HEALTH-RELATED QUALITY OF LIFE AND FAMILY IMPACT IN CHILDREN WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND CO-MORBID PSYCHIATRIC CONDITIONS

A Dissertation

by

CHRISTINE ASHLEY LIMBERS

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2010

Major Subject: Psychology

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ABSTRACT

Health-Related Quality of Life and

Family Impact in Children with

Attention-Deficit/Hyperactivity Disorder

and Co-Morbid Psychiatric Conditions. (May 2010)

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Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most prevalent chronic disorders in childhood. The measurement of health-related quality of life (HRQOL) can compliment ADHD behavior rating scales and provide a more comprehensive understanding of the impact of ADHD and its treatment on the child's overall daily functioning and well-being. The purpose of the current study was to assess HRQOL from the perspective of pediatric patient self-report and parent proxy-report and family impact from the perspective of parents in children with ADHD ages 5 to 18 years being seen at a Pediatric Psychiatric Clinic utilizing the PedsQL™ 4.0 Generic Core Scales and Family Impact Module. For all PedsQL™ 4.0 Generic Core Scales, pediatric patients with ADHD and their parents reported statistically significant worse HRQOL than healthy children, with large effect sizes across all domains. More impaired generic HRQOL was significantly correlated with more severe ADHD symptoms as measured by the NICHQ Vanderbilt Total ADHD Symptom Score for parent proxy-report but not

child self-report. More impaired family functioning was significantly correlated with more severe ADHD symptoms. Intraclass Correlations (ICC) between pediatric patient self-report and parent proxy-report across the PedsQL™ 4.0 Generic Core Scales were in the poor to fair agreement range. These findings have implications for future research and clinical practice with pediatric patients with ADHD and co-morbid psychiatric conditions and their families. Given the large effect sizes reported between the present sample and healthy children across all HRQOL domains, it is important that interventions designed for children with ADHD and co-morbid psychiatric conditions not only address psychosocial difficulties, but also the physical impairments that may result from medications and/or co-morbid psychiatric diagnoses such as anxiety or depression. Given our finding that greater ADHD symptomatology was significantly associated with greater negative family impact, interventions for this population should focus on mitigating the negative impact of ADHD and co-morbid psychiatric conditions on families, particularly related to the areas of parental worry, family relationships, and daily family activities.

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INTRODUCTION: HEALTH-RELATED QUALITY OF LIFE AND FAMILY IMPACT

Attention-Deficit/Hyperactivity Disorder (ADHD) is a chronic condition characterized by impulsivity, a developmentally inappropriate activity level, low frustration tolerance, poor organization of behavior, distractibility, and an inability to sustain attention and concentration (APA, 1994; Cormier, 2008). ADHD is one of the most prevalent chronic disorders in childhood, affecting approximately 3% to 7% of school-aged children and accounting for nearly one third to one half of child mental health referrals (Daviss, 2008). ADHD is diagnosed 3 times more often in boys than girls (Barkley, 1998). ADHD symptoms are associated with impairments across a number of domains including academic, social, and emotional functioning (Spencer, Biederman, & Mick, 2007). For example, children with ADHD are often underachieving in school, have significant problems in relationships with peers, teachers, and parents, and are at a higher-risk for developing anxiety, depression, and substance use disorders. A growing body of evidence suggests that ADHD symptoms and associated impairments persist into adulthood for the majority of children with ADHD (Barkley, Fischer, Smallish, & Fletcher, 2006).

ADHD Subtypes

Three ADHD subtypes are defined in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV): predominantly inattentive, predominantly hyperactive-impulsive, and a combined subtype (APA, 1994). To meet DSM-IV

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criteria for the predominantly inattentive or predominantly hyperactive-impulsive subtypes, at least 6 of 9 behaviors in one respective category must be endorsed (APA, 1994). Criteria for ADHD combined subtype is met when more than 6 behaviors are endorsed from each respective category (APA, 1994). For all three subtypes, symptoms must be present prior to 7 years of age, last at least 6 months at a frequency greater than what would be expected in children of a comparable level of development, present in two or more settings, have a clear impact on psychosocial functioning, and which can't be accounted for by other types of mental health or learning disorders (APA, 1994). The ADHD combined subtype is most often diagnosed (50% to 75% of all individuals with ADHD), followed by the inattentive subtype (20%-30%), and the hyperactive-impulsive subtype (less than 15%) (Spencer et al., 2007). Children diagnosed with the inattentive subtype are more likely to be girls and have less emotional and behavioral problems in comparison with the other subtypes; children diagnosed with the combined ADHD subtype tend to have the greatest overall impairments and have the highest frequency of co-morbid psychiatric disorders (Spencer et al., 2007).

ADHD and Co-Morbid Psychiatric Disorders

There is a high frequency of co-morbid (co-existing) psychiatric disorders in children with ADHD (Steinhausen et al., 2006). In fact, some estimates suggest that in the general population, 2 in 3 children with ADHD meet DSM-IV criteria for one or more co-morbid psychiatric disorders (Kadesjo & Gillberg, 2001). Co-morbid psychiatric disorders often associated with ADHD include oppositional defiant disorder (ODD), conduct disorder (CD), depression, bipolar disorder, anxiety, tic disorders,

obsessive compulsive disorder, autism spectrum disorders, learning disabilities, and mental retardation (Cormier, 2008). ODD and CD are among the most prevalent co-morbid psychiatric conditions in children with ADHD; 50% to 60% of children diagnosed with ADHD meet criteria for ODD while 25% of children diagnosed with ADHD meet criteria for CD (Kadesjo & Gillberg, 2001). Mood and anxiety disorders also frequently co-exist with ADHD in that nearly one in four children with ADHD also meets criteria for a mood and/or anxiety disorder (Root & Resnick, 2003). The co-existence of ADHD with other psychiatric conditions in children has been associated with greater severity of ADHD symptoms and behavioral problems, and more substantial impairments in psychosocial functioning (Steinhausen et al., 2006).

ADHD and Family Impact

ADHD also has a profound impact on family functioning. The social-ecological framework, based on the work of Dr. Urie Bronfenbrenner, provides a helpful model for understanding the interactions between a child with ADHD and the numerous systems relevant to the child, including the family (Bronfenbrenner, 1979). Microsystems are the most proximal levels of influence on the child and involve the "pattern of activities, roles, and interpersonal relations" the child experiences (Bronfenbrenner, 1979). Included in the microsystem are settings and people the child frequently interacts with including school and family members such as parents and siblings (Roberts, 2003). Also included in the microsystem of a child with a chronic health condition such as ADHD is the disease and its treatment (Roberts, 2003). Mesosystems are "interrelated miscrosystems, or the overlap or two or more microsystems" (Roberts, 2003). For

example, the mesosystem of a child with ADHD may involve interactions between teachers, parents, and health care providers who treat the child. The exosystem involves aspects of the child's environment that have significant indirect effects on the child (Roberts, 2003). For example, this can include parental employment which is important since parents provide the majority of care for their children.

A chronic health condition such as ADHD and its treatment can place a number of demands on a child's family (Wallander & Varni, 1998). In addition to the behavioral problems families of children with ADHD must cope with, parents are often faced with increased caretaking demands related to the delivery and management of the child's medication and behavioral treatment programs (Riley, Lyman et al., 2006; Whalen et al., 2006). Strained parent-child and sibling relationships, less perceived family cohesiveness, parental depression, and higher rates of separation and divorce have been reported in families of children with ADHD (Brown & Pacinin, 1989; Kaplan, Crawford, Fisher, & Dewey, 1998). Parents' work status and work productivity have been shown to be negatively impacted by childhood ADHD (Coghill et al., 2008).

Children's academic problems have been shown to negatively impact family functioning (Kaplan et al., 1998). To evaluate if the behavioral problems associated with ADHD impose a unique burden on families above and beyond general school difficulties, Kaplan et al. (1998) conducted a cross-sectional analysis of family functioning across a group of children with ADHD and a group of children with reading disabilities who had no reported behavior problems (Kaplan et al., 1998). The authors found that families of children with ADHD reported significantly more impairments in

family functioning compared to families of children with reading disabilities. These findings suggest that behavioral problems associated with ADHD pose a greater burden to families than general school problems (Kaplan et al., 1998). However, as noted by the authors, these findings should be interpreted with caution given the familial nature of ADHD. That is, many parents of children with ADHD may have characteristics of ADHD themselves which may contribute to family dysfunction (Kaplan et al., 1998).

There is a growing body of literature that suggests children with ADHD experience chronic sleep difficulties, which may in part be attributed to the side effects of medications used to treat ADHD (Lim, Ooi, Fung, Mahendran, & Kaur, 2008). These sleep difficulties may further negatively impact family functioning and include problems initiating sleep (resisting bedtime, delayed onset sleep) and maintaining sleep (recurrent awakenings, restless sleep, nightmares, disordered breathing) (Sung, Hiscock, Sciberras, & Efron, 2008). In a sample of 239 Australian children ages 5-18 years diagnosed with ADHD, Sung et al. (2008) found that 73.3% of children in their sample experienced sleep difficulties (28.5% mild sleep problems; 44.8% moderate or severe sleep problems) (Sung et al., 2008). The authors reported a strong association between moderate or severe sleep problems and the mental health of the primary caregiver, family functioning, and the primary caregiver's ability to fulfill daily responsibilities outside of the home (Sung et al., 2008). Specifically, parents in the sample of children with moderate or severe sleeps problems were more likely to report missing work or being late for work in the previous 6 months (Sung et al., 2008). A recent study by Mayes et al. (2009) found that children with ADHD combined subtype experienced

greater sleep difficulties than children with ADHD inattentive subtype; children with ADHD and co-morbid anxiety or depression experienced greater sleep problems than children with ADHD alone and children with ADHD and co-morbid ODD (Mayes et al., 2009).

Treatment of ADHD

Consistent with the treatment of other chronic mental health conditions, the goal of treatment for ADHD is to reduce symptoms, improve functionality, and enhance well-being for the child. Three treatments are the mainstay for treating children with ADHD (Kratochvil et al., 2009). These include behavioral interventions, central nervous stimulants, and a combination of the two. Expert guidelines indicate that a combination of behavioral treatment and stimulant medication is the most effective treatment for children with ADHD, particularly given the considerable behavioral problems that negatively impact family and school functioning (Edwards, 2002). Behavioral treatments for ADHD involve behavioral parent training and interventions in the classroom that attempt to alter the physical and social environment factors that lead to the maintenance of problematic child behavior; such training involves teaching parents and teachers specific techniques such as positive reinforcement, time-out, and "response cost" to reward positive behaviors and utilizing consequences for behaviors that are disruptive or noncompliant (Kratochvil et al., 2009).

Two types of stimulant medications (methylphenidate and dextroamphetamine) are used most frequently to treat symptoms of ADHD. Some data suggest that at least 90% of children with ADHD will respond positively to one stimulant with no major

adverse side effects when the medication is administered and dosed properly (Cormier, 2008). However, the use of stimulant medications to treat children with ADHD can be controversial given that some children experience adverse side effects including decreased appetite, headache or stomachache, delayed sleep onset, irritability, social withdrawal, and in a small number of children, motor tics (Kratochvil et al., 2009). Adverse side effects caused by stimulant medications tend to be transient and are typically managed by altering dosage and administration time (Daviss, 2008). There has been growing support for the effectiveness of non-stimulant drugs such as atomoxetine for treating children with ADHD (Newcorn et al., 2008).

Health-Related Quality of Life

The last decade has evidenced a dramatic increase in the development and utilization of pediatric patient patient-reported outcomes (PROs) in an effort to improve pediatric patient health and determine the value of healthcare services (FDA, 2006). By definition, PROs are self-report instruments that directly measure the patient's perceptions of the impact of disease and treatment as clinical trial endpoints (FDA, 2006). PROs include multi-item health-related quality of life (HRQOL) instruments, as well as single-item symptom measures (e.g., pain visual analogue scale [VAS]) (Acquadro et al., 2003; Sherman, Eisen, Burwinkle, & Varni, 2006; Willke, Burke, & Erickson, 2004). It has been extensively documented in the PRO measurement of children with chronic health conditions and healthy children that information provided by proxy-respondents is not equivalent to that reported by the child (Eiser & Morse, 2001a; Upton, Lawford, & Eiser, 2008). This has been especially true for internal

domains such as emotional functioning, pain, and fatigue in which symptoms may only be known by the child (FDA, 2006). Taken together, the findings on the proxy problem "indicate that parent reports cannot be substituted for child self-reports" (Theunissen et al., 1998) and evaluations of pediatric patients' perspectives regarding treatment outcomes should be included in pediatric clinical trials given the documented differences between child and parent report.

HRQOL is a multidimensional construct (World Health Organization, 1948) and consistent with the World Health Organization's definition of health, evaluates a patient's subjective perception of the impact of disease and treatment on physical, psychological, and social functioning (World Health Organization, 1948). A number of authors have argued that improving quality of life is the ultimate goal of healthcare (Kaplan, 2001). Although the term "quality of life" (QOL) is sometimes used interchangeably with HRQOL, QOL is actually a broader construct that encompasses aspects of life which are not amenable to healthcare services (e.g., the evaluation of the impact of the built environment on general well-being). Thus, HRQOL has emerged as the most appropriate term for QOL health dimensions which are within the scope of healthcare services (FDA, 2006).

One of the most widely used models in pediatric psychology for understanding a child and family's adjustment to a chronic health condition comes from Wallander and Varni (1998) (Wallander & Varni, 1998). Within this theoretical framework, a chronic health condition is conceptualized as "an ongoing chronic strain for both the children and their parents" (Wallander & Varni, 1998). Chronic strains are "persistent objective

conditions that require continual readjustment, repeatedly interfering with the adequate performance of ordinary role-related activities" (Wallander & Varni, 1998). Risk factors in the model include: (1) disease/disability parameters (e.g., diagnosis, severity, visibility, brain damage, cognitive functioning), (2) functional independence in activities of daily living, and (3) psychosocial stressors (e.g., handicap-related problems, daily hassles, major life events). Resistance factors in the model fall into 3 categories: (1) intrapersonal factors (e.g., temperament, competence, motivation, problem-solving ability), (2) social-ecological factors (e.g., family environment, family members' adjustment, social support), and (3) stress processing factors (e.g., cognitive appraisal, coping strategies). The main outcome in the model is consistent with the World Health Organization's definition of health, and which is currently defined conceptually as health-related quality of life (e.g., physical, mental, and social dimensions).

ADHD and Health-Related Quality of Life

Treatment response in children with ADHD often focuses on symptom reduction measured through behavioral rating scales completed by the child's parents and teachers (Barkley, 1998). These behavior rating scales such as the Conner's Rating Scales are specific for behavioral characteristics of ADHD (e.g., inattention, hyperactivity, cognitive problems, oppositional behavior, anxiety, social problems) and therefore are limited in their ability to assess the child's functioning broadly. Furthermore, the majority of these behavior rating scales only offer parent and teacher reports for young children. Consequently, they are unable to capture the young child's perspective regarding his/her functioning. The measurement of HRQOL can compliment ADHD

behavior rating scales and provide a more comprehensive understanding of the impact of ADHD and its treatment on the child's overall daily functioning and well-being (Yang, Hsu, Chiou, & Chao, 2007).

A number of recent studies have assessed HRQOL in children with ADHD (Bastiaens, 2008; A. F. Klassen, Miller, & Fine, 2004; Matza et al., 2004; Perwien et al., 2004; Riley, Coghill et al., 2006; Sallee, Ambrosini, Lopez, Shi, & Michaels, 2004; Sawyer et al., 2002; Sung et al., 2008; Varni & Burwinkle, 2006; Yang et al., 2007; Svanborg et al., In press; Wigal et al., 2005). These 12 studies are summarized in Table 1. While these studies are an important contribution to the empirical literature, demonstrating the substantial negative impact of ADHD on HRQOL, they provide a limited understanding of the HRQOL of children with ADHD since HRQOL was only evaluated via parent proxy-report for all but one of the studies (Varni & Burwinkle, 2006). The study by Varni & Burwinkle (2006) that assessed pediatric patient self-reported HRQOL in children with ADHD had a number of methodological limitations. For example, this was a population-based study so children were identified by their parents as having ADHD, not by a physician (Varni & Burwinkle, 2006). In addition, information on co-morbid psychiatric disorders was unavailable as was information on ADHD symptom severity (Varni & Burwinkle, 2006). Given the far reaching psychosocial difficulties associated with ADHD, the adverse side effects that can result from stimulant medications, many of which involve internal symptoms such as loss of appetite, headaches, stomachaches, and irritability, and the well documented discrepancies between parent and child self-reports in the PRO literature, there is a need

for methodologically sound studies that assess HRQOL from the perspective of children with ADHD.

Further, while 5 of the 12 studies summarized in Table 1 assessed the relationship between ADHD symptom severity and HRQOL, none of the studies used the Vanderbilt ADHD Diagnostic Rating Scales parent version (NICHQ, 2003) which is a well-validated measure of ADHD symptom severity consistent with the Diagnostic and Statistical Manual for Mental Disorders Fourth Edition (DSM-IV) (Froehlich, Lanphear, & Epstein, 2007; NICHQ, 2003; Wolraich, Lambert, & Doffing, 2003). Two of the studies (Perwien et al., 2004; Yang et al., 2007) used the Clinical Global Impressions-ADHD- Improvement, a single item measure of symptom severity based on the clinician's evaluation of a child's ADHD symptom severity in relation to the clinician's total experience with ADHD symptoms. A single item measure completed by a clinician who does not directly observe the child's behavior in multiple settings may not be the most reliable and valid indicator of ADHD symptom severity. In one study (A. F. Klassen et al., 2004), ADHD symptom severity was measured utilizing an instrument that has not been well-validated called the Child Symptom Inventory. Two studies (Matza et al., 2004; Riley, Coghill et al., 2006) used the ADHD Rating Scale-IV Parent Version, which is an 18-item measure that corresponds to the DSM-IV diagnostic criteria for ADHD and has been widely used to assess ADHD symptom severity. In a sample of 1,477 children ages 6-18 years diagnosed with ADHD, Riley et al. (2006) found that correlations between 5 of the 6 scales on the HRQOL measure CHIP-CE (Satisfaction, Comfort, Resilience, Academic Performance, and Peer Relations) and the

ADHD Rating Scale-IV Parent Version were in the small effect size range (Riley, Coghill et al., 2006). In a sample of 297 children ages 8 to 17 years diagnosed with ADHD, Matza et al. (2004) found that the psychosocial functioning scales of the Child Health Questionnaire (CHQ) Parent Version and the ADHD Rating Scale-IV Parent Version were significantly negatively correlated (Matza et al., 2004). In general, the CHQ physical scales were not significantly correlated with the measure of ADHD symptom severity. While these two studies provide useful information on the associations between ADHD symptom severity and HRQOL, they were limited by the fact the analyses only included Pearson correlations and did not control for the presence of co-morbid psychiatric conditions. Thus, it is unclear the impact co-morbid psychiatric conditions had on ADHD symptom severity and HRQOL in these two studies. As such, there is a need for additional research that elucidates the relationship between ADHD symptom severity and HRQOL controlling for co-morbid psychiatric diagnoses.

Finally, only one of the 12 published studies that assessed HRQOL in children with ADHD (Table 1) evaluated the relationship between HRQOL and family impact (Riley, Coghill et al., 2006). Riley et al. (2006) correlated the Family Strain Index with the CHIP-CE. The authors found that correlations between the Family Strain Index and 5 of the 6 scales of the CHIP-CE (Satisfaction, Comfort, Resilience, Academic Performance, and Peer Relations) were in the medium effect size range. The correlation between the Family Strain Index and the Risk Avoidance scale on the CHIP-CE was in the large effect size range. While these findings point to the significant association

between impaired HRQOL and family functioning in children with ADHD, they are limited by the fact that they only include Pearson correlations. Furthermore, the Family Strain Index is not a well-validated measure. In fact, as noted by the authors, this study represented the first use of the Family Strain Index as it was developed specifically for the purposes of this investigation (Riley, Coghill et al., 2006). Given the profound impact of ADHD on family functioning, there is a need to better understand the relationship between HRQOL and family impact in children with ADHD.

The current study aims to address a gap in the literature by assessing HRQOL from the perspective of pediatric patient self-report and parent proxy-report and family impact from the perspective of parents in children with ADHD ages 5 to 18 years being seen at a Pediatric Psychiatric Clinic. Specifically, this study: (a) compares child self-reported and parent proxy-reported HRQOL for pediatric patients with a physician-diagnosis of ADHD to a matched sample of healthy children, (b) investigates the interrelationships between child self-reported HRQOL, parent proxy-reported HRQOL, parent-reported family impact, ADHD symptom severity, and disease-specific indicators, and (c) evaluates agreement between child self-reported and parent proxy-reported HRQOL.

The following hypotheses were tested:

1. Consistent with previous PedsQL™ findings utilizing child self-report and parent proxy-report in a population-based study (Varni & Burwinkle, 2006) of children with ADHD and findings utilizing other HRQOL proxy-report measures in this population (A. F. Klassen et al., 2004; Matza et al., 2004), children with ADHD

will demonstrate significantly lower HRQOL (effect sizes in the medium to large range) than a matched sample of healthy children for both child self-report and parent proxy-report, with the greatest differences demonstrated on psychosocial functioning.

2. Consistent with previous findings with children with ADHD using parent proxy-report (A. F. Klassen et al., 2004; Matza et al., 2004; Perwien et al., 2004; Yang et al., 2007), more severe ADHD symptoms will be associated with more impaired generic HRQOL.
3. Greater impairments in the child's HRQOL and more severe ADHD symptoms will be associated with greater negative family impact consistent with previous literature utilizing parent proxy-report (Riley, Coghill et al., 2006).
4. Children and their parents will demonstrate moderate to good agreement regarding the child's HRQOL as evidenced by Intraclass Correlations between 0.41 to 0.80 consistent with the one previous population-based study that assessed HRQOL in children with ADHD from the perspective of both child self-report and parent proxy-report (Varni & Burwinkle, 2006). Parents will report lower mean HRQOL scores than children based on previous literature (Upton et al., 2008).

METHOD

Participants

The current study utilized a pre-existing database. Participants were children with a physician diagnosis of ADHD ages 5–18 years (n = 179) and parents of children with a physician diagnosis of ADHD ages 5–18 years (n = 181) from a Pediatric Psychiatric Clinic. This population of children with ADHD treated at a Pediatric Psychiatric Clinic were specifically selected given that it was anticipated that this a population of children would manifest a high prevalence of co-morbid psychiatric conditions (Epstein, Shawitz, Shaywitz, & Woolston, 1991; Wasserman et al., 1999). The average age of the 57 girls (31.1%) and 124 boys (67.8%; Missing, n = 2, 1.1%) was 11.08 years (SD = 3.70). With respect to race/ethnicity, the sample contained 147 (80.3%) White non-Hispanic, 8 (4.4%) Hispanic, 20 (10.9%) Black non-Hispanic, 5 (2.7%) Other, and 3 (1.6%) Missing. Mean SES was 40.62 (SD = 11.71), indicating on average a middle to upper middle class sample based on the Hollingshead index (Hollingshead, 1975). SES data was not available for 27 participants (14.9%). Mean number of months since being diagnosed with ADHD for the sample was 43.68 months (SD = 32.19; Range = 1-153). The median number of diagnoses children in the sample had was 2 (SD = 0.93; Range = 1-4). 88.0 % of the sample had at least one co-morbid diagnosis. The co-morbid diagnoses were predominantly psychological disorders and included Mood Disorders (n = 82), Disruptive Behavior Disorders (n = 99), Anxiety Disorders (n = 52), Psychotic Disorders (n =7), Substance Use Disorders (n =1), Learning Disability/Mental Retardation (n =28), and Other (n = 13). The median

number of daily medications children in the sample were taking was 1 (SD = 0.57; Range = 0-3); mean number of months children had been on medications was 42.09 (SD = 31.71; Range = 1-153). 98.4% of children in the sample were taking at least one daily medication to treat ADHD symptoms. These medications included Adderall (n = 68), Concerta (n = 59), Strattera (n = 12), Ritalin (n = 9), Methylphenidate (n = 4), Dexedrine (n = 3), Dextrostat (n = 1), Focalin (n = 2), Methylin (n = 2), and Metadate (n = 1). This sample is representative of the underlying population of children with ADHD in the United States which is more likely to be white males (Bimstein, Wilson, Guelmann, & Primosch, 2008).

The healthy children sample was derived from the previously conducted PedsQL™ 4.0 initial field test (Varni, Seid, & Kurtin, 2001) and a statewide SCHIP evaluation in California (Varni, Burwinkle, Seid, & Skarr, 2003) and was randomly matched by age, gender, and race/ethnicity to the ADHD sample utilizing the SPSS Version 16.0 statistical software random sample case selection command. Children were assessed either in physicians' offices during well-child visits, by telephone, or via a statewide mailing. The average age of the 957 boys (65.9 %) and 496 girls (34.1 %) was 9.21 years (SD = 4.46). With respect to race/ethnicity, the sample contained 1170 (80.5 %) White non-Hispanic, 112 (7.7 %) Hispanic, 131 (9.0 %) Black non-Hispanic, 26 (1.8%) Other, and 14 (1.0%) Missing. Mean socioeconomic status (SES) was unavailable for this sample, although the statewide SCHIP sample was representative of low-income families (< 250% of the federal poverty level).

Measures

Generic Health-Related Quality of Life. Generic health-related quality of life (HRQOL) was measured for both child self-report and parent proxy using the PedsQL™ 4.0 Generic Core Scales (Pediatric Quality of Life Inventory™) (Varni et al., 2001). The 23-item PedsQL™ 4.0 Generic Core Scales were designed to measure the core dimensions of health (physical, mental, and social health) delineated by the World Health Organization (World Health Organization, 1948), as well as role (school) functioning. The PedsQL™ consists of brief, practical, generic core scales suitable for use with healthy school and community populations, as well as with pediatric populations with acute and chronic health conditions. Pediatric self-report is measured in children and adolescents ages 5-18 years, and parent proxy-report of child HRQOL is measured for children and adolescents ages 2-18 years. In this study, only children ages 5 to 18 years and their parents completed the PedsQL™ given the low prevalence of children with ADHD ages 2-4 years seen in the Psychiatry Clinic in which data was collected. The 23-item PedsQL™ 4.0 Generic Core Scales encompass: 1) Physical Functioning (8 items), 2) Emotional Functioning (5 items), 3) Social Functioning (5 items), and 4) School Functioning (5 items). The instrument takes approximately 5 minutes to complete (Varni et al., 2001). The PedsQL 4.0 Generic Core Scales has emerged as a widely used generic HRQOL measure in pediatric chronic health conditions that has resulted from an extensive iterative process involving numerous patient and parent focus groups and individual focus interviews, item generation, cognitive interviewing, pre-testing, and subsequent field testing (Varni & Limbers, 2009). There are currently extensive

international data on thousands of healthy children and children with numerous pediatric chronic health conditions published or in press in over 350 peer-reviewed journals since 2001 (A full listing of the updated peer-reviewed journal publications is available at www.pedsql.org). The PedsQL™ 4.0 Generic Core Scales has been utilized in pediatric psychiatric disorders, demonstrating significant impairments in HRQOL and significant intercorrelations with the Child Behavior Checklist (Bastiaansen, Koot, Bongers, Varni, & Verhulst, 2004; Storch et al., 2007; Varni Seid, & Rode, 1999) and measures of emotional distress including the Children's Depression Inventory (Cotton et al., 2009; Varni, Seid, & Rode, 1999; Anderson et al., in press), the State-Trait Anxiety Inventory for Children (STAIC) (Varni, Seid, & Rode, 1999), the Revised Children's Manifest Anxiety Survey (RCMAS) (Anderson et al., in press), and the Social Phobia and Anxiety Inventory for Children and Short Mood and Feeling Questionnaire (Reinfjell, Hjemdal, Aune, Vikan, & Diseth, 2008).

The PedsQL™ 4.0 Generic Core Scales has been shown to distinguish between healthy children and children with pediatric chronic health conditions (Field, Alpert, Vega-Lahr, Goldstein, & Perry, 1988; Palmer, Meeske, Katz, Burwinkle, & Varni, 2007; Uzark, Jones, Burwinkle, & Varni, 2003; Varni et al., 2006; Varni, Burwinkle, Katz, Meeske, & Dickinson, 2002; Varni, Burwinkle, Rapoff, Kamps, & Olson, 2004), demonstrated sensitivity to disease severity(Chan, Mangione-Smith, Burwinkle, Rosen, & Varni, 2005; Varni et al., 2006; Varni, Limbers, & Burwinkle, 2007), responsiveness through patient change over time (Connelly & Rapoff, 2006; Fullerton et al., 2007; Holterman et al., 2007; Razzouk et al., 2006; Varni, Seid et al., 2002), and shown

significant intercorrelations with disease-specific symptoms (Varni et al., 2006; Varni, Burwinkle, Jacobs et al., 2003). The PedsQL™ 4.0 Generic Core Scales child self-report version has also demonstrated factorial invariance (stable factor structure) across age (Limbers, Newman, & Varni, 2008a), gender (Varni, Limbers, & Newman, 2008), race/ethnicity (Limbers, Newman, & Varni, 2009), socioeconomic status (Limbers, Newman, & Varni, 2008), health status (Limbers, Newman, & Varni, 2008b), longitudinally (Varni, Limbers, Newman, & Seid, 2008), and across mode of administration (Varni, Limbers, & Newman, 2009).

Family Impact. The 36-item PedsQL™ Family Impact Module Scales encompass 6 scales measuring parent self-reported functioning: 1) Physical Functioning (6 items), 2) Emotional Functioning (5 items), 3) Social Functioning (4 items), 4) Cognitive Functioning (5 items), 5) Communication (3items), 6) Worry (5 items), and 2 scales measuring parent reported family functioning; 7) Daily Activities (3 items) and 8) Family Relationships (5 items). Items and scales were developed through focus groups, cognitive interviews and pre-testing measurement development protocols (Varni, Sherman, Burwinkle, Dickinson, & Dixon, 2004), and our prior research and clinical experiences with children with chronic health conditions and their families. The PedsQL™ Family Impact Module has demonstrated acceptable reliability and validity across a number of populations including children with sickle cell disease (Panepinto, Hoffmann, & Pajewski, 2009), developmental delays (Hsieh, Huang, Lin, Wu, & Lee, 2009), cancer (Scarpelli et al., 2008), and medically fragile children with complex chronic health conditions (Varni, Sherman, Burwinkle, Dickinson, & Dixon, 2004).

The PedsQL™ Family Impact Module was developed as a parent-report instrument (Varni et al., 2004). Likert response scale and scoring method for the Family Impact Module are identical to the PedsQL™ 4.0 Generic Core Scales, with higher scores indicating better functioning (less negative impact). The PedsQL Family Impact Module Total Scale Score is the sum of all 36 items divided by the number of items answered. The Parent HRQOL Summary Score (20 items) is computed as the sum of the items divided by the number of items answered in the Physical, Emotional, Social, and Cognitive Functioning Scales. The Family Functioning Summary Score (8 items) is computed as the sum of the items divided by the number of items answered in the Daily Activities and Family Relationships Scales.

ADHD Symptom Severity. Parents completed the parent version of the Vanderbilt ADHD Diagnostic Rating Scales (NICHQ, 2003). The Vanderbilt ADHD Diagnostic Rating Scales Parent Version has been shown to have valid psychometric properties consistent with the Diagnostic and Statistical Manual for Mental Disorders Fourth Edition (DSM-IV) diagnosis of ADHD in school-aged children (Wolraich et al., 2003) and a single parent rater has been successfully used to identify children with ADHD in a nationally representative sample (Froehlich et al., 2007). The Vanderbilt includes a 9-item Inattentive Scale, 9-item Hyperactive/Impulsive Scale, 8-item Oppositional Defiant Disorder Scale, 14-item Conduct Disorder Scale, and 7-item Anxiety/Depression Scale. The Total ADHD Symptom Score (18 items), is a summary score of the Inattentive Scale and Hyperactive/Impulsive Scale. The Vanderbilt scales

use a 4-point Likert rating, in which the parent notes whether over the last 6 months the behavior symptoms have occurred rarely, sometimes, often, or very often.

Demographics. Parents completed the PedsQL™ Family Information Form (Varni et al., 2001) which contains demographic information including the child's date of birth, gender, race/ethnicity, and parental education and occupation information required to calculate the Hollingshead socioeconomic status (SES) index (Hollingshead, 1975).

Disease-Specific Indicators. The following information was retrieved from the child's medical chart by a research nurse: number of months since diagnosis, number of diagnoses, category of co-morbid diagnoses, number of daily medications, name of daily medications, and number of months on medications. ADHD and co-morbid psychiatric diagnoses were made after an extensive clinical interview by a child psychiatrist prior to the child being enrolled in the study based on signs and symptoms presented and history, including in some cases diagnostic scales completed by parents and teachers.

Procedures

Data collection took place over a three year period between 2005 and 2008. Children ages 5-18 and their parents were given a specific PedsQL™ Generic Core Scales age-appropriate form depending on the child's age (5-7, 8-12, and 13-18). Younger children (5-7 years) were assisted by a research assistant in completing the measure. The research assistant was also present to assist children in the older groups and parents as needed. Parents then completed the PedsQL™ Family Impact Module, Vanderbilt ADHD Diagnostic Rating Scales Parent Version, and the PedsQL™ Family

Information Form, in that order. Instruments were completed by participants in a patient examination room in the Pediatric Psychiatric Clinic, either while waiting for the physician or after the child's appointment with the physician. A $10 gift certificate was provided to each child/parent pair for their participation in the study. Written parental informed consent and child assent were obtained. This research protocol was approved by the Institutional Review Board at Scott & White Memorial Hospital and Clinics.

Statistical Analyses

First, independent samples *t* tests to compare pediatric patients with ADHD and a matched sample of healthy children on the PedsQL™ 4.0 Generic Core Scales. In order to determine the magnitude of the differences between pediatric patients with ADHD and healthy children, effect sizes were calculated (Cohen, 1988). Effect size as utilized in these analyses were calculated by taking the difference between the healthy sample mean and the ADHD sample mean, divided by the pooled standard deviation. Effect sizes for differences in means are designated as small (.20), medium (.50), and large (.80) in magnitude (Cohen, 1988).

To test hypothesis 2, an analysis of Pearson's Product Moment Correlations among the PedsQL™ 4.0 Generic Core Scales and the NICHQ Vanderbilt Total ADHD Symptom Score, as well as disease-specific indicators including number of months since diagnosis, number of diagnoses, number of daily medications, and number of months on medications, were examined. Pearson's Product Moment Correlation coefficient effect sizes are designated as small (.10-.29), medium (.30-.49), and large ($\geq$.50)(Cohen, 1988). In addition, to test hypothesis 2, two separate hierarchical linear regression models were

constructed to assess the associations between overall HRQOL and ADHD symptomatology, over and above the associations between HRQOL, demographic variables, and disease-specific indicators. It was hypothesized that inattentive symptoms would be more strongly associated with impairments in HRQOL than hyperactive/impulsive symptoms based on previous Pearson Correlation findings with children with ADHD (Gordon et al., 2006; A. F. Klassen et al., 2004). The block-entry method was used with overall generic HRQOL (PedsQL™ Generic Core Total Score for child self-report and parent proxy-report) as primary outcomes. Independent variables were entered into the models in blocks in the following order: (1) sociodemographic characteristics (age, gender, race/ethnicity, SES); (2) disease-specific indicators (number of ADHD medications, time on ADHD medications, time since ADHD diagnosis, presence of co-morbid diagnosis, number of diagnoses); and (3) ADHD symptomatology (Vanderbilt Inattentive Scale and Vanderbilt Hyperactive/Impulsive Scale). The order for entering independent variables (i.e., entering demographic variables first followed by disease-specific indicators and symptoms) was modeled after two previous studies that utilized hierarchical linear regression analyses (Bastiaansen, Koot, & Ferdinand, 2005; Cotton et al., 2009). As noted above in the description of the sample, there was some missing data with regard to demographic variables and disease-specific indicators. Since these variables were entered into the first and second blocks of the two hierarchical linear regression models, cases with missing demographic and disease-specific data were excluded from the analyses which resulted in a final sample of 140 for child self-report and parent proxy-report.

To test hypothesis 3, an analysis of Pearson's Product Moment Correlations among the PedsQL™ Family Impact Module and the NICHQ Vanderbilt Total ADHD Symptom Score, as well as disease-specific indicators including number of months since diagnosis, number of diagnoses, number of daily medications, and number of months on medications, were examined. An analysis of Pearson's Product Moment Correlations among the PedsQL™ Family Impact Module and PedsQL™ 4.0 Generic Core Scales was also conducted. As previously noted, Pearson's Product Moment Correlation coefficient effect sizes are designated as small (.10-.29), medium (.30-.49), and large ($\geq$.50)(Cohen, 1988). In addition, to test hypothesis 3 a separate hierarchical linear regression model was constructed to assess the associations between family impact and child psychosocial functioning, over and above the associations between family impact, demographic variables, and disease-specific indicators/symptom severity. The block-entry method was used with overall family impact (PedsQL Family Impact Module Total Score) as the primary outcome. It was hypothesized that child emotional, social, and school functioning would be associated with family impact based on previous literature (Riley, Lyman et al., 2006; Whalen et al., 2006; B. J. Kaplan et al., 1998). Independent variables were entered into the model in blocks in the following order: (1) sociodemographic characteristics (age, gender, race/ethnicity, SES); (2) disease-specific indicators/symptom severity (number of ADHD medications, time on ADHD medications, time since ADHD diagnosis, presence of co-morbid diagnosis, number of diagnoses, Vanderbilt ADHD Symptom Score); and (3) child psychosocial functioning (parent proxy-reported PedsQL™ Emotional Functioning Scale, PedsQL™ Social

Functioning Scale, PedsQL™ School Functioning Scale). The order for entering independent variables (i.e., entering demographic variables first followed by disease-specific indicators and symptoms) was modeled after two previous studies that utilized hierarchical linear regression analyses (Bastiaansen et al., 2005; Cotton et al., 2009). There was some missing data with regard to demographic variables and disease-specific indicators. Since these variables were entered into the first and second blocks of the hierarchical linear regression model, cases with missing demographic and disease-specific data were excluded from the analyses which resulted in a final sample of 147.

Agreement between child self-report and parent proxy-report (hypothesis 4) was determined through Intraclass Correlations (ICCs) (McGraw & Wong, 1996). The ICC provides an index of absolute agreement given that it takes into account the ratio between subject variability and total variability (Cremeens, Eiser, & Blades, 2006; McGraw & Wong, 1996). Intraclass Correlations are designated as $\leq$ 0.40 poor to fair agreement, 0.41-0.60 moderate agreement, 0.61-0.80 good agreement, and 0.81-1.00 excellent agreement (Bartko, 1966; Wilson, Dowling, Abdolell, & Tannock, 2001). In addition, mean values between children and parent scores on the PedsQL™ 4.0 Generic Core Scales were compared using independent samples *t* tests. In order to determine the magnitude of the differences between pediatric patients with ADHD and their parents, effect sizes were calculated.(Cohen, 1988) Effect size as utilized in these analyses were calculated by taking the difference between the child mean and the parent sample mean, divided by the pooled standard deviation. As previously noted, effect sizes for differences in means are designated as small (.20), medium (.50), and large (.80) in

magnitude (Cohen, 1988). Statistical analyses were conducted using SPSS Version 16.0 for Windows (SPSS, 2008).

RESULTS

Exploratory Age Analysis

Table 2 presents PedsQL™ 4.0 Generic Core Scale scores across age forms (5-7, 8-12, 13-18). For child self-report, statistically significant differences between age forms were found on Physical Health and School Functioning. Specifically, adolescents (ages 13-18 years) self-reported significantly better physical health than young children (ages 5-7) and children (ages 8-12 years). Young children self-reported significantly better school functioning than children and adolescents. For parent proxy-report, parents of young children (ages 5-7) reported significantly better PedsQL™ Total Scale, Psychosocial Health, Social Functioning, and School Functioning scores for their children compared to parents of children (ages 8-12). Despite these significant differences, data were pooled across age forms for the subsequent analyses given that sample sizes for each age form (n = 46 young child, n = 75 child, n = 60 adolescent) were not large enough to conduct separate analyses. It should be noted that for the hierarchical linear regression analyses (hypothesis 2 and 3), age was one of the socio-demographic variables controlled for in the first block.

Comparisons between Children with ADHD and Healthy Children

For pediatric patients with ADHD and healthy children, means and standard deviations of the PedsQL™ 4.0 Generic Core Scale Scores for patient self-report and parent proxy-report are presented in Table 3. For all PedsQL™ 4.0 Generic Core Scales, pediatric patients with ADHD and their parents reported statistically significant worse HRQOL than healthy children. All effect sizes were in the large range, with the greatest

effects for both child self-report and parent proxy-report found on the Psychosocial Health Summary Score.

Intercorrelations with the PedsQL™ 4.0 Generic Core Scales

Tables 4 and 5 show the intercorrelations among the PedsQL™ 4.0 Generic Core Scales, the NICHQ Vanderbilt Total ADHD Symptom Score, and disease-specific indicators including number of months since diagnosis, number of diagnoses, number of daily medications, and number of months on medications.

More impaired generic HRQOL was significantly correlated with more severe ADHD symptoms as measured by the NICHQ Vanderbilt Total ADHD Symptom Score for parent proxy-report (Table 5). All PedsQL™ 4.0 Generic Scales were significantly correlated with the Vanderbilt Total ADHD Symptom Score, with the largest intercorrelations demonstrated on Psychosocial Health (-0.56, $P<0.001$) and School Functioning (-0.52, $P<0.001$). Pearson's Product Moment Correlations between the PedsQL™ 4.0 Generic Core Scales and Vanderbilt Total ADHD Symptom Score were all in the medium to large effect size range. Number of diagnoses was also significantly correlated with all PedsQL™ 4.0 Generic Core Scales, with the largest intercorrelation found on Psychosocial Health (-0.33, $P<0.001$). Psychosocial Health and School Functioning were significantly correlated with number of daily medicines (-0.17, $P<0.05$; -0.17, $P<0.05$), number of months on medicines (-0.19, $P<0.05$; -0.19, $P<0.05$), and number of months since diagnosis (-0.19, $P<0.05$; -0.18, $P<0.05$).

For child self-report (Table 4), the intercorrelations between impaired generic HRQOL and more severe ADHD symptoms as measured by the NICHQ Vanderbilt

Total ADHD Symptom Score were not statistically significant. The only child self-report intercorrelation that was significant between the PedsQL™ and Vanderbilt Total ADHD Symptom Score was evidenced on the School Functioning Scale (-0.16, P<0.05). The PedsQL™ School Functioning Scale was also significantly correlated with number of diagnoses (-0.27, P<0.001), number of months on medicines (-0.21, P<0.01), and number of months since diagnosis (-0.20, P<0.01). The PedsQL™ Psychosocial Health Summary Score was significantly correlated with number of diagnoses (-0.18, P<0.05). All of the child self-report intercorrelations were in the small effect size range (<0.30).

Hierarchical Multiple Regression Modeling: PedsQL™ 4.0 Generic

Table 6 shows the results of the hierarchical linear regression analyses. Overall generic HRQOL was the primary outcome (PedsQL™ Generic Core Total Score for child self-report and parent proxy-report). Standardized betas for the full models (both significant and nonsignificant) are presented in Table 6. The parent proxy-report regression model was significant at P<0.001. The child self-report regression model was not statistically significant. Age was associated with HRQOL for child self-report in that older children had better overall HRQOL than younger children. Socioeconomic status was associated with HRQOL for parent proxy-report in that children from higher SES families had better overall HRQOL. Number of diagnoses was also associated with HRQOL for parent proxy-report in that children with fewer diagnoses had better overall HRQOL.

Over and above the association between demographic variables, disease-specific indicators, and HRQOL, ADHD symptomatology independently contributed to the

variance in both child self-report and parent proxy-report regression models. For both models, inattentive symptoms were significantly associated with overall HRQOL. Hyperactive/impulsive symptoms were not significantly associated with overall HRQOL in either model.

Intercorrelations with the PedsQL™ Family Impact Module

Table 7 presents intercorrelations among the PedsQL™ Family Impact Module and the NICHQ Vanderbilt Total ADHD Symptom Score, as well as disease-specific indicators including number of months since diagnosis, number of diagnoses, number of daily medications, and number of months on medications. Greater negative family impact was significantly correlated with more severe ADHD symptoms as measured by the NICHQ Vanderbilt Total ADHD Symptom Score (Table 7). All PedsQL™ Family Impact Module Scales were significantly correlated with the Vanderbilt Total ADHD Symptom Score, with the largest intercorrelations demonstrated on the Total Impact Score (-0.50, P<0.0001), Family Summary (-0.51, P<0.0001) and Worry Scale (-0.51, P<0.0001). All Pearson's Product Moment Correlations between the PedsQL™ Family Impact Module and Vanderbilt Total ADHD Symptom Score were in the large effect size range, with the exception of Cognitive Functioning (-0.28, P<0.0001) which was in the medium effect size range. Number of diagnoses was significantly correlated with the PedsQL™ Family Impact Module Parent HRQOL Summary (-0.18, P<0.05), Physical Functioning (-0.18, P<0.05), Emotional Functioning (-0.16, P<0.05), Social Functioning (-0.17, P<0.05), Communication (-0.16, P<0.05), and Family Summary (-0.18, P<0.05). Number of daily medications was significantly correlated with the PedsQL™ Family

Impact Total Scale Score (-0.16, P<0.05), Parent HRQOL Summary (-0.18, P<0.05), Physical Functioning (-0.18, P<0.05), Cognitive Functioning (-0.15, P<0.05), Worry (-0.15, P<0.05), Family Summary (-0.18, P<0.05), and Daily Activities (-0.19, P<0.05).

Tables 8 and 9 present intercorrelations among the PedsQL™ Family Impact Module and PedsQL™ 4.0 Generic Core Scales. More impaired generic HRQOL was significantly correlated with more severe family impact for parent proxy-report (Table 9). The largest intercorrelations for parent proxy-report were demonstrated between the PedsQL™ Family Impact Module Scales and the PedsQL™ Generic Core Psychosocial Health Summary Score, with all effect sizes in the medium to large range.

The majority of intercorrelations between the PedsQL™ Family Impact Module and child self-reported PedsQL™ 4.0 Generic Core Scales were not significant (Table 8). The PedsQL™ Generic Core Total Scale Score was significantly correlated with parent social functioning (0.16, P<0.05); the School Functioning Scale on the PedsQL™ Generic Core was significantly correlated with the Family Impact Module Family Summary (0.16, P<0.05) and Family Activities Scale (0.17, P<0.05). All effect sizes were in the small range.

Hierarchical Multiple Regression Modeling: PedsQL™ Family Impact

Table 10 presents the results of the hierarchical linear regression analysis. The PedsQL™ Family Impact Module Total Scale Score was the primary outcome. Standardized betas for the full model (both significant and nonsignificant) are presented in Table 10. The regression model was significant at P<0.001. ADHD symptom severity was associated with family impact in that families of children with greater

ADHD symptom severity had greater negative family impact. Over and above the association between demographic variables, disease-specific indicators/symptom severity, and family impact, child social functioning independently contributed to the variance in the regression model. Child emotional and school functioning were not significantly associated with the PedsQL™ Family Impact Module Total Score in the model.

Parent/Child Agreement

Intraclass Correlations (ICC) between pediatric patient self-report and parent proxy-report across the PedsQL™ 4.0 Generic Core Scales are as follows: Total Score = 0.24 ($P<0.0001$), Physical Health = 0.13 ($P<0.05$), Psychosocial Health = 0.30 ($P<0.0001$), Emotional Functioning = 0.19 ($P<0.001$), Social Functioning = 0.29 ($P<0.0001$), School Functioning = 0.35 ($P<0.0001$). These ICCs are in the poor to fair agreement range. The greatest agreement was found between children and parents on School Functioning while the lowest agreement was demonstrated between children and their parents on Physical Health.

Mean scores for the 177 parents and children who both completed the PedsQL™ 4.0 Generic Core Scales are presented in Table 11. Across all PedsQL™ Scales, children self-reported significantly higher HRQOL than their parents, with the greatest differences evidenced on School Functioning (effect size = 0.61) and Psychosocial Health (effect size = 0.57).

DISCUSSION AND CONCLUSIONS

The aim of the current study was to assess HRQOL from the perspective of pediatric patient self-report and parent proxy-report and family impact from the perspective of parents in children with ADHD ages 5 to 18 years being seen at a Pediatric Psychiatric Clinic. Consistent with previous PedsQL™ findings utilizing child self-report and parent proxy-report in a population-based study (Varni & Burwinkle, 2006) of children with ADHD and findings utilizing other HRQOL proxy-report measures in this population (A. F. Klassen et al., 2004; Matza et al., 2004), children with ADHD in our sample demonstrated significantly lower HRQOL than a matched sample of healthy children for both child self-report and parent proxy-report, with the greatest differences demonstrated on psychosocial functioning. All effect sizes were in the large range.

While we found large effect sizes between pediatric patients with ADHD and healthy children on physical functioning, previous studies have reported small effect sizes between children with ADHD and healthy children on this domain (A. F. Klassen et al., 2004; Varni & Burwinkle, 2006). This finding may in part be attributed to differences in symptom severity between our sample and the samples in Varni & Burwinkle (2006) and Klassen et al. (2004). Our sample consisted of children with ADHD and a high incidence of co-morbid psychiatric conditions being treated at a Psychiatric Clinic (98.4% of children were taking at least one daily medication to treat ADHD symptoms). Children with ADHD in Varni & Burwinkle were from a population-based sample (co-morbid diagnoses and medication use were unknown).

Children from Klassen et al. were from an ADHD Clinic; however, according to the authors, one-third of the sample was newly identified by family doctors and not necessarily complex (only 27.5% of children in the sample were on ADHD medications). There is literature that has shown after adjusting for measures of global disadvantage (i.e., poverty, caretaker's education, parental marital status, number of diagnoses other than ADHD) the correlation between ADHD and physical health problems was significant for children with ADHD seen in treatment facilities (Bauermeister et al., 2007). This may in part be attributed to the fact that children with ADHD seen in treatment facilities are often treated with stimulant medications which can have side effects that impact physical functioning (i.e., loss of appetite, headaches, stomachaches). Furthermore, children with ADHD seen in treatment facilities are more likely to have co-morbid psychiatric conditions such as depression and anxiety that have known physical effects including fatigue and pain (Walford, Nelson, & McCluskey, 1993). Thus, our finding that children with ADHD and healthy children evidenced large effect sizes on physical functioning from the perspective of both children and parents may in part be a function of the more severe nature of our sample.

Consistent with our hypothesis, more impaired generic HRQOL was significantly correlated with more severe ADHD symptomatology for parent proxy-report based on Pearson Correlation analyses. All parent proxy-reported PedsQL™ 4.0 Generic Scales were significantly correlated with the Vanderbilt Total ADHD Symptom Score, with the largest intercorrelations demonstrated on Psychosocial Health and School Functioning. Pearson's Product Moment Correlations between the PedsQL™ 4.0 Generic Core Scales

and Vanderbilt Total ADHD Symptom Score were all in the medium to large effect size range for parent proxy-report. Number of diagnoses was also significantly correlated with all parent proxy-reported PedsQL™ 4.0 Generic Core Scales, with the largest intercorrelation evidenced on Psychosocial Health. These findings suggest that from the perspective of parents, the severity of the child's ADHD symptoms and the number of diagnoses significantly impact the child's overall HRQOL, particularly with regard to psychosocial functioning.

Our hypothesis that more impaired generic HRQOL would be significantly correlated with more severe ADHD symptomatology was not supported for child self-report based on Pearson Correlation analyses. Significant intercorrelations between child self-reported PedsQL™ 4.0 Scales and the NICHQ Vanderbilt Total ADHD Symptom Score were found only on the PedsQL™ School Functioning Scale. For child self-report, the PedsQL™ School Functioning Scale was also significantly correlated with number of diagnoses, number of months on medicines, and number of months since diagnosis. These findings indicate that the severity of a child's ADHD symptoms (as reported by parents), number of diagnoses, number of months on medicines, and number of months since diagnosis are significantly associated with the child's perception of his/her school functioning. The finding that only one child self-reported PedsQL™ Scale (School Functioning) was significantly correlated with the Vanderbilt Total ADHD Symptom Score (compared to all parent proxy-reported PedsQL™ Scales) may in part be a function of the shared method of variance. That is, parents completed both the Vanderbilt Rating Scale and PedsQL™ 4.0 Generic Core parent proxy version. The

differences in the current study between children and parents' perceptions of the child's HRQOL suggest that children and parents may also have differences in their perceptions of the child's ADHD symptomatology. Thus, the small effect sizes and lack of significant intercorrelations between child self-reported PedsQL™ Generic Core Scales and the Vanderbilt Total ADHD Symptom Score may in part be a function of differences in child and parent perceptions of the child's ADHD symptom severity.

Results of the hierarchical linear regression analyses indicated that over and above the association between demographic variables, disease-specific indicators, and HRQOL, inattentive symptoms were significantly associated with overall HRQOL for both child self-report and parent proxy-report. Hyperactive/impulsive symptoms were not significantly associated with overall HRQOL in either model. It has been suggested that inattentive symptoms related to ADHD may contribute to poor self-observation and consequently impact one's perception of their HRQOL (Lenard et al., 2006). However, our findings held true for both child self-report and parent proxy-report. In fact, there was a stronger association between inattentive symptoms and overall HRQOL for parent proxy-report. Nonetheless, our findings suggest that in children with ADHD and co-morbid psychiatric conditions, inattentive symptoms may be a strong marker of impairment in daily functioning.

Consistent with our hypothesis, more severe ADHD symptomatology (as measured by the NICHQ Vanderbilt Total ADHD Symptom Score) was significantly associated with greater negative family impact based on Pearson Correlation analyses. All PedsQL™ Family Impact Module Scales were significantly correlated with the

Vanderbilt Total ADHD Symptom Score, with the largest intercorrelations demonstrated on the Total Impact Score, Family Summary, and Worry Scale. All Pearson's Product Moment Correlations were in the large effect size range, with the exception of Cognitive Functioning. These findings suggest that greater ADHD symptoms are significantly associated with greater parental worry, greater disruptions in family relationships, and greater disruption of daily family activities. Number of diagnoses was also significantly correlated with the physical, emotional, and social functioning of parents and family communication. Number of daily medications was significantly correlated with the physical and cognitive functioning of parents, parental worry, and daily family activities; more medications taken by the child was associated with more negative impact. This finding is consistent with previous literature that suggests demands related to the delivery and management of the child's ADHD medication can negatively impact family functioning (Riley, Lyman et al., 2006; Whalen et al., 2006).

Consistent with our hypothesis, more impaired generic HRQOL was significantly correlated with more negative family impact for parent proxy-report based on Pearson Correlation analyses. The largest intercorrelations for parent proxy-report were demonstrated between the PedsQL™ Family Impact Module Scales and the PedsQL™ Generic Core Psychosocial Health Summary Score, with all effect sizes in the medium to large range. These findings indicate that from the perspective of parents, impairments in the child's psychosocial functioning are significantly associated with more negative family impact. Our hypothesis was not supported for child self-report in that the majority of Pearson Correlations between the PedsQL™ Family Impact Module and

child self-reported PedsQL™ 4.0 Generic Core Scales were not significant (all effect sizes were in the small range). Differences in the magnitude of intercorrelations between the PedsQL™ Family Impact Module and PedsQL™ Generic Core Scales across child self-report and parent proxy-report may be a function of the shared method of variance. Children and parents may have different perceptions of family impact. The current study only assessed family impact from the perspective of parents.

Results of the hierarchical linear regression analyses indicated over and above the association between demographic variables, disease-specific indicators/symptom severity, and family impact, child social functioning was significantly associated with the PedsQL™ Family Impact Module Total Score. Child emotional and school functioning were not significantly associated with the PedsQL™ Family Impact Module Total Score in the model. ADHD symptom severity was associated with family impact in that families of children with greater ADHD symptom severity had greater negative family impact. The regression model was significant at $P<0.001$.

While we hypothesized that children and their parents would demonstrate moderate to good agreement regarding the child's HRQOL as evidenced by Intraclass Correlations between 0.41 to 0.80, this hypothesis was not supported. In the present study, Intraclass Correlations between pediatric patient self-report and parent proxy-report across the PedsQL™ 4.0 Generic Core Scales ranged from 0.13 to 0.35, corresponding to the poor to fair agreement range. Greatest agreement was found between children and parents on school functioning while the lowest agreement was demonstrated between children and parents on physical health. Consistent with our

hypothesis, across all PedsQL™ Generic Core Scales parents reported significantly lower HRQOL for their children when compared to children. Taken as a whole, these findings are consistent with both the adult and pediatric literature, suggesting information provided by proxy-respondents is not equivalent to that reported by the patient (Achenbach, McConaughy, & Howell, 1987; Sprangers & Aaronson, 1992). Imperfect agreement between self-report and proxy-report has been consistently documented in the HRQOL measurement of children with and without chronic illness (Eiser & Morse, 2001a; Upton et al., 2008), particularly for less observable or internal symptoms such as HRQOL.

Results of our hierarchical linear regression analyses indicated age was significantly associated with HRQOL for child self-report in that older children had better overall HRQOL than younger children. When examining mean PedsQL™ 4.0 Generic Core Scale Scores across age forms (5-7, 8-12, 13-18), we found statistically significant differences for both child self-report and parent proxy-report. Adolescents (ages 13-18 years) self-reported significantly better physical health than young children (ages 5-7) and children (ages 8-12 years). Young children self-reported significantly better school functioning than children and adolescents. For parent proxy-report, parents of young children (ages 5-7) reported significantly better PedsQL™ Total Scale, Psychosocial Health, Social Functioning, and School Functioning mean scores for their children compared to parents of children (ages 8-12). These differences across age groups may in part be a function of variations in how ADHD symptoms are manifested across childhood. For example, there is literature that suggests inattentive symptoms are

more common among adolescents while hyperactive/impulsive symptoms are more common among preschool children (Nolan, Gadow, & Sprafkin, 2001). In addition, the present findings may also reflect differences in demands placed on children of varying ages. For example, in the present study parents of young children (ages 5-7) reported better psychosocial health, social functioning, and school functioning mean scores for their children compared to parents of older children (ages 8-12). This finding may in part be a function of 8-12 year olds having increasing demands placed on them at home and school which may have a negative impact on their daily functioning.

Limitations

The present study has a number of potential limitations. Despite the significant differences we found across age forms on the PedsQL™ 4.0 Generic Core Scales, data were pooled across age forms for the larger analyses given that sample sizes for each age form were not large enough to conduct separate analyses. Furthermore, there was variability within our sample with regard to disease-specific indicators such as time since diagnosis and time on medications. While the heterogeneity of the sample may reduce internal validity, these differences also may increase the generalizability of the findings. There was no standardized protocol for diagnosing a child with ADHD or co-morbid psychiatric conditions in the present study. However, ADHD and co-morbid psychiatric diagnoses were made by a child psychiatrist prior to the child being enrolled in the study based on signs and symptoms presented and history, including in some cases diagnostic scales completed by parents and teachers. We did not have information on the exact co-morbid psychiatric conditions children in our sample had, but rather the

diagnostic category. Information on nonparticipants was not available and for the hierarchical linear regression analyses, we had to exclude some participants based on missing data which may limit the generalizability of the findings. Our sample was predominantly white males, which may further limit the generalizability of the findings. However, it should be noted that our sample was representative of the underlying population of children with ADHD in the United States which is more likely to be white males (Bimstein et al., 2008). This was a cross-sectional study, thus, it provided only a snapshot of HRQOL and family impact at one time point. Finally, ADHD symptom severity and family impact were measured only from the perspective of parents in the present study.

Implications for Future Research and Clinical Practice

These findings have several implications for future research and clinical practice with pediatric patients with ADHD and co-morbid psychiatric conditions and their families. First, given the large effect sizes reported between our sample and healthy children on physical functioning, it is important that interventions designed for children with ADHD and co-morbid psychiatric conditions not only address psychosocial difficulties, but also the physical impairments that may result from medications and/or co-morbid psychiatric diagnoses such as anxiety or depression. A post-hoc analyses of responses to individual items on the PedsQL™ Physical Functioning Scale in the current sample revealed that 11.7% of the children self-reported "often" or "almost always" having low energy, while 14.5% of the children self-reported "often" or "almost always" having hurts or aches; 19.9% of parents reported their child "often" or "almost always"

had low energy, while 26.5% of parents reported their child "often" or "almost always" had hurts or aches. These findings suggest that the constructs of fatigue and pain may be important to address in future interventions with this population. It will be beneficial for future research to elucidate the relationship between fatigue, pain, and HRQOL so that more efficacious interventions can be developed. Given the growing body of literature that suggests children with ADHD experience chronic sleep difficulties (Lim et al., 2008), future research should also investigate the relationship between sleep deficits and physical functioning in children with ADHD and co-morbid psychiatric conditions.

Given our finding that greater ADHD symptomatology was significantly associated with greater negative family impact, interventions for this population should also focus on mitigating the negative impact of ADHD and co-morbid psychiatric conditions on families. Our Pearson Correlation analyses suggest that parental worry (i.e., worrying about whether or not my child's medical treatments are working, worrying about the side effects of my child's medications/medical treatments, worrying about how others will react to my child's condition, worrying about how my child's illness is affecting other family members, worrying about my child's future), family relationships (i.e., lack of communication between family members, conflicts between family members, difficulty making decisions together as a family, difficulty solving family problems together, stress or tension between family members), and daily family activities (i.e., family activities taking more time and effort, difficulty finding time to finish household tasks, feeling too tired to finish household tasks) may be key areas to address in an intervention. Our hierarchical regression analysis suggested that from the

perspective of parents, child social functioning may have the strongest association with family impact. As such, it does not seem sufficient for interventions to only address social functioning with the child. Teaching parents strategies for coping with their child's social impairments will be important. Given that number of daily medications was significantly correlated with the physical and cognitive functioning of parents, parental worry, and daily family activities, interventions should also focus on teaching parents strategies for coping with the demands related to the delivery and management of their child's ADHD medication regimen.

Our Pearson Correlation finding that the PedsQL™ School Functioning Scale was the only significantly correlated PedsQL™ Scale with the Vanderbilt Total ADHD Symptom Score for child self-report (compared to all parent proxy-reported PedsQL™ Scales) suggests that from the perspective of children with ADHD and co-morbid psychiatric conditions, school functioning is a particularly salient domain. This finding also indicates that future research should assess ADHD symptom severity not only from the perspective of parents, but also from the perspective of children, as these different perspectives may provide unique information. Assessing ADHD symptomatology from the perspective of other informants such as teachers and healthcare providers may provide valuable information as well. Given the small magnitude of the intercorrelations between the PedsQL™ Family Impact Module and child self-reported PedsQL™ 4.0 Generic Core Scales, future research should establish the reliability and validity of measures of family impact that evaluate the perspectives of older children and adolescents in order that their perspectives be included in future clinical trials.

Our findings demonstrate the importance of including HRQOL as a multidimensional outcome in future clinical trials (Wigal et al., 2005; Sallee, Ambrosini, Lopez, Shi, & Michaels, 2004). The data suggest that improvements in a child's ADHD symptomatology should be associated with improvements in the child's overall HRQOL. While previous Pearson Correlation studies indicate inattentive symptoms are more strongly associated with impairments in HRQOL and daily functioning than hyperactive/impulsive symptoms in children with ADHD (Gordon et al., 2006; A. F. Klassen et al., 2004), to the best of our knowledge this is the first study to use hierarchical linear regression analyses to assess the associations between HRQOL, inattentive symptoms, and hyperactive/impulsive symptoms over and above the associations between demographic variables, disease-specific indicators, and HRQOL. While the focus of these analyses was on ADHD symptomatology, future studies should use hierarchical linear regression analyses to assess the associations between HRQOL and symptoms related to co-morbid psychiatric conditions such as anxiety, depression and conduct problems.

The finding that children and their parents demonstrated poor to fair agreement regarding the child's HRQOL underscores the importance of evaluating both children's and parents' perspectives regarding HRQOL in routine assessment in clinical practice and clinical trials for children with ADHD and co-morbid psychiatric conditions since their different perspectives potentially provide unique information. Discrepancies between child and parent reports of the child's HRQOL can be used clinically to facilitate communication between parents and children. For example, if a child reports

that “almost always” other kids tease him/her and his mother reports that the child “never” gets teased by other children, this would be an opportunity for the child’s healthcare provider to intervene and discuss these differences in perspective with the child and parent. A number of studies with children with chronic health conditions have reported greater agreement between parents and children on physical functioning since this is a more observable construct (Eiser & Morse, 2001b). The finding that agreement was lowest between parents and children on physical functioning in our sample further demonstrates the need for future research to investigate the construct of physical functioning in children with ADHD and co-morbid psychiatric conditions. Future studies should evaluate factors that influence parent-child agreement in this population. For example, one recent study with children with ADHD utilizing the Child Health Questionnaire found that parent-child agreement was related to the presence of co-morbid oppositional/defiant disorder, a psychosocial stressor, and increased ADHD symptomatology (A. Klassen, Miller, & Fine, 2006). Other variables that may be important to evaluate in future research include SES, child age, and treatment setting.

The age differences reported in this study on the PedsQL™ 4.0 Generic Core Scales, and the literature that indicates ADHD symptoms may be manifested differently across childhood (Nolan et al., 2001), have implications for how interventions are designed for children with ADHD and co-morbid psychiatric conditions. For example, our study suggests that from the perspective of children, impairments in physical functioning may be especially important to address in young children (ages 5-7) and children (ages 8-12 years); difficulties related to school may be more important to

address in older children and adolescents than young children. From the perspective of parents, issues related to social and school functioning may be important to address in older children. Future studies should evaluate HRQOL across individual age groups with sufficient sample sizes in order to determine the impact of age on ADHD symptomatology and HRQOL. Given that our study was cross-sectional, and provided a snapshot of HRQOL and family impact at one time point, longitudinal studies of HRQOL and family impact should be conducted with this population.

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APPENDIX

TABLES

Table 1. Studies Assessing Health-Related Quality of Life in Children with Attention-Deficit/ Hyperactivity Disorder

Study	Sample	HRQOL Outcome	Key Findings
Varni & Burwinkle (2006)	72 children identified by their parents as having ADHD ages 5-16 years	PedsQL™ 4.0 Generic Core Scales Child Self-Report and Parent Proxy-Report	PedsQL™ evidenced minimal missing responses for child self-report (0.0%) and parent proxy-report (4.9%), demonstrated excellent reliability for the Total Scale Score for child self-report (alpha=0.92) and parent proxy-report (alpha=0.92), and discriminated between children with ADHD and a matched sample of healthy children with the greatest differences evidenced in psychosocial functioning

Table 1 continued

Study	Sample	HRQOL Outcome	Key Findings
Matza et al. (2004)	297 children who met DSM-IV criteria for ADHD by clinical assessment and structured interview ages 8-17 years	Child Health Questionnaire (CHQ) Parent Form	The CHQ Parent scores on psychosocial scales lower than physical scales, CHQ psychosocial scales significantly negatively correlated with measures of ADHD symptom severity but in general CHQ physical scales were not, significant differences between the 3 symptom severity groups were demonstrated on CHQ, and improvements in ADHD symptoms over time were associated with improvements in CHQ psychosocial scales

Table 1 continued

Study	Sample	HRQOL Outcome	Key Findings
Sallee et al. (2004)	2,968 children who met DSM-IV criteria for a primary diagnosis of ADHD ages 6-12 years	PedsQL™ 4.0 Generic Core Scales Parent Proxy-Report	In this prospective,open-label study, baseline immediate-release stimulants (Adderall or Concerta) were converted to approximately equivalent once-daily dose (extended release) Adderall; Mean PedsQL™ Total Score at baseline was 74.5 compared to 81.0 after 7 weeks of treatment ($p<.0001$)
Bastiaens (2008)	84 children ages 5-18 years diagnosed with ADHD	Health and Life Functioning Scale Parent Proxy-Report	In this prospective, nonrandomized comparison between children with ADHD treated with atomexetine or stimulants, no significant differences in improvements in quality of life were reported between the 2 groups after 8 months of treatment

Table 1 continued

Study	Sample	HRQOL Outcome	Key Findings
Riley et al. (2006)	1,477 children diagnosed with ADHD ages 6-18 years	Child Health and Illness Profile (CHIP) Parent Proxy-Report	Cronbach's alphas were all above 0.70 for the CHIP scales, no ceiling or floor effects were reported, moderate to high correlations were observed between the CHIP and ADHD symptoms and family factors, scores on the CHIP for children with ADHD were 2 standard deviations below community norms
Sawyer et al. (2002)	308 children ages 6-17 years identified as having ADHD through the parent version of the DISC-IV	Child Health Questionnaire (CHQ) Parent Form	Children with ADHD were compared to a sample of children with Major Depressive Disorder and a sample of children with Conduct Disorder; children with ADHD had significantly more behavioral problems and significantly fewer emotional problems than children with Major Depressive Disorder.

Table 1 continued

Study	Sample	HRQOL Outcome	Key Findings
Perwien et al. (2004)	877 children who met DSM-IV criteria for ADHD ages 6-17 years	Child Health Questionnaire (CHQ) Parent Form	Children who received atomoxetine had significantly greater improvement in psychosocial functioning compared to placebo group; no significant differences were found between once-a-day and twice-a-day dosing; treatment with atomoxetine, lower HRQOL baseline scores, no history of stimulant use, and absence of oppositional defiant disorder were associated with improvements in psychosocial functioning

Table 1 continued

Study	Sample	HRQOL Outcome	Key Findings
Sung et al. 2008	239 children diagnosed by a clinician with ADHD ages 5-18 years	PedsQL™ 4.0 Generic Core Scales Parent Proxy-Report	Children with mild and moderate or severe sleep problems had significantly lower PedsQL™ Total and Psychosocial scores than those without sleep problems; severity of ADHD symptoms was strongly associated with both moderate and or severe sleep problems and the Physical Functioning scale on the PedsQL™
Klassen et al. (2004)	131 children with a physician diagnosis of ADHD ages 6-17 years	Child Health Questionnaire (CHQ) Parent Form	Children with ADHD had comparable physical health to the population norms but clinically important deficits in HRQOL in all psychosocial domains; poorer HRQOL for all domains of psychosocial health correlated significantly with more parent-reported inattentive, hyperactive, and combined symptoms of ADHD

Table 1 continued

Study	Sample	HRQOL Outcome	Key Findings
Yang et al. (2007)	119 children who met DSM-IV criteria for ADHD currently receiving methylphenidate treatment ages 6-15 years	Child Health Questionnaire (CHQ) Parent Form	HRQOL of children with ADHD was reported to be significantly worse than the healthy control group on all CHQ psychosocial scales; the Psychosocial Summary Score increased with improvement of clinical symptoms after methylphenidate treatment
Svanborg et al. (In press)	99 patients diagnosed with ADHD receiving either atomoxetine (n = 49) or placebo (n = 50)	Child Health and Illness Profile-Child Edition (CHIP-CE)	A statistically significant difference in favor of atomoxetine was seen in the improvement from baseline to study endpoint for the CHIP-CE domains ‘‘Achievement’’ and ‘‘Risk Avoidance.’’

Table 1 continued

Study	Sample	HRQOL Outcome	Key Findings
Wigal et al., 2005	215 subjects ages 6 to 12 years with ADHD were enrolled in the study; 107 subjects were randomized to receive MAS XR and 108 subjects were randomized to receive atomoxetine	PedsQL™ 4.0 Generic Core Scales Parent Proxy-Report	The mean PedsQL total score increases of 7.1 unit points in the MAS XR group and 7.9 unit points in the atomoxetine group represent statistically significant improvements compared with baseline scores, but the difference between medication effects was not statistically significant. The PedsQL school functioning score was the only subscale score for which a statistically significant treatment effect was observed. The 34% improvement in the PedsQL school functioning subscale in the MAS XR group was larger than the 25% improvement in the atomoxetine group

Table 2. PedsQL™ 4.0 Generic Core Scales Scores across Age Forms

	Age Form								
Scale	Young Child (5-7 years) [a]			Child (8-12 years) [b]			Teen (13-18 years) [c]		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Child Self-Report									
Total Score	46	66.17	17.36	73	64.88	15.57	60	70.2	14.5
Physical Health	46	71.74	17.86	73	73.80	18.71	60	83.7	13.6
Psychosocial Health	46	63.19	20.18	73	60.10	16.59	60	63.0 8	16.7 0
Emotional Functioning	46	58.26	27.97	73	57.95	21.10	60	61.3 3	22.5 1
Social Functioning	46	63.04	28.27	73	64.57	24.19	60	72.1	22.2
School Functioning	46	69.33	22.30	73	57.71	19.65	60	55.7	18.2
Parent Proxy-									
Total Score	46	63.07	16.29	75	55.03	17.48	60	58.9	19.3
Physical Health	46	74.85	23.03	75	69.17	25.26	60	69.6	24.4
Psychosocial Health	46	56.72	17.00	75	47.50	16.47	60	53.2	19.2
Emotional Functioning	46	49.46	21.17	75	44.85	18.31	60	51.9 2	21.8 3
Social Functioning	46	66.74	19.67	75	54.93	21.77	60	57.7	25.5
School Functioning	46	54.00	19.73	75	42.73	19.00	60	50.0	18.2

Note: Higher values equal better health-related quality of life.
Comparisons based on Tukey HSD Post-hoc analysis (ANOVA).
Child Self-Report Physical Health c>a,b, $p<.05$; Child Self-Report School Functioning a>b,c, $p<.05$.
Parent Proxy-Report Total Score, Psychosocial Health, Social Functioning, and School Functioning, a>b, $p<.05$.

Table 3. PedsQL™ 4.0 Generic Core Scales for Child Self-Report and Parent Proxy-Report across Samples and Reliability for ADHD Sample

	ADHD			Healthy		Differences	Effect Size
Scale	α	Mean	SD	Mean	SD		
Child Self-Report	***(n = 179)***			***(n =876)***			
Total Score	0.85	67.00	15.80	85.86	11.76	18.86***	1.50
Physical Health	0.71	76.59	17.60	90.09	11.58	13.50***	1.05
Psychosocial Health	0.81	61.89	17.57	83.62	13.47	21.73***	1.53
Emotional Functioning	0.72	59.16	23.41	81.99	17.16	22.83***	1.24
Social Functioning	0.75	66.73	24.86	87.25	15.63	20.52***	1.17
School Functioning	0.65	59.99	20.55	81.66	15.92	21.67***	1.29
Parent Proxy-Report	***(n = 181)***			***(n =1443)***			
Total Score	0.92	58.38	18.04	86.04	12.72	27.66***	2.06
Physical Health	0.89	70.77	24.44	89.33	15.20	18.56***	1.13
Psychosocial Health	0.90	51.76	17.87	84.19	13.45	32.43***	2.31
Emotional Functioning	0.79	48.36	20.39	82.39	15.88	34.03***	2.07
Social Functioning	0.85	58.87	22.96	88.01	15.58	29.14***	1.76
School Functioning	0.78	48.00	19.40	81.41	17.61	33.41***	1.88

Note: ***p<.001 based on independent samples *t* tests.
α = Cronbach internal consistency reliability coefficient alpha.
SD = standard deviation.
Effect sizes are designated as small (.20), medium (.50), and large (.80).

Table 4. Intercorrelations among PedsQL™ 4.0 Generic Core Scales and Disease-Specific Indicators of ADHD for Child Self-Report

	Child Self-Report						
PedsQL™ Scales	Vanderbilt ADHD Symptom Score	Vanderbilt Inattentive Scale	Vanderbilt Hyperactive-Impulsive Scale	Number of Diagnoses	Number of Daily Medicines	Number of Months on Medicines	Number of Months since Diagnosis
Total Score	-0.12	-0.16*	-0.09	-0.12	-0.02	-0.05	-0.05
Physical Health	-0.04	-0.06	-0.01	0.03	0.05	0.07	0.08
Psychosocial	-0.15	-0.19*	-0.13	-0.18*	-0.06	-0.11	-0.10
Emotional	-0.04	-0.07	-0.04	-0.07	-0.03	-0.06	-0.07
Social	-0.13	-0.09	-0.16*	-0.12	-0.03	-0.02	0.00
School	-0.16*	-0.29***	-0.07	-0.27***	-0.08	-0.21**	-0.20**

Note: *p<.05, **p<.01, ***p<.001.
Effect sizes are designated as small (0.10), medium (0.30), and large (0.50) for Pearson's product moment correlations.

Table 5. Intercorrelations among PedsQL™ 4.0 Generic Core Scales and Disease-Specific Indicators of ADHD for Parent Proxy-Report

	Parent Proxy-Report						
PedsQL™ Scales	Vanderbilt ADHD Symptom Score	Vanderbilt Inattentive Scale	Vanderbilt Hyperactive-Impulsive Scale	Number of Diagnoses	Number of Daily Medicines	Number of Months on Medicines	Number of Months since Diagnosis
Total Score	-0.51***	-0.55***	-0.37***	-0.31***	-0.09	-0.19*	-0.19*
Physical	-0.33***	-0.37***	-0.24**	-0.21**	0.04	-0.13	-0.14
Psychosocial	-0.56***	-0.59***	-0.40***	-0.33***	-0.17*	-0.19*	-0.19*
Emotional	-0.48***	-0.47***	-0.39***	-0.27***	-0.20**	-0.10	-0.12
Social	-0.44***	-0.45***	-0.34***	-0.29***	-0.06	-0.20**	-0.19*
School	-0.52***	-0.61***	-0.31***	-0.28***	-0.17*	-0.19*	-0.18*

Note: *p<.05, **p<.01, ***p<.001.
Effect sizes are designated as small (0.10), medium (0.30), and large (0.50) for Pearson's product moment correlations.

Table 6. Hierarchical Linear Regression Models for Factors Associated with HRQOL

Variables	PedsQL™ Core Total Scale Score Child Self-Report	PedsQL™ Core Total Scale Score Parent Proxy-
Block 1 (demographic variables)		
R^2	0.03	0.04
Gender	-0.04	-0.08
Race/Ethnicity	0.04	0.04
Socioeconomic Status	0.00	0.14*
Age	0.24*	-0.02
Block 2 (disease-specific indicators)		
R^2 change	0.05	0.17***
Number of daily ADHD	0.09	0.04
Months on daily ADHD	-0.29	0.15
Months since ADHD Diagnosis	0.08	-0.30
Presence of Co-Morbid Diagnosis	0.15	0.12
Number of Diagnoses	-0.08	-0.24*
Block 3 (ADHD Symptomatology)		
R^2 change	0.05*	0.20***
Inattentive Symptoms	-0.27**	-0.45***
Hyperactive/Impulsive Symptoms	0.09	-0.08
Cumulative R^2	0.13	0.41***

Note: Betas presented are standardized betas for the full model.
Both significant and non significant betas are presented.
*p<.05, **p<.01, ***p<.001.

Table 7. Intercorrelations among PedsQL™ Family Impact Module and Disease-Specific Indicators of ADHD

PedsQL™ Family Impact Module	Vanderbilt ADHD Symptom Score	Vanderbilt Inattentive Scale	Vanderbilt Hyperactive-Impulsive Scale	Number of Diagnoses	Number of Daily Medicines	Number of Months on Medicines	Number of Months since Diagnosis
Total Impact Score	-0.50***	-0.46***	-0.43***	-0.13	-0.16*	-0.10	-0.07
Parent HRQOL Summary	-0.43***	-0.36***	-0.38***	-0.18*	-0.18*	0.01	0.03
Physical Functioning	-0.37***	-0.30***	-0.33***	-0.18*	-0.18*	0.07	0.06
Emotional Functioning	-0.46***	-0.42***	-0.38***	-0.16*	-0.14	0.00	0.02
Social Functioning	-0.34***	-0.33***	-0.27***	-0.17*	-0.14	-0.02	0.01
Cognitive Functioning	-0.28***	-0.18*	-0.30***	-0.09	-0.15*	-0.02	-0.01
Communication	-0.34***	-0.34***	-0.27***	-0.16*	-0.09	0.01	0.02
Worry	-0.51***	-0.45***	-0.45***	-0.07	-0.15*	0.05	-0.05
Family Summary	-0.51***	-0.49***	-0.39***	-0.18*	-0.18*	-0.02	0.00
Daily Activities	-0.48***	-0.46***	-0.38***	-0.13	-0.19*	-0.04	-0.01
Family Relationships	-0.44***	-0.44***	-0.34***	-0.11	-0.11	-0.12	-0.10

Note: *p<.05, **p<.01, ***p<.001.
Effect sizes are designated as small (0.10), medium (0.30), and large (0.50) for Pearson's product moment correlations.

Table 8. Intercorrelations among PedsQL™ 4.0 Generic Core Scales and PedsQL™ Family Impact Module for Child Self-Report

	Child Self-Report					
PedsQL™ Family Impact Module	Generic Core Total Score	Physical Health	Psychosocial Health	Emotional Functioning	Social Functioning	School Functioning
Total Impact Score	0.10	0.09	0.09	0.02	0.07	0.11
Parent HRQOL Summary	0.07	0.07	0.06	0.03	0.03	0.10
Physical Functioning	0.05	0.04	0.04	0.03	0.00	0.08
Emotional Functioning	0.07	0.08	0.05	0.00	0.05	0.09
Social Functioning	0.16*	0.14	0.15	0.08	0.15	0.12
Cognitive Functioning	-0.01	0.00	-0.01	0.01	-0.06	0.06
Communication	0.15	0.14	0.13	0.04	0.13	0.12
Worry	0.06	0.05	0.05	0.02	0.09	-0.01
Family Summary	0.09	0.07	0.08	-0.03	0.06	0.16*
Daily Activities	0.10	0.09	0.09	0.02	0.08	0.11
Family Relationships	0.07	0.05	0.07	-0.05	0.04	0.17*

Note: *p<.05, **p<.01, ***p<.001.
Effect sizes are designated as small (0.10), medium (0.30), and large (0.50) for Pearson's product Moment correlations.

Table 9. Intercorrelations among PedsQL™ 4.0 Generic Core Scales and PedsQL™ Family Impact Module for Parent Proxy-Report

	Parent Proxy-Report					
PedsQL™ Family Impact Module	Generic Core Total Score	Physical Health	Psychosocial Health	Emotional Functioning	Social Functioning	School Functioning
Total Impact Score	0.50***	0.30***	0.55***	0.50***	0.47***	0.44***
Parent HRQOL Summary	0.44***	0.27***	0.47***	0.44***	0.41***	0.36***
Physical Functioning	0.34***	0.21**	0.38***	0.37***	0.30***	0.29***
Emotional Functioning	0.44***	0.26**	0.49***	0.46***	0.42***	0.37***
Social Functioning	0.42***	0.25**	0.46***	0.38***	0.45***	0.35***
Cognitive Functioning	0.29***	0.22**	0.29**	0.27***	0.25**	0.23**
Communication	0.41***	0.26**	0.45***	0.42***	0.37***	0.38***
Worry	0.41***	0.24**	0.46***	0.43***	0.37***	0.38***
Family Summary	0.46***	0.27***	0.52***	0.47***	0.43***	0.45***
Daily Activities	0.46***	0.27***	0.52***	0.48***	0.42***	0.45***
Family Relationships	0.40***	0.23**	0.45***	0.40***	0.37***	0.39***

Note: *p<.05, **p<.01, ***p<.001.
Effect sizes are designated as small (0.10), medium (0.30), and large (0.50) for Pearson's product moment correlations.

Table 10. Hierarchical Linear Regression Models for Factors Associated with Family Impact

Variables	PedsQL™ Family Impact Total Score
Block 1 (demographic variables)	
R^2	0.06
Gender	0.04
Race/Ethnicity	0.05
Socioeconomic Status	0.04
Age	0.08
Block 2 (disease-specific indicators/ADHD symptom severity)	
R^2 change	0.22***
Number of daily ADHD medications	-0.14
Months on daily ADHD medications	-0.05
Months since ADHD Diagnosis	0.06
Presence of Co-Morbid Diagnosis	-0.03
Number of Diagnoses	0.06
Vanderbilt ADHD Symptom Score	-0.29***
Block 3 (child psychosocial functioning)	
R^2 change	0.09***
PedsQL™ Emotional Functioning Scale	0.13
PedsQL™ Social Functioning Scale	0.29**
PedsQL™ School Functioning Scale	-0.04
Cumulative R^2	0.38***

Note: PedsQL™ Emotional Functioning Scale, Social Functioning Scale, and School Functioning
Scale entered in Block 3 are parent proxy-report.
Betas presented are standardized betas for the full model.
*p<.05, **p<.01, ***p<.001.

Table 11. Comparisons between PedsQL™ 4.0 Generic Core Scales for Child Self-Report and Parent Proxy-Report for ADHD Sample

	Child Self-Report [a]		Parent Proxy-Report [b]		Differences	Effect Size
Scale	Mean	SD	Mean	SD		
	(n = 177)					
Total Score	66.99	15.88	58.42	18.19	a>b***	0.50
Physical Health	76.45	17.65	70.90	24.61	a>b*	0.26
Psychosocial Health	61.94	17.66	51.76	18.02	a>b***	0.57
Emotional Functioning	59.27	23.52	48.35	20.61	a>b***	0.49
Social Functioning	66.61	24.96	58.79	22.99	a>b**	0.33
School Functioning	60.16	20.59	48.10	19.23	a>b***	0.61

Note: *p<.05, **p<.01, ***p<.001.
SD = standard deviation.
Effect sizes are designated as small (.20), medium (.50), and large (.80).

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