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ADHD and gender: are risks and sequela of ADHD the same for boys and girls?

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Background: Research comparing treatment-referred boys and girls with attention-deficit/hyperactivity disorder (ADHD) has yielded equivocal results. Contradictory findings may be associated with differential referral practices or unexplored interactions of gender with ADHD subtypes. **Method:** We examined possible gender differences in ADHD and its subtypes among children aged 4 to 17 in a representative community sample ($N = 1896$) in Puerto Rico. Caretakers provided information through the Diagnostic Interview Schedule for Children (version IV) and a battery of impairment, family relations, child problems, comorbidity and treatment measures. **Results:** ADHD was 2.3 times more common in boys than girls, but with one exception there was little evidence that the patterns of associations of ADHD with correlates were different for boys and girls. The exception was school suspension, which was more common among ADHD boys than girls. Additional gender interactions were found when ADHD subtypes were considered. Among those with combined type ($n = 50$), boys were more likely to be comorbid with mood disorders than girls. For those with the inattentive type ($n = 47$), girls were more likely to be comorbid with anxiety disorders than boys. **Conclusions:** Our findings lend cross-cultural generalizability to recent reports that gender does not interact with correlates for ADHD overall, but that it may play a role in subtypes. **Keywords:** Attention deficit/hyperactivity impulsivity disorder, gender differences, Latino/Hispanics, ADHD subtypes. **Abbreviations:** CT: combined type; HIT: hyperactive-impulsive type; IT: predominantly inattentive type; ICC: intraclass correlation coefficient.

The research literature on attention-deficit/hyperactivity disorder (ADHD) reports that individuals with this disorder present diverse family backgrounds, patterns of comorbidity, and impairment profiles. The heterogeneous nature of ADHD has led to its subdivision into more homogeneous subtypes based on the predominance of symptoms of inattention (predominantly inattentive subtype or IT), of hyperactivity-impulsivity symptoms (hyperactive-impulsive subtype or HIT) or on both sets of symptoms (combined subtype or CT) (American Psychiatric Association, 1994). Research has generally supported the validity of the DSM-IV subtypes (e.g., Carlson, Shin, & Booth, 1999; Bauermeister et al., 2005; Graetz, Sawyer, Hazell, Arney, & Baghurst, 2001). The CT and IT may be stable enough over time to segregate groups for research (Lahey, Pelham, Loney, Lee, & Willcutt, 2005).

The vast majority of the initial papers about ADHD were based on studies of treated males who mostly had CT. Recently there has been more attention placed on to what extent males and females with ADHD show different manifestations (e.g., Arcia & Conners, 1998; Arnold, 1996; Gaub & Carlson, 1997). Like the initial papers, most of the studies of gender are also based on treatment samples. These results have generally been equivocal. A meta analysis and critical review of the published research literature found no differences in girls and boys on impulsivity, academic performance, social functioning, fine motor skills, parental education or parental depression (Gaub & Carlson,1997), but other studies published after the meta analysis continue to report inconsistent results (see Gershon, 2002; Heptinsall & Taylor, 2002).

The contradictory results may be associated with differential referral practices for boys and girls that can be related to different impairment or severity levels of treated populations. Unexplored interactions of gender with ADHD subtypes may also explain contradictory findings. Studies based on treated samples may be appropriate when generalizing findings to children who receive services in clinics. However, even this generalization may be limited by the fact that girls with ADHD are underrepresented in these settings (Gaub & Carlson, 1997). In addition, treated cases are likely to be more impaired than children from the general population (Angold, Costello, & Erkanli, 1999). If, as suggested by some researchers, girls with ADHD in clinical settings are more severely affected, comparison between boys and girls with ADHD in these settings can mask potential sex differences and lead to erroneous conclusions (Gaub & Carlson, 1997).

In contrast to the studies of treatment samples, studies of non-referred samples have generally been consistent in showing no differences of risks for

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ADHD by gender. Recently, Biederman and colleagues (2005) examined gender effects in a non-referred sample of siblings of probands with ADHD and non-ADHD comparison children. No significant gender differences were reported in psychiatric comorbidity, treatment history, and psychosocial variables. The authors concluded that boys and girls with ADHD present similar clinical profiles and suggested that gender differences reported in treatment samples may be related to referral biases.

Two other studies of children from the general population found similar results. Graetz, Sawyer, and Baghurst (2005) reported that among children who were identified from a nationally representative sample of Australian children, boys and girls who met symptom criteria for DSM-IV ADHD did not differ on core symptoms of the disorder, comorbidity, or impairment. The only exceptions were that girls with ADHD received higher ratings of somatic complaints and better school functioning. However, on impairment measures of social problems, schoolwork difficulties, and self-esteem, girls were less impaired than boys in the CT and HIT groups but equally or more impaired than boys in the IT group.

The second study of children from the general population (Levy, Hay, Bennett, & McStephen, 2005) examined whether gender moderated the association of ADHD types with comorbidity in a large sample of Australian twins and their siblings. They did not find significant gender differences among ADHD types in terms of comorbidity for externalizing disorders, but they did find that gender interacted with comorbidity of the IT group with separation anxiety disorder (SAD) and of the CT group with generalized anxiety disorder (GAD). These disorders were higher in females.

In summary, the few studies on gender differences carried out with non-referred children suggest that the clinical correlates of ADHD are not moderated by gender, but that gender differences may be found among the ADHD types. Although these studies are suggestive, they are not definitive with respect to findings in the general population. Two of the three studies with non-referred samples were not formally representative of the general population (Biederman et al., 2005; Levy et al., 2005). Furthermore, the studies that examined gender differences for the diagnosis of ADHD used DSM-III criteria (Biederman et al., 2005) or used symptom criteria to approximate DSM-IV diagnosis (Graetz et al., 2005). Finally, the studies did not adjust for the effects of the presence of non-ADHD diagnoses on the gender differences reported.

In this paper, we examine whether boys and girls exhibit different risk factors and correlates for the diagnosis of ADHD, as well as for ADHD types in a population-based representative sample of Puerto Rican children 4 to 17 years. This article extends analyses of this community sample that were previously presented (Bauermeister et al., in press) on overall correlates of ADHD in both community and treated samples. Based on the community sample, we reported that ADHD was 2.2 times more prevalent in boys than girls and that it was significantly associated with child, family, and school variables. Because we did not examine whether these associations were different for boys and for girls, we now report tests of the interactions of the risk variables with gender for both ADHD and its subtypes.

This study provides an important test of the generalizability of the existing literature to another cultural context, namely island-residing Puerto Rican youth. Insofar as that literature generalizes to a community-based Puerto Rican sample, we expect no gender differences in the risk factors for ADHD, with the possible exception of poorer school adaptation for boys. We do not expect significant gender differences among the ADHD types in comorbidity with disruptive disorders. However, we expect that gender will moderate the association between CT and IT, and the internalizing disorders.

Method

Participants

The community sample was an island-wide probability household sample of children aged 4–17 years. This sample and the methods of the study have been described in detail elsewhere (Canino et al., 2004). Briefly, the sample was stratified by Puerto Rico's (P.R.) health reform regions, urban and rural areas, child's age and gender, using U.S. 1990 Census block groups as primary sampling units. One child was selected at random from each household adjusted for age and gender. Out of 2,102 eligible households, 1,886 parent–child dyads were interviewed (completion rate of 90.1%).

Instruments and measures

Diagnostic Interview Schedule for Children. Presence of DSM-IV disorders in children during the last year was assessed using the latest translation into Spanish of the Computerized Diagnostic Interview Schedule for Children, version IV (DISC-IV; Bravo et al., 2001). The DISC-IV is a structured instrument designed to be administered by lay interviewers for the assessment of psychiatric and substance use disorders in children and adolescents.

We defined caseness as presence of DISC-IV criteria based on parental reports including at least one moderate level of impairment or distress linked to each of the psychiatric disorders ascertained. Data have suggested that parents (vs. youths) are more reliable informants for ascertaining the presence of ADHD (Jensen et al., 1999). ADHD subtypes were identified using DISC-IV symptom criteria: IT group, presence of 6 or more symptoms of inattention but 5 or less of hyperactivity-impulsivity; HIT group, 6 or more symptoms of hyperactivity-impulsivity but 5 or less of inattention; and CT group, 6 or more symptoms on both symptom dimensions.

Brief Impairment Scale (BIS). The Spanish BIS provides a measure of the caretaker's report of a child's global impairment along interpersonal, school/work, and self-fulfillment dimensions of functioning. Each subscale provides reliable and valid measures of impairment (Bird et al., 2005).

Parent Interviewer Children's Global Assessment Scale (PICGAS). The latter yields a global measure of the child's impairment on adaptive functioning as scored by lay interviewers. The Spanish PICGAS has adequate reliability and validity (Bird et al., 1996).

Developmental history. We developed four parent-reported measures: speech or language problems identified by a health professional; grade failure; school suspension or expulsion; and problems sleeping at night during the last year.

Parent–Child Attachment Scale. This scale (10 items) is adapted from Hudson's Index of Parental Attitudes and the Child's Attitude towards Mother/Father Scale (Hudson, 1982), and assesses the primary caretaker's perception about the quality of the parent–child relationship. We examined the internal consistency (alpha) of this and other scales in our community sample and the test–retest reliability (intraclass correlation coefficient: ICC) in a clinical sample described elsewhere (Bravo et al., 2001). Alpha is .76 and ICC is .72.

Family Care Burden Scale. This is a short 7-item scale based on a family burden scale developed by Messer, Angold, Costello, and Burns (1996). It measures feelings of personal well-being, family relationships, activities, and responsibilities (alpha = .72; ICC = .50).

Parental Discipline Scale. We used the negative disciplinary practices section of the original 8-item scale, which include physical punishment, yelling, and emotional detachment (Goodman et al., 1998) (alpha = .62; ICC = .67).

Parents Attitude towards Medication Scale (PATMS). This is a one-item scale designed to assess attitudes towards medication used in the treatment of behavior problems in children (ICC = .60).

Service Assessment for Children and Adolescents (SACA). The Spanish version of the SACA (Canino et al., 2002) was used to ascertain last-year use of services and treatments by children for emotional, alcohol, and drug problems. It has shown fair to substantial reliability for most services and for last-year use of any psychoactive medication.

Procedures

The procedures of the study have been described in detail elsewhere (Canino et al., 2004). The survey was carried out from January 1999 through December 2000. Assent was obtained for children 6 to 10 years and informed consent was obtained from the child's primary caretaker and youths aged 11 and older.

Analytic strategy

The sample was weighted to represent the population of children ages 4 to 17 in P.R. Sampling weights reflect differences in selection probability due to the complex sample design. All statistical analyses were conducted using SUDAAN software (release 8.0) (Research Triangle Institute, 2001).

Regression analyses were specified with the correlates as outcome variables and presence of ADHD and gender as main predictors. Age and number of non-ADHD disorders were used as covariates in all regression where these factors were not the outcome of interest. In the analyses where the predictors were the ADHD subtypes, the three IT, HIT and CT groups were simultaneously included in the regression analyses. To test whether gender moderated the association between ADHD and each correlate, the interaction between the two (ADHD/gender) was included. The reference group in these regressions was girls with non-ADHD disorders.

Results

Table 1 shows the gender differences in ADHD, ADHD types and the range of demographic, family, child, clinical and treatment variables that have been shown to be correlated with ADHD. Boys are significantly more likely to be diagnosed with ADHD in the past year than girls, with an age adjusted odds ratio of 2.3. This odds ratio was slightly different from the unadjusted 2.2 ratio reported previously (Bauermeister et al., in press). Similar ratios were found for the ADHD types, but only IT was significantly different from 1.0. For IT the ratio was 2.6, for HIT the ratio was 1.4 and for CT the ratio was 2.1. Table 1 also shows a number of other gender differences. Although the boys and girls in the sample did not differ by age, overall impairment as measured by PICGAS, family burden, parent–child attachment, rates of mood and anxiety disorders, and caretaker's attitudes toward medication; they did differ on a number of other variables. Boys have higher scores on the BIS School scale; receive more negative discipline practices at home; and present more speech and sleep problems, grade failure and school suspension, and higher levels of comorbid disruptive disorders than girls. Boys are also more likely to receive treatment services than girls.

Gender differences in correlates of ADHD. Table 2 shows the average level of each correlate broken down by ADHD (present/absent) and gender (girls/boys). It also shows results of tests of interactions between ADHD and gender in regression models that predict each of the correlates. These interactions test whether the strength of association of each correlate with ADHD differs between boys and girls. Although

Table 1 Regression analyses for continuous (age, impairment, family) and categorical (ADHD prevalence, child, comorbidity, treatment) variables among girls and boys

	Girls ($n = 915$)	Boys ($n = 982$)	Gender effects		
Measures	Mean (SE)	Mean (SE)	β	SE	p
Continuous					
Age (mean years)	10.5 (.2)	10.5 (.1)	−.0	.2	.98
Impairment					
PICGAS	84.0 (1.0)	82.8 (.8)	−1.2	1.2	.30
BIS total	7.3 (.3)	9.1 (.3)	1.8	.4	.00
Interpersonal	1.2 (.1)	1.4 (.1)	.2	.1	.13
School	2.2 (.1)	3.5 (.2)	1.4	.2	.00
Self-fulfillment	3.8 (.1)	4.0 (.1)	.2	.2	.22
Family variables					
Family burden	8.7 (.1)	8.6 (.1)	.1	.1	.35
Parent–child attachment	35.4 (.2)	35.0 (.2)	−.4	.2	.11
Negative discipline	5.6 (.1)	5.8 (.1)	.2	.1	.02
	% (n)	% (n)	OR	95% CI	p
Categorical					
ADHD	4.7 (43)	10.3 (100)	2.3	1.4–4.0	.01
IT	1.3 (12)	3.6 (35)	2.6	1.1–6.5	.03
HIT	4.6 (42)	6.1 (60)	1.4	.8–2.5	.20
CT	1.5 (14)	3.7 (36)	2.1	.9–4.7	.06
Child problems					
Speech problems	4.8 (47)	11.0 (118)	2.4	1.6–3.7	.00
Sleep problems	8.4 (81)	11.5 (109)	1.4	1.0–2.0	.04
Grade failure	10.1 (85)	23.0 (203)	2.8	1.9–4.0	.00
School suspension	4.2 (32)	11.1 (105)	3.0	1.8–4.8	.00
Comorbidity					
Any disruptive disorder	4.4 (38)	6.9 (70)	1.6	1.0–2.6	.05
Any mood disorder	2.5 (18)	1.5 (12)	.6	.3–1.3	.18
Any anxiety disorder	5.1 (56)	4.7 (41)	1.1	.6–1.9	.75
Treatment					
School services	6.0 (53)	11.5 (108)	2.0	1.3–3.1	.00
Outpatient services	3.7 (30)	8.9 (94)	2.5	1.5–4.4	.00
Medication use	.24 (3)	2.4 (26)	10.6	2.9–38.0	.00
Medication attitude	35.6 (316)	36.5 (363)	1.0	.8–1.4	.79

Note: Weighted estimates of population means (standard error in parentheses) or percentages (n in parentheses) and unstandarized regression coefficients (β) or odds ratios (OR). ADHD = Attention-Deficit Hyperactivity Disorder, PICGAS = Parent Interviewer Children's Global Assessment Scale; BIS = Brief Impairment Scale; IT = Inattentive Type; HIT = Hyperactive Impulsive Type; CT = Combined Type; CI = 95% Confidence Interval. Age was used as covariate in all regressions where this factor was not the outcome of interest.

there are more than twice as many boys as girls in the survey who were diagnosed as having ADHD on the basis of their parents' report, and although ADHD was associated with higher levels of impairment, poor family relations, higher number of child sleep problems, higher levels of comorbidity, and increased use of services, there was little evidence that these associations differed by gender. As shown in the columns on the right in Table 2, almost none of the ADHD by gender interactions were significant. With the exception of school suspensions, the relation of risk variables and correlations to ADHD appeared to be similar for boys and girls.

School suspensions appeared to be more strongly related to ADHD in boys than girls. Among boys, the odds of school suspension with ADHD were 2.3 times larger than for those without the disorder. Nearly a quarter of boys with ADHD (22.7%) in our sample reported having been suspended. In contrast, there were no girls with ADHD who had been suspended from school and this resulted in an odds ratio (OR) for this interaction that was undefined (approaching infinity). To get a conservative lower bound for the interaction, we carried out an analysis in which a hypothetical female with both ADHD and a school suspension was introduced into the sample. The single hypothetical data point reduced the point estimate of the interaction from infinity to 124.7. The lower 95% bound on the interaction in this analysis was 11.3.

Gender differences in correlates of ADHD types. As a final analysis we examined gender interactions with ADHD types. Some of the children who were classified within an ADHD subtype did not meet full criteria for the disorder, and hence the number of children with no diagnosis is slightly smaller in Table 3 than in Table 2. This can be explained by the fact that ADHD subtypes were solely based on symptom requirement on the DSM IV.

Table 2 Regression analyses for continuous (age, impairment, family) and categorical (child, comorbidity, treatment) variables among girls and boys with and without ADHD

	ADHD		Non-ADHD		Interaction Gender and ADHD		
	Girls ($n = 43$)	Boys ($n = 100$)	Girls ($n = 869$)	Boys ($n = 878$)			
Measures	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	β	SE	*p*
Continuous							
Age (mean years)	8.8 (.7)	9.3 (.5)	10.6 (.2)	10.7 (.2)	.5	.8	.54
Impairment							
PICGAS	60.8 (5.0)	60.4 (2.8)	85.2 (1.1)	85.3 (.8)	−2.4	6.3	.71
BIS total	13.9 (1.9)	16.6 (1.4)	6.9 (.3)	8.2 (.3)	2.0	2.2	.34
Interpersonal	3.1 (.70)	3.5 (.6)	1.1 (.1)	1.1 (.1)	.6	1.0	.52
School	4.8 (.8)	7.0 (.5)	2.1 (.1)	3.2 (.2)	1.2	1.0	.25
Self-fulfillment	5.8 (.9)	5.9 (.5)	3.7 (.1)	3.8 (.1)	.3	.8	.77
Family variables							
Family burden	11.5 (.8)	11.2 (.3)	8.4 (.11)	8.5 (.1)	−.1	.9	.91
Parent-child attachment	30.9 (1.1)	30.8 (.5)	35.6 (.2)	35.5 (.2)	−.2	1.3	.85
Negative discipline	7.4 (.4)	7.2 (.3)	5.5 (.1)	5.7 (.1)	−.4	.5	.46
	% (*n*)	% (*n*)	% (*n*)	% (*n*)	OR	95% CI	*p*
Categorical							
Child problems							
Speech problems	4.9 (3)	23.6 (27)	4.8 (44)	9.6 (90)	3.1	.5–19.5	.23
Sleep problems	25.2 (15)	32.0 (30)	7.6 (66)	9.3 (79)	1.4	.4–4.7	.58
Grade failure	6.8 (3)	27.6 (29)	10.2 (81)	22.3 (173)	1.9	.4–8.6	.42
School suspension[a]	0 (0)	22.7 (21)	4.4 (32)	9.8 (84)	124.7	11.3–1378.2	<.01
Comorbidity							
Any disruptive disorder	37.9 (16)	43.2 (42)	2.8 (22)	2.8 (28)	1.2	.3–5.4	.78
Any mood disorder	11.3 (4)	8.1 (6)	2.0 (13)	.7 (6)	1.8	.2–20.3	.63
Any anxiety disorder	26.7 (10)	23.2 (24)	3.6 (30)	3.0 (31)	1.0	.3–3.7	.98
Treatment							
School services	22.2 (8)	28.4 (27)	5.2 (45)	9.6 (81)	.7	.2–2.7	.65
Outpatient services	21.2 (6)	27.9 (29)	2.8 (24)	6.7 (64)	.6	.2–2.5	.51
Medication use	1.8 (1)	9.6 (11)	.2 (2)	1.6 (15)	.7	.0–11.3	.80
Medication attitude	48.8 (24)	65.0 (66)	65.1 (568)	63.3 (545)	2.1	.8–5.1	.12

Note: Weighted estimates of population means (standard error in parentheses) or percentages (*n* in parentheses) and unstandarized regression coefficients (β) or odds ratios (OR). ADHD = Attention-Deficit Hyperactivity Disorder, PICGAS = Parent Interviewer Children's Global Assessment Scale; BIS = Brief Impairment Scale; CI = 95% Confidence Interval. Age and number of non-ADHD diagnoses were used as covariates in all regressions where these factors were not the outcome of interest.

[a] Usual interaction could not be tested because one cell in the analysis had a zero and the estimate of the interaction was undefined. Instead, interaction test is based on conservative analysis in which a single observation was created to obtain a lower bound on the association, as described in the text.

Table 3 shows descriptive statistics for the three ADHD types, as well as the children with no ADHD type diagnosis. Interactions of gender with ADHD subtype for age, impairment, family, child, comorbidity, and treatment variables with gender are shown in Table 4. To guard against Type I errors in carrying out the multiple tests of the four groups, we carried out an omnibus test for each variable. This test was significant for comorbidity with mood disorders (*Wald* $F = 3.8$; $p < .01$) and with anxiety disorders (*Wald* $F = 3.0$; $p < .05$). Boys with CT were at greater risk for comorbidity with mood disorders than girls with the same subtype (30.0% vs. 4.9%). Girls with IT were at a greater risk for any anxiety disorder than boys with IT (58.3% vs. 12.2%). Because there were no girls with CT who failed a grade, and also no girls with IT or CT who were suspended from school, it was not possible to estimate and test the effects for these combinations through weighted logistic regression. To obtain a conservative lower bound of the interaction, we carried out special analysis similar to what we reported for school suspension for ADHD. We created a single hypothetical girl with CT and with IT and coded this fictitious person as having a school suspension (or failed grade for the CT association). Omnibus tests of the interaction based on these analyses were not significant for either school suspension or grade failure.

Discussion

Boys are more than twice as likely to be diagnosed with ADHD as girls, and they also tend to show higher levels of conditions that are associated with ADHD and its types. This has raised the possibility that boys might be more susceptible to both risks for ADHD and its sequela. Using a representative sample of children from the general population of Puerto Rico we found only slight evidence of gender

Table 3 Age, impairment, family, child and comorbidity variables among girls and boys with and without ADHD types in the community population

	IT		HIT		CT		No ADHD types	
	Girls ($n = 12$)	Boys ($n = 35$)	Girls ($n = 40$)	Boys ($n = 59$)	Girls ($n = 14$)	Boys ($n = 36$)	Girls ($n = 847$)	Boys ($n = 849$)
Measures	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)
Continuous								
Age (years)	12.3 (.7)	11.6 (.6)	9.0 (.7)	8.4 (.7)	8.2 (.8)	10.4 (.7)	10.6 (.2)	10.6 (.2)
Impairment								
PICGAS	68.6 (5.2)	64.9 (4.2)	63.5 (4.8)	66.7 (2.8)	50.6 (8.9)	51.3 (3.6)	85.8 (1.0)	85.8 (.8)
BIS total	13.3 (2.1)	18.7 (1.7)	11.3 (1.0)	12.7 (1.4)	18.5 (3.2)	22.7 (1.9)	6.8 (.3)	7.9 (.3)
Interpersonal	1.9 (.7)	3.5 (.5)	2.2 (.4)	2.4 (.6)	4.6 (1.3)	5.2 (1.0)	1.1 (.1)	1.1 (.1)
School	4.5 (1.6)	9.7 (.8)	3.8 (.3)	5.1 (.7)	7.6 (1.4)	9.2 (.6)	2.0 (.1)	3.0 (.2)
Self-fulfillment	6.8 (1.1)	5.4 (.7)	5.0 (.8)	5.0 (.5)	6.2 (.9)	8.0 (.7)	3.7 (.1)	3.7 (.1)
Family variables								
Family burden	10.4 (.8)	11.0 (.5)	10.8 (.9)	10.3 (.4)	12.7 (.7)	12.4 (.5)	8.4 (.1)	8.4 (.1)
Parent–child attachment	32.4 (1.4)	31.2 (1.1)	32.5 (.5)	31.8 (.8)	27.6 (2.0)	29.6 (.7)	35.7 (.2)	35.6 (.2)
Negative discipline	7.2 (.6)	6.8 (.4)	6.3 (.2)	6.9 (.3)	8.4 (.8)	7.5 (.4)	5.5 (.1)	5.6 (.1)
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Categorical								
Child problems								
Speech problems	5.5 (2)	10.2 (5)	8.6 (5)	25.7 (16)	11.5 (1)	30.4 (13)	4.5 (39)	9.3 (84)
Sleep problems	5.5 (2)	24.3 (9)	32.0 (11)	31.9 (19)	29.1 (6)	42.4 (14)	7.0 (62)	8.5 (67)
Grade failure	24.1 (5)	29.5 (9)	21.7 (7)	24.4 (15)	.0 (0)	33.8 (14)	9.6 (73)	22.0 (164)
School suspension	.0 (0)	26.9 (10)	6.3 (2)	19.7 (9)	.0 (0)	24.0 (8)	4.2 (30)	9.4 (78)
Comorbidity								
Any disruptive disorder	20.6 (4)	39.6 (12)	21.6 (11)	30.5 (16)	53.3 (6)	60.0 (23)	2.5 (17)	1.9 (19)
Any mood disorder	39.3 (4)	2.1 (2)	3.0 (3)	0 (0)	4.9 (1)	30.0 (6)	1.9 (10)	.5 (4)
Any anxiety disorder	58.3 (5)	12.2 (5)	14.6 (8)	19.7 (14)	11.4 (2)	27.5 (9)	3.4 (26)	3.0 (28)

Note: Weighted estimates of population means (standard error in parenthesis) or percentages (n in parenthesis). ADHD = Attention Deficit Hyperactivity Disorder; IT = Inattentive type; HIT = Hyperactive-Impulsive type; CT = Combined type; PICGAS = Parent Interviewer Children's Global Assessment Scale; BIS = Brief Impairment Scale.

differences in the strength of associations with correlates of ADHD.

Similarity of correlates of ADHD over gender. Our results argue against the hypothesis that the sequela and risks for ADHD are systematically different for boys and girls. Previously we had reported that ADHD became less common as children grow older (Bauermeister et al., in press), and we now conclude that this pattern is the same for boys and girls. Other correlates may be both a combination of risk and sequela of ADHD. These include family burden, negative discipline, and quality of parent–child relationship. It appears that these variables have similar degrees of association in boys and girls. Patterns of comorbidity are another example of variables that are strongly related to ADHD, but which are not different for girls and boys. These findings are similar to those reported by Biederman et al. (2005) in a sample of non-referred children.

School suspension, ADHD, and gender. One exception to our general findings of similar associations of ADHD with the outcome variables examined is school suspension or expulsion. We conservatively estimate that the magnitude of the ratio of odds ratios for this interaction was greater than 11.3, which means that the association is more than 11 times stronger for boys than girls. This finding is intriguing because, while school suspension or expulsion is usually explained by the presence of externalizing behaviors, both genders presented similar rates of disruptive behavior disorders. Consistent with Graetz et al.'s (2005) findings, it is possible that boys with ADHD present higher rates of annoyance or distress to teachers and problems with schoolwork relative to girls. This hypothesis, and an additional one of less tolerance of these behaviors on the part of school administrators towards boys with the disorder, can explain our school suspension finding and deserve further investigation.

Comorbidity, ADHD types, and gender. Consistent with our expectations and recent research findings (Graetz et al., 2005; Levy et al., 2005), we found no gender differences among the ADHD types in comorbidity with disruptive disorders. We identified a different pattern of comorbidity for boys and girls with the combined type. Boys in the CT group were at a greater risk for depression than their female counterparts. This interaction could be associated with the findings that males with CT presented more problems at school than girls. For example, whereas about a third of the boys with CT had failed a grade

Table 4 Regression analyses for continuous (age, impairment, family) and categorical (child, comorbidity) variables for girls and boys with and without ADHD types

		Interaction, Gender and ADHD types								
		IT Male			HIT Male			CT Male		
	Omnibus Wald *F*	*β*	SE	*p*	β	SE	*p*	β	SE	*p*
Continuous										
Age	1.7	−.9	1.0	.37	−.6	1.1	.58	2.2	1.2	.06
Impairment										
PICGAS	.9	−11.6	9.3	.21	4.8	5.8	.41	3.0	8.20	.71
BIS total	1.6	7.2	3.5	.04	−.2	1.4	.86	1.7	2.9	.55
Interpersonal	1.5	2.9	1.4	.04	−.1	.7	.92	.2	1.3	.89
School	2.0	5.2	2.1	.02	.2	.7	.81	−.1	1.2	.92
Self-fulfillment	.9	−.7	1.0	.49	−.2	.8	.80	1.5	1.1	.18
Family variables										
Family burden	1.5	1.4	.8	.08	−.7	1.0	.52	−.6	.8	.44
Parent–child attachment	1.0	−2.2	2.1	.31	−.5	1.0	.65	2.5	2.0	.21
Negative discipline	.9	.3	.6	.68	.4	.4	.38	−1.2	.9	.20
		OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI	*p*
Categorical										
Child problems										
Speech problems	.2	.9	.1–6.3	.93	1.6	.3–7.9	.54	1.7	.2–16.3	.65
Sleep problems	1.9	9.5	1.1–79.5	.04	.7	.2–2.3	.53	1.5	.3–7.4	.64
Grade failure	1.2[a]	.5	.1–3.2	.49	.4	.1–1.8	.24	5.0[a]	.5–3.0	.18
School suspension	1.5[a]	16.8*[a]	1.0–277.0	.05	1.6	.2–11.3	.64	2.6 [a]	.2–37.1	.47
Comorbidity										
Any disruptive disorder	.6	3.3	.5–20.0	.20	2.1	.4–11.8	.42	1.8	.2–13.5	.57
Any mood disorder	3.8**[a]	.1	.0–2.1	.16	.6[a]	.0–9.6	.71	32.6	1.7–623.8	.02
Any anxiety disorder	3.0*	.1	.0–.8	.03	1.6	.4–6.4	.49	3.5	.5–23.3	.19

Note: Weighted estimates of population unstandarized regression coefficients (*β*) or odds ratios (OR).
ADHD = attention-deficit hyperactivity disorder; IT = inattentive type; HIT = hyperactive-impulsive type; CT = combined type; PICGAS = Parent Interviewer Children's Global Assessment Scale; BIS = Brief Impairment Scale; CI = 95%Confidence Interval. Age and number of non-ADHD diagnoses were used as covariates in all regressions where these factors were not the outcome of interest. The OR with this footnote are estimated as the conservative lower bound. *$p < .05$; **$p < 01$.
[a]Usual interaction could not be tested because one or more cells in the analysis had a zero and the estimate of the interaction was undefined. Instead, Omnibus test is based on conservative analysis in which a single observation was created to obtain a lower bound on the association, as described [in the text].

and a quarter of them had been suspended or expelled from school during the last year, none of the girls with CT had gone through these demoralizing experiences.

The other interaction indicated that girls with IT were at a greater risk for any anxiety disorder than boys with this type. Further analyses (data not shown) suggest that separation anxiety was the only disorder within the anxiety umbrella, for which a similar pattern was observed. Inattentive girls have a much higher prevalence of SAD than boys (50.0% vs. 6.7%). Levy et al. (2005) also reported an IT/gender interaction for this disorder in their community sample.

The results that boys and girls with ADHD subtypes present different patterns of comorbidity are especially interesting and suggest that contradictory comorbidity findings in the ADHD-gender literature may be associated with differential referral practices and/or unexplored interactions of gender with ADHD types. In addition, analyses of comorbidity patterns by ADHD types and gender can result in a better understanding of childhood psychopathology.

Gender ratio and treatment. The age-adjusted gender ratio obtained for ADHD (2.3) is consistent with findings from other community studies (Arnold, 1996). However, our findings do not support previous reports that girls with ADHD are more likely to have the inattentive type (Biederman et al., 2002) or that the proportion of girls with IT is higher than the other types (Carlson et al., 1999). Additional research is needed to ascertain if these findings are associated with cultural, sampling, or informant source factors. Nevertheless, it is important to note that a significantly higher female:male ratio with IT is not a finding consistently reported in the research literature.

Children with ADHD in the community were under-treated. The absence of an ADHD/gender interaction for services received argues against previous observation that under-treatment of girls in clinics is associated with preferential treatment settings, such as school (girls) vs. outpatient clinics (boys) (Arnold, 1996; Heptinsall & Taylor, 2002). This finding is also inconsistent with the view that girls with ADHD are under-treated relative to boys. Nevertheless, a lower rate of medication treatment was received by girls

(1.8%) even though our data suggest that this treatment is not associated with a negative attitude towards medication.

Limitations. Since teacher reports were not available, our findings are limited to reports from parents who may not be fully cognizant of their child's behavior at school. Also, with the exception of the PICGAS, no independent measures were obtained for the correlates examined. Consequently, the associations reported may have been affected by shared method variance. Second, we did not use gender-specific symptom thresholds to ascertain ADHD. Recent research suggests that there may be a small number of girls who have behaviors and impairment that are consistent with ADHD but do not meet DSM IV symptom criteria (Waschbusch & King, 2006). Third, our ADHD types were defined in terms of symptoms criteria without consideration of additional cross-situational, age of onset, and impairment criteria. This decision, modeled after other researchers (Graetz et al., 2005; Levy et al., 2005), resulted in an increased number of children analyzed but discrepant sample sizes for the ADHD and ADHD type analyses. It also may have resulted in more heterogeneity across ADHD types. Finally, our general conclusion that there are no striking interactions of correlates with gender does not imply that subtle interactions might be found with larger sample sizes. Although there were no statistically significant interactions in our sample of 1,886 children, the standard errors and confidence bounds reported in Table 2 clearly show that our data are consistent with possible interactions.

Conclusion and implications

In conjunction with an emerging cross-cultural literature on children sampled from the community, our data suggest that differences between boys and girls with ADHD were similar to those obtained for children without ADHD. Nonetheless, gender differentially affects comorbidity of the ADHD subtypes with mood and anxiety disorders.

Clinicians should be aware of the possibility that girls with the inattentive type are more at risk than boys for anxiety disorders, possibly SAD, and that boys with the combined type are a greater risk for depression. Thereby reducing the risk of misdiagnosis, particularly for girls with the inattentive type whose ADHD could be overlooked and diagnosed as anxiety. Schools also need to develop programs to help boys with ADHD effectively without resorting to suspension or expulsion as the primary mean of handling school problems. This practice can increase the risk of demoralization of boys with the disorder and school dropout. Also, the fact that girls are less subject to school suspension should not be misconstrued to mean that girls with the disorder are not impaired and do not need referral to treatment.

The general findings that boys and girls with ADHD present similar risks and sequela argue against gender differences in prognosis, response to treatment, and eventual outcome. However, this is not to say that gender could not mediate the consequences of living with ADHD. Girls and boys face different gender-related challenges in their life courses that need to be taken into account in a treatment program (Arnold, 1996). These and other questions related to differential clinical course and outcome for boys and girls with ADHD need to be studied longitudinally and with a comprehensive battery of gender sensitive measures.

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