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Intellectual Ability and Achievement in Anxiety-Disordered Children: A Clarification and Extension of the Literature

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Abstract Intellectual and achievement deficits associated with childhood anxiety disorders are of considerable controversy. Part of this controversy and inconsistency in findings appears related to methodological differences in studies: anxiety disorders are defined as occurring anywhere in the diagnostic profile (e.g., primary, secondary, or tertiary) in some studies whereas in other studies anxiety disorders are defined only when primary (excluding secondary or tertiary disorders). Results in the present study broadly parallel findings from the previous studies when the procedures inherent to each study are replicated. Through careful diagnostic assignment, it is shown that anxiety disorders are no more impairing than other psychiatric disorders in the present study. However, when compared to referred children without significant psychopathology, children with anxiety disorders show statistically and clinically significant impairment. Subsequent analyses do not suggest inattention mediates this effect. Discussion emphasizes the need to assess for and consider comorbidity in understanding these differences.

Keywords Anxiety disorder · Children · Intelligence · Comorbidity · Assessment

In the years that have followed the work of Hodges and Plow (1990), there has been ongoing debate as to whether children with anxiety disorders have lowered intelligence quotients (IQ) and achievement scores that are both statistically significant and clinically meaningful (Profitera et al. 2005; Zimet et al. 1994b). Presumably, the chronic, pervasive, and intrusive worry associated with anxiety disorders affects measures of achievement and intelligence by disrupting thought processes and impairing attention. However, methodological problems such as diagnostic overlap in study groups limit the conclusions that can be drawn from studies that have examined this issue. The current study had four goals: (1) to address limitations in the existing studies by replicating the divergent methods that have been used to form comorbid diagnostic groups, (2) to offer and examine an alternative method of classifying children with anxiety disorders which emphasizes consideration of the child's entire diagnostic profile, (3) to clarify the actual effects of anxiety disorders by investigating their impact in non-comorbid groups, and 4) to examine inattention as a potential mediator of the relationships that might be observed.

Hodges and Plow (1990) initially examined the effects of various forms of child psychopathology on ability and achievement. They assessed the ability, achievement, and psychopathology of 76 children by using the Wechsler Intelligence Scale for Children-Revised (Wechsler 1974; WISC-R), the Woodcock–Johnson Pscyhoeducational Battery (Woodcock and Johnson 1977), and the Child

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Assessment Schedule (Hodges et al. 1982, 1987). Multivariate analyses of variance revealed that anxiety-disordered children had significantly lower Full-Scale IQ scores on the WISC-R as well as significantly lower WISC-R subtest scores (Information, Vocabulary, Comprehension, Digit Span, Picture Completion, and Coding) than children with other psychiatric disorders. Total achievement scores did not differ significantly with the presence of an anxiety disorder; however, the composite means for the subscale scores were lower for those diagnosed with an anxiety disorder and marginally significant trends were evident.

Though important, the study by Hodges and Plow (1990) possessed several limitations. First, the four diagnostic groups examined in that study (i.e., conduct, oppositional, depression, anxiety) were not mutually exclusive. Inclusion in a group was based upon the presence of a disorder *anywhere* in the child's diagnostic profile. This methodology resulted in 15 of the 76 children being included in more than one diagnostic group. For example, a child displaying co-occurring depression and oppositional defiant disorder was included in *both* of these groups, resulting in overlap of participants in the diagnostic groups. Second, the sample studied by Hodges and Plow consisted of children receiving inpatient treatment. As such, it is unknown whether these effects were obtained because of the severity of the sample or the diagnostic overlap among the disorders.

Following Hodges and Plow (1990), Zimet et al. (1994a) identified the diagnostic overlap in the Hodges and Plow (1990) sample as a limitation and attempted to replicate their findings with non-overlapping diagnostic groups. They examined these relations in 120 inpatient children, as did Hodges and Plow; however, their inpatient children did not overlap in disorders. Unexpectedly, their results did not replicate those of Hodges and Plow (1990). Anxiety-disordered children in this inpatient sample were not found to have significantly lower ability or achievement scores compared to those in other diagnostic groups.

This discrepancy may be due to several important methodological differences between the study by Zimet et al. (1994a) and Hodges and Plow (1990). Foremost, Zimet et al. (1994a) assigned the children only primary diagnoses from intake data in an effort to avoid the multiple group membership reported by Hodges and Plow. Unfortunately, this attempt to correct overlapping participant group assignment only served to create another difficulty similar to that evident in Hodges and Plow. In as much as a primary diagnosis only was assigned, information regarding comorbid secondary or tertiary disorders was ignored or not reported by them. This practice would potentially disperse the effects of the various disorders (anxiety disorder, conduct disorder, oppositional disorder, or depressive disorder) among all the groups, thereby once again confounding potential group differences. In addition, their participants were recruited from inpatient and day treatment settings, again allowing for the severity of the disorders to affect and potentially bias the findings.

More recently, Saigh et al. (2006) examined the effects of posttraumatic stress disorder (PTSD) on children's Wechsler Intelligence Scale for Children-III scores (WISC-III). They found that the PTSD group was significantly lower than both a non-PTSD trauma-exposed group and a non-exposed control group on Verbal and Full Scale IQ scores. Unfortunately, while Saigh et al. (2006) employed considerable exclusionary criteria, the study failed to exclude children with learning disabilities which may explain the impairment evidenced on the IQ measures, especially so on the Verbal subtests (e.g., see Ingesson 2006, for a discussion of the effects of learning disabilities on measures of intelligence).

Several additional studies have also examined the relationship between broad symptoms of child psychopathology and academic achievement with non-clinical populations (Ialongo et al. 1996; Kusche et al. 1993; Rapport et al. 2001). These studies utilized mutually exclusive groups based on teacher report, self-report, and/or peer report of symptoms. Kusche et al. (1993), for example, examined the relationship between psychopathology and cognitive functioning among elementary school-aged children in an unselected community sample. Based on teacher and self-report measures, children were placed in one of four groups: no psychopathology control group; anxious/somatic only; externalizing only; and comorbid symptomatology. Children in the control group had significantly higher IQ scores than children in the remaining three groups.

In yet another study, Ialongo et al. (1996) examined the relationship between anxious symptoms, depressive symptoms, and academic achievement in out-patient first-graders as measured by teacher-, self-, and peer-report measures. They found that among boys, depressive symptoms were associated with impaired achievement, but anxious symptoms were not. Comorbidity among boys was also associated with lower achievement scores; however, it was suggested this was likely a function of the boys' depressive symptoms. Among girls, anxious symptoms and depressive symptoms alone were not associated with impaired achievement; however, lower achievement scores were evident among those with a comorbid presentation of anxious and depressive symptoms. Finally, Rapport et al. (2001) examined internalizing difficulties and academic achievement among children in grades 2 through 9 where symptomatology was measured by a teacher report measure. Their results indicated that anxious/depressed scores, along with scores of withdrawal on the teacher measure,

significantly contributed to the prediction of cognitive functioning after accounting for cognitive ability.

Overall, then, discrepant findings have been reported which are potentially attributable to how children with anxiety are classified, to the type and severity of the samples employed, and especially to whether comorbidity was adequately considered and addressed. It is proposed that the effects of an anxiety disorder upon a child need to be considered and evaluated regardless of primacy in the diagnostic hierarchy. For example, two children who have identical anxiety disorder diagnoses, impairing and debilitating to the same degree, but who also have different orders of these diagnoses (e.g., primary, secondary, tertiary), should be considered for assignment to the anxiety-disordered group. Essentially, both children experience similar anxiety-related effects, although for one child the disorder can be said to be primary whereas for the other the diagnosis is secondary. Given these assertions, and consistent with the original speculations of Hodges and Plow (1990), it was hypothesized that anxiety-disordered children and adolescents would differ significantly and clinically on measures of intellectual ability and academic achievement from clinical controls and from referred children without significant psychopathology. As such, the purpose of the current study was to test these hypotheses and attempt to integrate and expand previous conflicting findings in the context of a large and well characterized sample of children seen in an outpatient setting. Moreover, the previous findings were expanded by examining the effects of anxiety-disorders in children without comorbidity on IQ scores and by examining inattention as a potential mediator of the effects observed.

Method

Participants

The participants for this study were 161 children (mean age=10.56, SD=2.82) and their parents who were seen at a university-affiliated, outpatient psychological assessment clinic. The sample was drawn from a sample of 303 youth. Of the 161 children, 99 were male (61.5%, mean age=10.16, SD=2.53), and 62 were female (38.5%, mean age=11.19, SD=3.15). Ethnicity of the sample was largely homogenous with 91.9% identified as Caucasian, 5.6% as African-American, and 1.9% as belonging to other ethnic groups. Demographically, 75.2% of the participants' parents were married or remarried, 11.2% were presently divorced, 5.6% were presently separated, 2.5% were widowed, and the remainder was single, never married parents (4.3%). Mean family income was $45,245. The WISC-III Full-Scale IQ scores of the 161 participants ranged from 70 to 134 (mean score=97.86, SD=15.62). Preliminary analyses revealed no significant association between Full-Scale IQ and age, [r (155)=0.09, p=0.24], nor significant differences in Full-Scale IQ due to gender (male, female) or race [Caucasian, African American, Other; F (1, 155)=.644, p=0.424; F (2, 153)=1.232, p=0.295, respectively]. Local schools, physicians, and mental health professionals referred the majority of youth (75%). Remaining participants presented based on word of mouth or from having selected the clinic from the local phonebook. No children were on medication believed to affect performance during testing (e.g., psychostimulant medication was withheld during the assessment process). Children with IQ scores less than 70, mental retardation, learning disorders, autism, or other intellectual or developmental disabilities were excluded. This included 33 participants who based on intellectual assessment, adaptive functioning, diagnostic interview, and multi-informant reports met criteria for a pervasive developmental disorder and/or mental retardation. Also, 109 participants were excluded for learning disorder diagnoses based upon significant discrepancies between intellectual ability and academic achievement scores. The study was approved by the university's institutional review board (IRB).

Measures

The Wechsler Intelligence Scale for Children—Third Edition (WISC-III) Participants' intellectual abilities were assessed using the WISC-III (Wechsler 1991). The WISC-III was administered individually and can be used with children 6 years of age to 16 years, 11 months of age. Several of the WISC scores from each participant were used in this study: Full-Scale IQ (FSIQ), Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI), Processing Speed Index (PSI), and the 10 standard subtests. Additionally, WISC-III scores were analyzed based on the Verbal IQ (VIQ) and the Performance IQ (PIQ).

The Wechsler Individual Achievement Test—First Edition (WIAT) This study used the WIAT (Psychological Corporation 1992) to assess academic achievement. The WISC and WIAT are frequently used together to allow for the comparison of intellectual ability and academic performance that is necessary to render DSM-IV diagnoses of learning disabilities. The WIAT was developed for use with children and adolescents 5 to 19 years of age. Each child was administered the full WIAT, and, subsequently, the four composite scores (i.e., Reading Composite, Writing Composite, Mathematics Composite, Language Composite) and individual subtest scores were calculated.

The Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent Versions (ADIS-C/P) The ADIS-C/P (Silverman and Albano 1996) are semi-structured diagnostic interviews based upon the *Diagnostic and Statistical Manual of Mental Disorders, 4th edition* (American Psychiatric Association 1994; *DSM-IV*) categorical scheme. The interviews are designed to be administered by trained clinicians and can be used to assess psychopathology in children and adolescents 7 to 17 years of age. The ADIS-C and ADIS-P were administered separately and appropriate diagnoses were determined based on the separate interviews. In this way, a diagnostic impression based upon the child's report and an independent impression based upon the parent's report were obtained. Severity of each diagnosis was assigned on a scale from 0 (None) to 8 (Very Severely Disturbing/Disabling) with a severity rating of 4 (Definitely Disturbing/Disabling) being considered clinically significant, as recommended by Silverman and Albano (1996). Following completion of the interviews, consensus diagnoses were determined by examining and discussing both the child clinician's diagnostic impressions and the parent clinician's impressions with a senior research clinician. Clinicians administering the ADIS-C/P completed one day of training followed by two full-length role-playing interviews. In addition, their first two actual client interviews were directly supervised by an advanced clinician. For additional details on the ADIS-C/P and other empirically based assessments for anxiety disorders in children, interested individuals are directed to Silverman and Ollendick (2005). Inter-rater reliabilities of interviews were found to be acceptable (child interviews, κ=0.71; parent interviews, κ=0.77; see Grills and Ollendick 2002).

Continuous Performance Task (CPT) This computer-based task required participants to press a key each time a non-target letter (non-X) was presented on the screen and to refrain from pressing a key whenever a target letter (X) was presented. The task lasted approximately 14 minutes and yielded measures of correct key-presses, incorrect key-presses, omissions, commissions, and rate of key-pressing. An overall index score (Conners 1995) was used for the mediational analyses reported below. The CPT is a reliable and valid measure of attention in children and adolescents.

Procedure

As noted, participants and their parents presented at a university-affiliated outpatient assessment and treatment clinic. After completing informed consent forms, the children and their parents participated in three separate assessment sessions lasting approximately 2 1/2 to 3 hours each. During these sessions, clinical psychology doctoral students administered the ADIS-C, the WISC-III, and the WIAT to the child, and the ADIS-P to the parents (other instruments were also administered but are not reported upon here). Results and diagnostic impressions from each evaluation were discussed in weekly consensus diagnosis meetings supervised by a licensed clinical psychologist with 35 years of experience in clinical child and adolescent psychology. Consensus diagnoses were determined jointly by the two graduate clinicians and the supervisor. Based upon that diagnostic information, the participants were assigned to various groups to allow for the replication of previous studies' findings and an extension of extant findings with diagnostically pure groups. Four groupings were created in order to adequately address existing methodological concerns in the literature and to examine the actual impairment in IQ and achievement from anxiety disorders (both pure and comorbid).

In order to compare and contrast with findings from the Hodges and Plow (1990) study, two groups were created (*with* the appropriate mutual exclusions): an anxiety-disordered group composed of those with a primary, secondary, or tertiary diagnosis of an anxiety disorder and a clinical control group diagnosed with other disorders, but not an anxiety disorder *anywhere* in the clinical profile. Next, in order to compare and contrast findings from the Zimet et al. (1994a) study, an anxiety-disordered group was created which only included children with a primary diagnosis of an anxiety disorder and a clinical control group that included all other children, even those with a secondary or tertiary anxiety disorder. Next, the Hodges and Plow group was reconstituted and any cases comorbid with attention-deficit/hyperactivity disorder (ADHD) were removed from both the anxiety-disordered group and the clinical control group (this was done because the original Hodges and Plow study did not exclude these cases and ADHD may affect findings due to equally compelling attentional difficulties). Finally, a "pure" subset of the sample with only anxiety disorder diagnoses (i.e., no additional comorbidity) was created and compared to a "pure" control group which had no diagnosed psychopathology, even though they had been referred for an evaluation (see Table 1 for a summary of these groups).

Table 1 Demographic characteristics of participants by analytic group

	N (males/females)	Mean Age (SD)	Age range (years)
Hodges and Plow test	144 (88/56)	10.67 (2.84)	6–17
Zimet test	144 (88/56)	10.67 (2.84)	6–17
Anxiety without ADHD test	39 (20/19)	12.23 (2.78)	7–17
Pure anxiety test	29 (19/10)	10.41 (2.80)	7–16

Table 2 Descriptive data and effect sizes separated by group assignment methodology: Hodges and Plow test

Test/scale	Anxiety in profile			Clinical control			*F* values	d values
	M	SD	*n*	*M*	SD	*n*		
WISC								
Full scale IQ	94.3	15.1	81	99.4	14.5	59	4.00*	0.34
Verbal IQ	95.3	15.8	80	101.1	15.6	59	4.66	0.37
Performance IQ	94.3	15.3	80	98.0	13.3	59	2.28	0.26
WIAT								
Reading composite	98.6	14.6	70	103.5	13.7	46	3.31	0.35
Mathematics composite	95.3	15.3	70	99.1	15.2	46	1.77	0.25
Writing composite	96.8	15.3	70	95.9	14.3	46	0.12	−0.06
Language composite	106.7	15.3	70	110.8	12.8	46	2.28	0.29

Significant univariate analyses which were appropriate to interpret following multivariate analyses are indicated with the following symbols: *$p \leq .05$, **$p \leq .01$

Effect sizes are indicated for all univariates using the following symbols: *Md* medium effect size ($d \geq 0.5$), *Lg* large effect size ($d \geq 0.8$)

n varies slightly based on diagnostic assignment/reassignment of groups and based on data available (i.e., given this was a clinic setting, patient presentation may not have necessitated the administration of some tests or subtests)

As the focus of the present study was pervasive worry and anxiety, those children meeting criteria for specific phobias only, while technically having anxiety disorder diagnoses, were not included in the anxiety or control groups (i.e., while children with circumscribed specific phobias are included in the sample, no child was included who only had a circumscribed specific phobia as an anxiety disorder).

Analyses

Preliminary analyses carried out on each of these subgroupings of the sample failed to reveal significant differences due to age. In order to replicate the findings of Hodges and Plow (1990) with the appropriate mutually exclusive groups, a univariate analysis of variance (ANOVA) was conducted to determine if a diagnosis of an anxiety disorder significantly affected FSIQ. Additionally, multivariate analyses of variance (MANOVAs) using Wilks' lambda were undertaken on other IQ and achievement scores to determine if children and adolescents diagnosed with anxiety disorders anywhere in their clinical profiles (i.e., primary, secondary, tertiary) differed significantly from clinical controls who did not present with an anxiety disorder anywhere in their clinical profile. Subsequent univariate analyses were conducted to determine which variables contributed to the significant MANOVA effect. Finally, Cohen's *d* was calculated as a measure of effect size for each univariate comparison (this information is included in Tables 2, 3, 4 and 5). Second, in order to contrast the findings of Zimet et al. (1994a), the participants were reassigned (see Procedure section for description) and the analyses were rerun as specified above. Third, analyses were rerun again with the reassigned no ADHD groups to elucidate the effects of anxiety (without the potential confound of an attentional disorder). Finally, groups were again reassigned and only pure anxiety or pure control cases were examined. Subsequently, an attention index score from the CPT was examined as a potential mediator of any significant findings between these pure groups (cf. Baron and Kenny 1986; Holmbeck 1997).

Results

Anxiety Anywhere in the Diagnostic Profile Compared to Non-anxiety Disordered Clinical Control (Hodges and Plow Test)

WISC scores Examination of the independent ANOVA on Full Scale IQ scores revealed significant impairment associated with the presence of an anxiety disorder, F (1, 138)=

Table 3 Descriptive data and effect sizes separated by group assignment methodology: Zimet Test

Test/scale	Anxiety primary			Clinical control			*F* values	*d* values
	M	SD	*n*	M	SD	*n*		
WISC								
Full Scale IQ	96.4	15.2	39	96.5	15.0	101	0.00	0.01
Verbal IQ	98.2	16.7	38	97.5	15.7	101	0.05	−0.04
Performance IQ	94.7	14.5	38	96.2	14.6	101	0.29	0.10
WIAT								
Reading composite	100.3	16.2	37	100.6	13.6	79	0.02	0.02
Mathematics composite	98.2	16.1	37	96.2	15.0	79	0.44	−0.13
Writing composite	99.2	16.6	37	95.1	13.9	79	1.94	−0.27
Language composite	108.5	17.8	37	108.3	12.7	79	0.01	−0.01

Significant univariate analyses which were appropriate to interpret following multivariate analyses are indicated with the following symbols: *$p \leq .05$, **$p \leq .01$

Effect sizes are indicated for all univariates using the following symbols: *Md* medium effect size ($d \geq 0.5$), *Lg* large effect size ($d \geq 0.8$)

n varies slightly based on diagnostic assignment/reassignment of groups and based on data available (i.e., given this was a clinic setting, patient presentation may not have necessitated the administration of some tests or subtests)

Table 4 Descriptive data and effect sizes separated by group assignment methodology: anxiety with comorbidity test (No ADHD)

Test/Scale	Anxiety in profile			Clinical control			*F* values	*d* values
	M	SD	*n*	M	SD	*n*		
WISC								
Full Scale IQ	95.8	18.0	24	103.2	13.3	15	1.90	0.48
Verbal IQ	98.3	19.9	23	105.6	16.2	15	1.41	0.40
Performance IQ	93.2	17.7	23	100.3	10.8	15	1.97	0.48
WIAT								
Reading Composite	101.4	14.3	23	107.6	13.0	14	1.76	0.45
Mathematics Composite	99.0	18.4	23	102.8	12.2	14	0.47	0.24
Writing Composite	99.3	16.0	23	101.1	15.8	14	0.10	0.11
Language Composite	110.5	18.9	23	113.7	9.5	14	0.34	0.21

Significant univariate analyses which were appropriate to interpret following multivariate analyses are indicated with the following symbols: *$p \leq .05$, **$p \leq .01$

Effect sizes are indicated for all univariates using the following symbols: *Md* medium effect size ($d \geq 0.5$), *Lg* large effect size ($d \geq 0.8$)

n varies slightly based on diagnostic assignment/reassignment of groups and based on data available (i.e., given this was a clinic setting, patient presentation may not have necessitated the administration of some tests or subtests)

4.00, $p=0.047$, $d=0.34$ (see Table 2). Also, and as explained above, three separate MANOVAs were conducted on the IQ measures (MANOVA 1 included Verbal IQ scores and Performance IQ scores; MANOVA 2 included only the Verbal subtests; and MANOVA 3 included only the Performance subtests). All three MANOVAs failed to reach significance (see Table 2 for results and univariate effect sizes).

WIAT scores The MANOVA conducted on WIAT composite scores (reading, writing, mathematics, and language) revealed a statistically significant difference between the anxiety disordered group and the clinical control group, Wilks' Λ, $F(4, 111)=4.04$, $p=0.004$. Subsequent univariate analyses, however, failed to detect critical differences (see Table 2 for results and univariate effect sizes).

Anxiety as the Primary Diagnosis Compared to a Clinical Control Group which Includes Secondary and Tertiary Diagnoses of Anxiety (Zimet Test)

WISC scores As described above, this set of analyses was conducted in order to draw a comparison to the methodological limitation observed in Zimet et al. (1994a; i.e., ignoring secondary or tertiary diagnoses of anxiety disorders). As such, an ANOVA was conducted on the Full Scale IQ scores and only one MANOVA was conducted on the Verbal IQ scores and Performance IQ scores (Zimet et al. 1994a did not examine subtest scores). As was the case with the original Zimet et al. (1994a) findings, none of the analyses revealed statistically significant differences between the primary anxiety group and the clinical control group that included secondary and tertiary anxiety disorders (see Table 3 for results and univariate effect sizes).

WIAT scores Although Zimet et al. (1994a) did not examine achievement scores in their study, the present analyses were undertaken to illustrate the potential confounds inherent in their study. MANOVAs conducted on the composite scores revealed no significant findings (see Table 3 for results and univariate effect sizes).

Anxiety Anywhere in the Diagnostic Profile Compared to Non-Anxiety Disordered Clinical Control, Without the Presence of Attention-Deficit/Hyperactivity Disorder (Anxiety with Comorbidity Test)

WISC scores As with previous comparisons, a single ANOVA (Full Scale IQ) and three separate MANOVAs were run on the IQ measures (MANOVA 1 included Verbal

Table 5 Descriptive data and effect sizes separated by group assignment methodology: pure anxiety test

Test/scale	Pure anxiety			Pure control			*F* values	*d* values
	M	SD	*n*	M	SD	*n*		
WISC								
Full Scale IQ	94.8	18.9	12	109.5	16.1	17	5.02*	0.84^{Lg}
Verbal IQ	98.7	19.8	11	108.8	17.4	17	2.00	0.54^{Md}
Performance IQ	90.4	19.6	11	108.5	15.2	17	7.56*	1.03^{Lg}
WIAT								
Reading Composite	102.3	12.9	12	103.8	9.4	11	0.11	0.13
Mathematics Composite	96.7	19.8	12	107.2	11.7	11	2.34	0.65^{Md}
Writing Composite	98.7	17.9	12	95.7	6.6	11	0.26	0.22
Language Composite	108.7	16.1	12	113.8	16.1	11	0.59	0.32

Significant univariate analyses which were appropriate to interpret following multivariate analyses are indicated with the following symbols: *$p \leq .05$, **$p \leq .01$

Effect sizes are indicated for all univariates using the following symbols: *Md* medium effect size ($d \geq 0.5$), *Lg* large effect size ($d \geq 0.8$).

n varies slightly based on diagnostic assignment/reassignment of groups and based on data available (i.e., given this was a clinic setting, patient presentation may not have necessitated the administration of some tests or subtests). Low *n* in the "pure" anxiety group reflect the comorbidity problem frequently seen with these disorders (e.g., Angold et al. 1999).

IQ scores and Performance IQ scores; MANOVA 2 included only the Verbal subtests; and MANOVA 3 included only the Performance subtests). None of these MANOVAs or the ANOVA on Full Scale IQ produced significant differences between those with anxiety and other comorbid disorders (but not ADHD) and those with other disorders (but not ADHD; see Table 4 for results and univariate effect sizes).

WIAT scores The MANOVA conducted on WIAT composite scores (reading, writing, mathematics, and language) revealed no statistically significant differences among the two groups (see Table 4 for results and univariate effect sizes).

Pure Anxiety-Disordered Group Compared to Pure No-Diagnosis Control Group (Pure Anxiety Test)

WISC scores As with the Hodges and Plow comparison, the ANOVA on Full Scale IQ indicated those with anxiety disorders had significantly lower scores [F (1, 27)=5.02, p=0.033, d=0.84; see Table 5]. In addition, three separate MANOVAs were conducted on the IQ measures (MANOVA 1 included Verbal IQ scores and Performance IQ scores; MANOVA 2 included only the Verbal subtests; and MANOVA 3 included only the Performance subtests). Results suggested significant multivariate effects for the first and third MANOVAs (i.e., for Verbal IQ and Performance IQ scores entered together, Wilks' Λ, F (2, 25)=3.80, p=0.036; and for the Performance subtests, Wilks' Λ, F (5, 22)=3.19, p=0.026. Subsequent univariate analyses indicated Performance IQ [F (1, 26)=7.56, p=0.011, d=1.03] was significantly lower in the pure anxiety-disordered group. Medium to large effect sizes were observed suggesting clinical significance (see Table 5 for results and univariate effect sizes). Univariate tests on Performance subtests, however, were not significant.

WIAT scores The MANOVA conducted on WIAT composite scores (reading, writing, mathematics, and language) of those with pure anxiety disorders and no-diagnoses yielded a significant result, Wilks' Λ, F (4, 18)=3.356, p=0.032. However, subsequent univariates were not significant (see Table 5 for results and univariate effect sizes).

Mediational Analysis: Does Inattention as Measured by the CPT Mediate the Relationships Between Anxiety and IQ?

To test whether inattention mediated the relationship between anxiety disorders among children and Full Scale IQ scores (cf. Baron and Kenny 1986; Holmbeck 1997), two sets of analyses were undertaken. First, the pure subsamples of children with only anxiety disorders and children who met no criteria for a clinical diagnosis of any kind were entered into a series of regression equations. Inattention was indicated by the overall index score of the continuous performance task (CPT). Group diagnostic status significantly predicted Full Scale IQ (β=−0.40, R^2=0.16, p=0.03), but did not significantly predict inattention (β=0.35, R^2<0.01, p=0.86). Further, inattention did not significantly predict Full Scale IQ (β=−0.14, R^2=0.02, p=0.10). As a result, the criteria for mediation were not met and subsequent mediational tests were not pursued. Second, in order to determine if comorbid attentional disorders affected the outcome in the Hodges and Plow test, those comorbid groups were entered into a series of regression analyses using the overall index score from the CPT as a potential mediator. As above, group diagnostic status predicted Full Scale IQ (β=−0.17, R^2=0.03, p=0.05), but did not significantly predict inattention (β=0.52, R^2=0.00, p=0.56); and inattention again did not predict Full Scale IQ (β=−0.14, R^2=0.02, p=0.10). Given initial steps toward mediation were not fruitful, further mediational tests were not undertaken.

Discussion

This study sought to clarify the seemingly discrepant findings in the literature on the effects of anxiety disorders on IQ and achievement in children. Hodges and Plow (1990) were the first to suggest that children with anxiety disorders scored significantly lower on measures of IQ. Even so, a follow-up study by Zimet et al. (1994a) failed to replicate their findings. They suggested that the significant results obtained by Hodges and Plow (1990) were likely an aberration resulting from individuals having had multiple group memberships. As a result, they attempted to correct this difficulty by including only those individuals with a primary diagnosis; however, co-occurring disorders were not reported or seemingly determined in this study. Unfortunately, this method of group assignment failed to recognize that children tend to have more than one diagnosis even though they might not have been "diagnosed" (a phenomenon frequently observed in clinically referred children (see Angold et al. 1999). Thus, even though they may have had no overlapping primary diagnoses in their group assignments (i.e., those children with anxiety and those without), they failed to ensure that children with secondary or tertiary diagnoses of anxiety were not included in the control group and visa versa.

The current study addressed these limitations. Results from the composition of pure groups taking the above

factors into consideration demonstrate a statistically significant impact of an anxiety disorder on Full Scale IQ and on Performance IQ. Interestingly, this impact was not observed on Verbal IQ and Performance IQ in the comorbid groups, or on the individual subtests of the WISC. Similarly, the debilitating effects of an anxiety disorder were not observed on the individual achievement composite scores, rather, only on the overall multivariate effect. As a result, this study provides limited but important support for the hypothesis that anxiety disorders negatively impact IQ scores in children with comorbidity.

When the groups were constituted to reflect Zimet et al. (1994a) grouping of primary anxiety disordered children as compared to clinical controls that included children with secondary and tertiary anxiety disorders, no significant differences for Full Scale IQ, Verbal IQ, Performance IQ, or the achievement scores were found. Moreover, when the presence of ADHD was controlled for in the analyses, the effects were also not observed. That is, comparing anxiety disordered children (diagnosis anywhere in the profile) without ADHD to clinical controls, also without ADHD, resulted in no significant differences. Next, the potential mediating role of attentional problems on the observed relations between the presence of an anxiety disorder and compromised intellectual ability and achievement performance was examined. No support was found for such an effect for attentional problems as defined by the Overall Index Score on Conner's (1995) CPT.

Presumably the deficit in IQ associated with the presence of anxiety disorders could result from a myriad of factors. One potential candidate for this difference is a cognitive dulling, similar to that seen in depression, resulting from intrusive thoughts and worries. A similar effect has been observed in depression using word recall tasks. Depressed patients, compared to controls, demonstrate an impairment in noun recall during an unfocused trial (i.e., picking a noun from a group which correctly completes a sentence); however, during a focused trial their performance deficit disappeared (i.e., in this condition the correct noun had to be repeated at the end of the trial; Hertel and Rude 1991). Whether inattention mediated the relationship between anxiety disordered children and full scale IQ scores was examined; however, the mediation analysis failed to predict IQ scores based on a standard measure of inattention (see above). Surprisingly, this was the result even for those with comorbid diagnoses of ADHD.

The causal direction of these effects has yet to be determined. It has not yet been determined if children with lower IQ scores are predisposed to develop anxiety disorders, or if children with anxiety disorders are predisposed to experience impairment in IQ over time. In the former, a child with less intellectual resources and impaired cognitive fluidity and flexibility may have greater difficulties enduring stress and solving problems of daily life. In the latter, a child with an anxiety disorder may experience a relative impairment in cognitive resources from the pervasiveness and constancy of the worry. Presumably, both options are viable and, in all likelihood, a reciprocal interaction of the two maintains or exacerbates this effect. Future research should attempt to examine the development of anxiety disorders in relation to prior IQ scores. Use of a developmental psychopathology perspective will be especially important in such studies. Additionally, treatment efficacy studies with anxiety-disordered children should include pre- and post-treatment measures of IQ and academic achievement to determine if these deficits improve with the alleviation of anxiety symptoms. If so, such findings would suggest the role of anxiety in leading to these differences.

This study also differed from previous studies by making use of an outpatient sample. A question arising from Hodges and Plow (1990) was if the statistically and clinically significantly impairment in IQ associated with an anxiety disorder was only present in an inpatient population. Results suggest that significant statistical and clinical impairment in IQ does exist in an outpatient population. In addition, it may be that inadequate power associated with the sample sizes in the pure group comparisons underemphasizes the degree of IQ impairment (e.g., a medium effect size was found for differences in Mathematics Composite scores). Future research should attempt the difficult task of examining this effect in larger samples of pure groups (see Kazdin and Bass 1989). Even so, it is noteworthy that medium to large effects were found suggesting meaningful intellectual impairment.

In sum, the current study attempted to determine if children diagnosed with an anxiety disorder were at greater risk of doing poorly on measures of IQ and achievement. Generally, anxiety-disordered children performed lower at least on the IQ measures than children diagnosed with other disorders, as hypothesized. It is asserted that the impact of anxiety disorders on the psychological functioning of children should not be underestimated.

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