combined symptom	2.74 (4.50)	4.45 (5.35)	2.19 (3.97)	3.34 (4.85)	1.90 (3.31)	BNH > WNH, ONH, & HSP
Inattention impairment	0.99 (1.66)	1.73 (2.00)	0.70 (1.32)	1.19 (1.70)	0.90 (1.37)	BNH > WNH, ONH, & HSP HSP > ONH
Hyperactive/Impulsive impairment	0.84 (1.59)	1.46 (1.99)	0.65 (1.33)	1.07 (1.71)	0.57 (1.17)	BNH > WNH, ONH, & HSP
Combined impairment	1.83 (3.16)	3.19 (3.86)	1.35 (2.61)	2.27 (3.29)	1.48 (2.42)	BNH > WNH, ONH, & HSP HSP > ONH

Note. WNH = White non-Hispanic; BNH = Black non-Hispanic; ONH = Other non-Hispanic; HSP = Hispanic; 2+ = 2+ races non-Hispanic. Standard deviations in parentheses.

Discussion

The results of this study affirm the importance of considering both symptoms and impairment when making screening and diagnostic decisions about ADHD, a practice highlighted in the *DSM–IV–TR* (APA, 2000) and reemphasized in the *DSM-5* (APA, 2013). This study specifically examined the separate and combined contributions of ratings of symptoms and symptom-related impairments in assessing ADHD. Prevalence estimates of ADHD based on teacher ratings were substantially lower, and consistent with widely accepted rates (APA, 2013; Willcutt, 2012), when symptom counts and impairment were considered together (7.3%) as opposed to when either symptoms (18.9%) or symptom-related impairments (31.4%) were

considered alone. These findings clearly demonstrate the clinical and epidemiological importance of simultaneously considering symptoms and impairment when assessing ADHD. Failure to do so, either by reliance on symptom counts or impairment alone, may increase the risk for identifying ADHD in a child who does not have this disorder or lead to inflated prevalence estimates within a given child population.

This study also examined the impact of student and teacher characteristics on informant ratings of ADHD based on items derived directly from the *DSM-5*. The findings confirm the results of previous studies indicating that severity of ADHD (DuPaul et al., 1997) and level of symptom-related impairment (Evans et al., 2013; Murray et al., 2009) are associated with student age and gender. Higher teacher ratings of ADHD symptoms and impairments were inversely related to child age with small, but clinically important effect sizes. As expected, the effect of student age was much greater on ratings of symptoms and symptom-related impairments for hyperactivity-impulsivity as compared with ratings related to inattention. Also, as hypothesized, boys were more likely than girls to have elevated symptoms and symptom-related impairments with small, but clinically meaningful effect sizes. Further, as expected based on previous studies (DuPaul et al.,Evans et al.,Murray et al.), Black non-Hispanic students received higher symptom and impairment ratings than White non-Hispanic and Hispanic students across ADHD dimensions with small to medium effect sizes. The tendency for Black students to receive higher teacher-reported symptom and impairment ratings may contribute to elevated diagnostic rates for these students. Additional research is needed to understand this persistent finding. Given disproportionate rates of lower socioeconomic status (SES) among Black students, the unique contribution of SES and race needs to be investigated. Informant bias is another factor that could be explored further. Also, research is accumulating to support the hypothesis that the roots of racial disparities in mental health conditions may be attributable in part to variations in neurobiological vulnerability related to disproportionate rates of exposure to stress and trauma among children of Black and other minority backgrounds (Shonkoff, Boyce, & McEwen, 2009). There is a strong need for research exploring the connection between neurobiological vulnerability, exposure to stress and trauma, and risk for ADHD.

Consistent with our hypotheses, symptom counts, impairments, and ADHD identification rates were higher for special education relative to general education students. This finding is not surprising given that disability conditions often resulting in special education (e.g., learning disabilities, emotional and behavioral disorders) are associated with elevated rates of ADHD diagnosis. Further, students with ADHD are often eligible for special education under the category of Other Health Impaired because of impairments directly related to ADHD.

This study is one of the few to investigate the relationship of teacher level of experience to ADHD behavior ratings. Consistent with Busing and colleagues (2002), this study found that greater teacher experience was related to lower ratings of ADHD symptoms, although the effect size was very small. In contrast, level of teacher experience was not significantly related to

symptom-related impairments. These findings suggest that teachers of varying levels of experience have similar views about impairments related to ADHD.

This study found no evidence of gender differences among teachers. Male and female teachers are likely to have had similar training and experience in working with children who have ADHD, leading them to perceive children with ADHD in similar ways. Additional research is needed to confirm this finding.

A limitation of this study is that ADHD identification rates were based on reports provided only by teachers. Best practices for assessing ADHD (American Academy of Pediatrics, 2011; APA, 2013) stipulate that the assessment of ADHD should include information about child functioning in multiple settings, which is typically operationalized as evidence of symptoms and impairments based upon both teacher and parent ratings (DuPaul & Stoner, 2014). Also, in this study, estimates of ADHD prevalence rates did not take into account other diagnostic factors delineated in the *DSM-5*, such as age of onset of ADHD symptoms and consideration of alternative diagnostic explanations for ADHD symptoms (e.g., autism spectrum disorders). Further, determinations of risk for ADHD in this study did not include the results of a norm-referenced measure of ADHD symptoms, which is recommended best practice (Barkley, in press). In the absence of these additional *DSM-5* criteria, our results represent teacher-based prevalence estimates and therefore should be interpreted with caution. It is noteworthy, however, that obtained prevalence estimates (e.g., 5.7% for ADHD-C) are consistent with those reported in prior prevalence studies (Willcutt, 2012). Additionally, we were unable to collect data on socioeconomic status (SES). We cannot rule out that differences in symptom counts and impairment were attributable to differences in SES across Black and White students. It is also possible that teacher–child ethnic differences influenced results (Graves & Howes, 2011). Because there were so few non-White teachers we were unable to test for this factor.

Another limitation of this study is that the response rate for teachers who were “off panel” and therefore less likely to represent national census targets was low (11.1%), especially in relation to the teachers who were “on panel” and likely to represent census targets (67.5%). To address this limitation, off-panel teachers were over recruited and only those who qualified based upon a consideration of census targets linked to demographic variables (i.e., student grade, ethnicity, race, geographic region) were included. Note however that the response rate for the off-panel teachers was near the median rate of 15% reported by e-Rewards. Additionally, nesting of students was a potential issue because the same teacher rated two students. Nonindependence in the teacher ratings could reduce standard errors leading to a potentially inflated Type I error rate. However, this is only problematic when design effects exceed a value of 2 (Muthén & Sattora, 1995). In our case, because all of the clusters are small (2 students per teacher) the resultant design effects were practically negligible. For example, the design effect for the inattentive subscale score was 1.29 suggesting the nested structure did not cause any inflation of the Type I error rate.

As a result of the recruitment strategies used in the study, the sample generally was representative of national census targets. With regard to ethnicity, the sample closely approximates national estimates of the Hispanic population of children (about 23%). With respect to race, the sample closely approximates national estimates of the White, Black, Asian, and Native American populations. A limitation of the 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%).

Such limitations notwithstanding, the findings from the current study have important practice implications for school psychologists who work with students who have, or who are suspected of having, ADHD symptoms that interfere with educational performance. For example, for students who have not yet been identified but are suspected of having ADHD, information derived from a rating scale that simultaneously assesses ADHD symptoms and symptom-related impairment can be combined with classroom observations and objective classroom performance indices to increase diagnostic screening accuracy before referral to outside health care providers. In so doing, the risk for incorrectly identifying a student as having ADHD is reduced. For students who have been identified with ADHD, simultaneous assessment of ADHD symptoms and symptom-related impairment can also serve as an important tool for determining response to treatment, whether it be pharmacotherapy, a classroom intervention, or other types of psychosocial treatment.

In conclusion, this study is among the first to examine teacher ratings of ADHD symptoms as defined by *DSM-5* (APA, 2013). Consistent with prior research that used *DSM–IV*symptom descriptions for ADHD (DuPaul et al., 1997), higher levels of ADHD symptoms were found among boys, younger children, children in special education classrooms, and children from Black non-Hispanic backgrounds. Higher ratings of ADHD symptoms were also more likely to be reported by teachers with fewer years of classroom experience. Together, such findings call attention to the need for taking various child and teacher characteristics into account when interpreting ADHD rating scale findings.

Recognizing that symptom-related impairment is a critical criterion for diagnosing ADHD, this study examined teacher-reported symptoms and impairments, which allowed for an examination of the separate and combined contributions of symptom ratings and symptom-related impairment in assessing ADHD. Prevalence estimates of ADHD based on teacher ratings were consistent with widely accepted rates when symptom counts and impairment were considered together, but not when either symptom counts or symptom-related impairment were considered alone. Such findings highlight the clinical and epidemiological importance of simultaneously considering symptoms and symptom-related impairment when diagnosing ADHD.

Footnotes

[1] Permission from the American Psychiatric Association is required when using *DSM-5* symptoms in a behavior rating scale or survey. It is important to note, however, that neither the APA nor any other organization, company, or agency provided financial support for this study.

Acknowledgement: Drs. Anastopoulos, DuPaul, Power, and Reid have a financial interest in the *ADHD Rating Scale-5*, which was used in this study to assess teacher ratings of ADHD symptoms and impairment.

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