THE IMPACT OF FAMILY FUNCTIONING AND TREATMENT BURDEN ON HEALTH-RELATED QUALITY OF LIFE IN CHILDREN WITH CYSTIC FIBROSIS

A Dissertation

by

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ABSTRACT

Health-Related Quality of Life (HRQOL) is the leading construct for measuring the impact of chronic illness on general well-being in pediatric populations. Little is known about what factors contribute to HRQOL in pediatric cystic fibrosis (CF). The current study hypothesized that family functioning and treatment burden would impact HRQOL and explored treatment burden as a potential moderator using self and parent-proxy reports.

Self-report results confirmed that "unhealthy" family functioning ($F(4,43) = 3.83$, $p = 0.01$, $R^2 = 0.26$, $R^2_{adjusted} = 0.20$) predicted poor HRQOL, controlling for age and disease severity. Greater treatment burden perceptions were also associated with poor HRQOL using a self-report score ($F(4,43) = 4.14$, $p = 0.01$, $R^2 = 0.28$, $R^2_{adjusted} = 0.21$) and the CFQ-R treatment burden subscale ($F(4,45) = 3.29$, $p = 0.01$, $R^2 = 0.29$, $R^2_{adjusted} = 0.20$), controlling for age and disease severity. Parent-proxy report results demonstrated significant relationships for family functioning ($\alpha = -0.34$, $p < 0.05$) and treatment burden ($\alpha = 0.46$, $p < 0.05$) with HRQOL as well. Moderation analyses indicated that the relationship between family functioning and HRQOL was not dependent upon treatment burden perceptions in either child or parent-proxy report. However, the overall models suggested that together age, disease severity, family functioning, and treatment burden accounted for significant variance in HRQOL scores for self-report ($R^2 = 0.32$, $F(5,47) = 4.03$, $p = 0.004$) and parent-proxy report ($R^2 = 0.25$, $F(2,23) = 3.90$, $p = 0.035$).

Results confirm previous findings that family functioning is related to HRQOL in pediatric CF. This is the first study to suggest that perceptions of treatment burden are related to HRQOL. Overall findings suggest that children who experience "unhealthy" family functioning and greater treatment burden perceptions are at risk for experiencing diminished HRQOL. Intervention efforts to promote familial support and monitoring perceptions of treatment burden may be useful in promoting greater HRQOL within pediatric CF.

DEDICATION

I would like to dedicate this work to the three people who provide me with endless love, support, and happiness. To my mom, my husband, and my son: I am forever grateful for the sacrifices you have made to help me pursue my dreams. Thank you for helping me keep my faith and my family at the center of my world.

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NOMENCLATURE

CF	Cystic Fibrosis
FEV_1%	Forced Expiratory Volume 1
HRQOL	Health-Related Quality of Life

CONTRIBUTORS AND FUNDING SOURCES

This work was supervised by a dissertation committee consistent of Chair, Dr. Sherecce Fields and Dr. Robert Heffer of the Department of Psychology, Dr. William Rae of the Department of Education, and Dr. James Varni of the Department of Architecture. Additionally, this work was supervised by Dr. Jamie Becker and Dr. Roy Kim from Children's Medical Center Dallas, Texas.

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INTRODUCTION

Cystic Fibrosis (CF) is the second most common genetic disorder in children, occurring in 1 in every 3,700 births (Centers for Disease Control and Prevention, 2004). With approximately 1,000 new cases of CF each year, there are an estimated 30,000 children and adults living with CF in the United States alone (Cystic Fibrosis Foundation, 2014). Despite increases in life expectancy over the past decade (Cystic Fibrosis Foundation, 2014), CF remains a chronic, progressive, and fatal disease with lung infections being the most common cause of morbidity (Morgan et al., 1999).

Cystic Fibrosis is determined by the inheritance of specific genes from each parent. The impact of the disease is most profuse throughout the respiratory and digestive systems, however, the disease impacts all systems of the body. CF symptoms such as coughing, mucus production, wheezing, shortness of breath, and lung infections occur as a result of mucus blockage in the respiratory system (Cunningham & Taussig, 2003; National Heart, Lung, and Blood Institute, 2013). Further, thick mucus in the pancreas blocks digestive enzymes, and ultimately the absorption of nutrients, resulting in poor weight gain, greasy stools, stomachaches, and excessive gas (Cunningham & Taussig, 2003; National Heart, Lung, and Blood Institute, 2013). The severity and profuseness of these symptoms is determined by the individual's inheritance of specific variations of the genes related to CF.

The breadth of symptoms associated with CF has resulted in a need for diverse and extensive treatment strategies. Typically, regimens include several respiratory

interventions aimed at thinning mucus, clearing airways, and treating infections in combination with digestive interventions to address malabsorption such as a high fat, high calorie diets, pancreatic enzyme replacements, and high doses of vitamins (Cunningham & Taussig, 2003). Treatment regimens for most individuals with CF have been found to be extremely time-consuming, complex, and costly, often more so than other pediatric chronic illnesses (Herzer et al., 2010). Further, these treatments are only useful at prolonging vitality by preserving lung functioning and sustaining nutrition, but there is not a cure for CF.

Research in adults suggests that at some point, the number of therapies and resulting perceptions of treatment burden may outweigh the benefits of adhering to the therapy regimen (Sawicki, Sellers, & Robinson, 2009). Thus, it has become increasingly important to determine how the burden of CF treatments not only impacts objective clinical measures, but also how it impacts an individual's general well-being, or health-related quality of life (HRQOL). Given that in pediatric populations the demands of CF are a shared responsibility and stressor between the child and their family, further examination of how treatment burden impacts the overall family system is critical to encourage continued management and administration of the complex treatment regimen.

Health-Related Quality of Life in Pediatric Cystic Fibrosis

Given the aggressive and time-consuming treatments that are necessary for prolonged life expectancy in CF and other pediatric chronic illnesses, objective outcome measures such as survival rates are no longer considered sufficient for capturing how the child fares (Eiser, Mohay, & Morse, 2000). Recommended meaningful outcome

measures should include the patients' subjective assessment of how their medical demands (i.e. cost of treatment, time dedicated to treatment, pain involved in treatment) impact their psychosocial functioning (Upton, Lawford, & Eiser, 2008; Schor, 2007; Britto, Kotagal, Chenier, Tsevat, Atherton, & Wilmott, 2004). Within the past decade, health-related quality of life (HRQOL) has emerged as a leading construct for measuring the impact of various aspects of chronic illness on a child's overall functioning, including pediatric CF. In fact, The Cystic Fibrosis Foundation and the National Heart, Lung and Blood Institute have recommended using HRQOL as a standard measure in clinical trials and practice with pediatric CF patients (Abbott, 2011; Arrington-Sanders, 2006; Goldbeck, Zerrer, & Schmitz, 2007; Eigen, Clark, & Wolle,1987).

A vast body of literature suggests that defining HRQOL is multi-faceted. First, HRQOL is a subjective assessment, or patient-reported outcome of one's own perception of the impact that an illness or medical treatment has had on their psychosocial functioning (e.g. Varni & Limbers, 2009; Spieth, & Harris, 1996). Second, HRQOL is multidimensional, meaning that the construct spans the measurement of functioning across several domains (e.g. Eiser & Morse, 2001; Eiser, 1997; Spieth, & Harris, 1996). This is largely based on the original definition by the World Health Organization, which delineated health into three dimensions including physical, mental, and social health (Eiser, Mohay, & Morse, 2000; Speith & Harris, 1996; World Health Organization, 1948). As a result, HRQOL typically assesses physical, psychological, and social functioning (Matza, Swensen, Flood, Secnik, & Leidy, 2004; Eiser et al., 2000; Speith, 1996). There is less agreement on the specific domains that are measured within these

three broader categories (Speith & Harris, 1996), depending on age (Matza et al., 2004), and disease-specific areas of concern (Speith & Harris, 1996). For example, some measures of HRQOL may include school functioning, neuropsychological functioning, appearance satisfaction, etc. (Speith & Harris, 1996), depending on relevance to the population they are used to assess.

Two important considerations are necessary when utilizing HRQOL measurements in pediatric chronic health populations. First, it has been well-documented that significant differences exist in parent-proxy and child self-report ratings of HRQOL (e.g. Ingerski et al., 2010; Upton, Lawford, & Eiser, 2008; Varni, Katz, Colegrove,& Dolgin, 1996), although the different studies seem to report various discrepancies and similarities within specific HRQOL domains. In a large meta-analysis, it was determined that there is low agreement in parent-proxy and child self-report on the domains of emotional and social HRQOL, while ratings in the domains of general functioning and physical functioning were in greater agreement across pediatric chronic illness populations (Eiser & Morse, 2001).

In pediatric CF, there is limited research devoted to examining these discrepancies. One study suggests that adolescents with CF rate their overall HRQOL as better than their parents, and consistent with literature on other pediatric chronic health populations, the largest discrepancies occurred in the domains of worry about health and susceptibility to disease (Britto, Kotagal, Chenier, Tsevat, Atherton, & Wilmott, 2004). However, that same study found that adolescents with CF and their parents reported similar levels of overall mental health and pain, which tend to be less similar in other

pediatric chronic health populations due to the internal nature of these domains (Britto et al., 2004). Thus, further research is needed to examine how parent-proxy and child self-report differs for HRQOL in pediatric CF.

It is important to maintain awareness of the differences in parent-proxy and child self-report; however, research suggests that there may be circumstances in which parent proxy-report is useful such as when a child is too young, ill, or too impaired to provide self-report (Varni & Limbers, 2009). Further, it has been suggested that parents' perceptions of the chronically ill child's HRQOL are more likely to influence health care decisions, such as adherence to medical treatment (Varni & Limbers, 2009; Campo, Comer, Jansen-McWilliams, Gardner & Kelleher, 2002; Janicke, Finney & Rile, 2001). As a result, the current standard is to acquire reports from multiple informants (both parent-proxy and child self-report) when possible.

The second consideration with regard to the measurement of HRQOL is the difference between generic and disease-specific measures. Generic HRQOL measures are used in both ill and healthy populations allowing for comparisons and contain subscales that are applicable across individuals in both groups (Varni & Limbers, 2009). In contrast, disease-specific measures capture the impact of a specific illness or disease on the individual's functioning (Varni & Limbers, 2009; Solans et al., 2008). For example, disease-specific measures for pediatric CF include questions that address how respiratory and digestive symptoms impact functioning across domains. Since each approach serves a unique purpose, it is suggested that both generic and disease-specific

HRQOL measures be administered to acquire a comprehensive evaluation (Varni & Limbers, 2009).

Research on how children and parents rate HRQOL in pediatric CF is less extensive than other pediatric chronic illnesses (e.g. pediatric cancer) with many studies combining adolescent and adult populations and taking place outside of the United States. This research does suggest that the majority of children with CF fair within one standard deviation of their healthy peers. As a result, studies continue to investigate what factors contribute to the subset of individuals who demonstrate poor adjustment (Wong & Heriot, 2008). Within this context, studies have examined the relationship between biological markers of cystic fibrosis disease severity and HRQOL, resulting in mixed findings (Powers, Gerstle & Lapey, 200; de Jong et al., 1997; Jedlicka-Köhler, & Götz, 1988). Even those studies that do suggest a significant relationship note that disease severity accounts for only a small portion of the variance in HRQOL ratings, highlighting the idea that there are additional factors contributing to poor adjustment (Drotar, Doershuk, Stern, Boat, Boyer & Matthews, 1981;Wong & Heriot, 2008). Gender has also been linked to variations in HRQOL reports, such that adolescent females with CF report lower HRQOL in all domains except role behavior compared to their male counterparts (Arrington-Sanders, Yi, Tsevat, Wilmott, Mrus, & Britto, 2006). Given the limited findings regarding what contributes to poor HRQOL in pediatric CF, researchers have suggested that family functioning may be a potential factor in predicting childhood adjustment (Hegarty, MacDonald, Watter, & Wilson, 2008; Schmitz & Goldbeck, 2006; Patterson, McCubbin & Warwick, 1990) given that this link

has been present in other pediatric chronic health populations such as diabetes (e.g. Grey, Boland, Yu, Sullivan-Bolyai, & Tamborlane, 1998).

Family Functioning in Pediatric Cystic Fibrosis

It is well documented that having a chronic medical condition can be a familial stressor resulting in distress for all individuals, disruptions of family roles and structure, and diminished family cohesion (Herzer et al., 2010; Quittner et al., 2000; Drotar, 1997). There are mixed results regarding whether families of children with pediatric chronic illness are more likely to function in "unhealthy" ranges compared to families with healthy children; however it has been suggested that there are a least a subset that do demonstrate "unhealthy" general family functioning, poor division of responsibility for completing tasks, and poor communication (Herzer et al., 2010).

As in other pediatric chronic health populations, families of children with CF can experience distress related to the demanding, progressive, and fatal nature of the disease (Herzer et al., 2010; DeLambo, Ievers-Landis, Drotar, & Quittner, 2004; Patterson et al., 1990). In fact, families of children with CF may experience greater distress and more time spent on treatment-related activities than families of children with asthma, often at the cost of family recreational activities (Modi & Quittner, 2006).

The majority of studies on family functioning in CF are observational assessment studies of mealtime in preschool and young children. In contrast to the emotional and interactional experience that mealtime is for healthy families, it is often a stressful event in which parents of children with CF must focus on the treatment goal of ensuring sufficient caloric intake for their child (Stark et al., 2000). As a result, parents are

required to be more task-oriented and abandon typical parenting techniques, leading to lower overall family communication, affect management, interpersonal involvement, behavioral control, and role allocation (Spieth, Stark, & Mitchell, 2001; Janicke, Mitchell, & Stark, 2005; Crist et al., 1994).

While mealtime studies suggest that family functioning may improve with age alternative family characteristics in pediatric CF may cause disruption during adolescence. Parents of children with CF have been found to be over-protective and engage in extreme levels of parental monitoring (Patterson et al., 1990). In fact, as many as 77% of parents of children with CF admit to over-protecting their child (Phillips, Bohannon, Gayton, & Friedman, 1985). While this is advantageous for ensuring treatment compliance, it hinders normative adolescent development (especially the increasing need for autonomy) and can result in subsequent behavior problems (Szyndler, Towns, Asperen, & McKay, 2005; Drotar & Ievers, 1994; Cappelli et al., 1988).

More general factors have also been linked to how parents adjust to having a child with CF. Poor parental adjustment has been associated with high levels of daily stress regarding illness tasks and poor family involvement. Positive adjustment has been linked to paternal involvement with the family, maternal involvement outside of the family, family communication, and time for recreation (Kulczycki, Robinson, & Berg, 1969; Patterson, 1990). These factors are important given that parents' overall adjustment to the disease has an impact on the well-being of the child with CF.

One difficulty that has plagued the understanding of how families of children with chronic illnesses function, including those with CF, is a lack of a cohesive theoretical approach for conceptualizing their functioning (Alderfer, 2008). For example, in CF, theories such as the Transactional Stress and Coping Model (e.g., Thompson, Gustafson, Hamlett, & Spock, 1992), the Family Adjustment and Adaptation Response Model (e.g., Patterson et al., 1990), and the McMaster Model of Family Functioning (e.g., Herzer, 2010) have all been used to understand the impact of the disease on various areas of functioning. To complicate matters more, studies constantly use different assessment measures to operationalize family functioning, many of which call overlapping dimensions by differing terms and use different dimensions to summarize "general" family functioning (Herzer, 2010; Drotar, 1997). Also, some measures specifically capture the impact of the chronic illness on the family while others are more general; only the later allow for comparisons between families with healthy children and those with a child with pediatric chronic illness. Given the slew of theoretical explanations and assessment tools, it is difficult to summarize the specific impact that CF has on family functioning.

Impact of Family Functioning on HRQOL

Research does suggest that changes in family functioning impact the child with the disease. Relationship characteristics such as family cohesion, conflict, organization, expressiveness, and adaptability have all been related to HRQOL in children and adolescents with CF (Szyndler, Towns, Asperen, & McKay, 2005; Cappelli et al., 1988). Children that demonstrate poor levels of HRQOL tend to be from families that function

at the extreme levels (high or low) of family characteristics. For example, lack of familial involvement or over-involvement can both detrimental to the well-being of the child and result in behavior problems at home and school (Szyndler, Towns, Asperen, & McKay, 2005; Drotar & Ievers, 1994; Cappelli et al., 1988). Familial variables have also been used to predict the HRQOL domain of self-esteem (Cappelli et al., 1988). However, many of these studies took place using outdated measures of HRQOL. Consistent research on the impact of family functioning on HRQOL in children with CF appears to be absent.

Family Functioning, HRQOL and Treatment Burden

Preliminary studies suggest that families who experience disruptions in functioning as a result of their child's CF may differ on one important characteristic: their perceptions of the stress and burden associated with the disease. It is well documented that both parents and children perceive the treatment regimen for CF as burdensome and stressful (e.g. Jamieson, Fitzgerald, Singh-Grewal, Hanson, Craig, & Tong, 2014). Furthermore, as demonstrated in mealtime studies which are thought to represent illness burden (Janicke et al., 2005), the majority of parents report having at least minor difficulties getting their child to comply with treatment requirements and are forced to alter their functioning characteristics (Janicke et al., 2005; Spieth et al., 2001; Phillips et al., 1985,). Families of children with CF report that they must sacrifice family leisure activities in order to allocate sufficient time to completing treatments and caring for their child (Quittner, Opipari, Regoli, Jacobsen, & Eigen, 1992). Additionally, poor

familial adjustment is linked to higher levels of daily stress regarding treatment tasks (Thompson et al., 1992).

To date, only one study has directly examined the role of treatment burden and HRQOL in pediatric CF. Ziaian et al. (2006) found that although treatment burden was higher for children with CF than other pediatric chronic health populations, there was no significant correlation with HRQOL among Australian families. However, further investigation of this relationship is necessary to expand upon these findings.

Current Study

Given that prior research sheds light on the complexity of the relationship between HRQOL, family functioning, and treatment burden in pediatric CF, the current study seeks to elaborate on the understanding of how these factors are related. With regard for the current recommendations for measuring HRQOL in pediatric chronic health populations, the study will utilize both a generic and disease-specific measure of HRQOL, both of which allow for a child self-report and parent-proxy report. The current study will address the following specific aims:

Study Aim 1

To determine whether self-reported family functioning will be related to self-reported HRQOL

Hypothesis 1**:** Consistent with previous literature, family functioning will be significantly related to HRQOL such that children who perceive difficulties in their family functioning will report lower HRQOL.

Study Aim 2

To determine whether parent-proxy report of family functioning will be related to parent-proxy report of HRQOL

Hypothesis 2: Consistent with previous literature, family functioning will be significantly related to HRQOL, such that parents who perceive difficulties in their family functioning will report lower HRQOL in their children.

Study Aim 3

To determine whether self-reported treatment burden is related to self-reported HRQOL

Hypothesis 3: It is hypothesized that self-reported treatment burden will be associated with self-reported HRQOL, such that children who perceive greater treatment burden will report lower HRQOL.

Study Aim 4

To determine whether parent-proxy report of treatment burden is related to parent-proxy report of HRQOL

Hypothesis 4: It is hypothesized that parent-proxy report of treatment burden will be associated with parent-proxy report of HRQOL, such that parents who perceive greater treatment burden will report lower HRQOL in their children.

Study Aim 5

To determine whether self-reported treatment burden moderates the relationship between self-reported family functioning and self-reported HRQOL

Hypothesis: It is hypothesized that treatment burden will moderate the relationship between child-reported family functioning and HRQOL. Specifically, the relationship between unhealthy family functioning and poor HRQOL will be stronger when children perceive their treatment burden to be greater.

Study Aim 6

To determine whether parent-proxy reports of treatment burden moderate the relationship between parent-proxy report of family functioning and parent-proxy report of HRQOL.

Hypothesis 6: It is hypothesized that parent-proxy reports of treatment burden will moderate the relationship between parent-proxy report of family functioning and HRQOL. Specifically, the relationship between unhealthy family functioning and poor HRQOL will be stronger when parents perceive their child's treatment burden to be greater.

Current Study Exploratory Aims

The following analyses were conducted similarly to the specific aims of the current study. However, they must be considered exploratory given that there is insufficient power to conduct these extensive analyses (Cohen, 1992). Thus, there is an increased chance of experiencing Type I and Type II error as a result of running multiple analyses on an insufficient sample size (Cohen, 1992).

Exploratory Aim 1

To determine the association between the self-reported subscales of family functioning (problem solving, communication, roles, affective responsiveness, affective

involvement, behavioral control) and the child self-report domains on the generic (physical, emotional, social, and school functioning) and disease-specific (physical functioning, vitality, health perceptions, respiratory symptoms, treatment burden, role functioning, emotional functioning, social functioning) HRQOL measures

Exploratory Aim 2

To determine the association between the parent-proxy report subscales of family functioning (problem solving, communication, roles, affective responsiveness, affective involvement, behavioral control) and the parent-proxy report domains on the generic (physical, emotional, social, and school functioning) and disease-specific (physical functioning, vitality, health perceptions, respiratory symptoms, treatment burden, role functioning, emotional functioning, social functioning) HRQOL measures

Exploratory Aim 3

To determine the association between child-reported treatment burden and the child self-report domains (physical, psychosocial) on the HRQOL measure.

Exploratory Aim 4

To determine the association between treatment burden and the parent-proxy report domains (physical, psychosocial) on the HRQOL measure.

METHOD

Participants

Participants for the current study were recruited from the Cystic Fibrosis Clinic at Children's Health Children's Medical Center in Dallas, Texas. 50 children ages 6-18 and their parents were approached during their scheduled appointment times and asked if they were willing to participate in a research study. In accordance with the University of Texas Southwestern Institutional Review Board standards, all participants were informed of their rights as participants were required to provide written consent/assent, and agreed to the release of their medical information in accordance with the Health Insurance Portability and Accountability Act.

Measures

Health-Related Quality of Life

Cystic Fibrosis Questionnaire- Revised (CFQ-R; Quittner, Buu, Messer, Modi, & Watrous, 2005). The CFQ-R is a disease-specific measure of HRQOL. The current study utilized 4 versions of the measure: CFQ-R Child Report Interview Format for ages 6 to 11, CFQ-R Child Self-Report Format for ages 12 and 13, CFQ-R Adolescent and Adult Self-Report Format for ages 14 and older, and the CFQ-R Parents/Caregiver Proxy Report format for parents of children under 13 years of age. There is no parent report CFQ-R for children over the age of 13, thus parent report was not collected for older participants.

The CFQ-R child interview and self-report measures as well as the parent-proxy report consist of 8 subscales: physical, emotional, social, body image, eating, treatment burden, respiratory, and digestion. Internal consistency on the CFRQ-R child version range from .60 to .76 (Modi & Quittner, 2003). The CFQ-R Adolescent and Adult Self-Report includes all 8 of the aforementioned scales and four additional scales: roles, vitality, health perceptions, and weight. Internal consistency for the CFQ-R Adolescent and Adult version ranges from .67 to .94 (Quittner et al., 2005).

Participants were asked to rate statements on 4-point Likert scales, resulting in scaled scores that range from 0 to 100. Higher scores on the CFQ-R represented greater HRQOL.

Given that parent-proxy report of HRQOL on the CFQ-R was only available for individuals under the age of 14, all parent-proxy analyses with this measure will only be run for participants falling under this age cutoff.

Pediatric Quality of Life Inventory™ Version 4.0 Short Form Generic Core Scales (PedsQL™ 4.0 SF15; Chan, Mangione-Smith, Burwinkle, Rosen & Varni, 2005). The PedQL™ Short Form (SF15) Generic Core Scale is a shortened version of the original PedsQL 4.0 Generic Core Scales. The following forms of the SF15 were utilized: child self-report and parent-proxy report for young children (ages 5-7), children (ages 8-12), and adolescents (ages 13-18).

The SF15 has two subscales: physical functioning and psychosocial functioning. In addition, the Total Score is the sum of all questions and represents overall HRQOL.

Participants rated items on a 5-point scale. Items were reversed scored and linearly transformed to a 0-100 scale with greater scores representing greater HRQOL.

Family Functioning

Family Assessment Device (FAD; Miller, Kabacoff, & Epstein, 1994) The FAD is a well-established measure of family functioning according to the American Psychological Association (Alderfer, 2008) and is based on the McMaster Model of Marital and Family Functioning. The measure is intended to be completed by multiple family members in a self-report format for children ages 12 years and above and can be used in an interview format for children as young as 7 years of age. The 60-item measure consists of 6 subscales: problem solving, communication, roles, affective responsiveness, affective involvement, and behavioral control. A general functioning dimension was derived from specific items. Participants were asked to rate statements on a 4-point Likert scale from 1 (strongly agree) to 4 (strongly disagree). Higher scores indicated "unhealthy" levels of family functioning. Scores of 2 or higher on any subscale, including the general functioning dimension, are considered "unhealthy," (Miller, Epstein, & Bishop, 1985).

Treatment Burden

Two measures were utilized to quantify child-reported treatment burden. First, as a part of a larger study participants completed a time use interview to identify all activities that were completed within the last 24-hours. The interview focused on identifying treatment-related activities, when they occurred, and who they occurred with. During the interview, participants were asked to rate each treatment activity on how

much it intruded on their daily life, which primed them to consider how their treatments impact their daily routines. Upon completion, participants rated the extent to which the need to complete all treatments imposes on their daily routine on a scale from 0 (not burdensome) to 5 (extremely burdensome). This overall question was utilized as one measure of the child-reported treatment-burden.

CFQ-R Treatment Burden Subscale. The treatment burden subscale of the CFQ-R consists of the following 3 items: To what extent do your treatments make your daily life more difficult? How much time do you currently spend each day on your treatments? How difficult is it for you to do your treatments each day? The subscale was standardized and scored on a 0-100 point scale with lower levels indicating higher treatment burden. This method has been used in previous studies as an independent measure of treatment burden for CF (e.g. Sawicki, Sellers, & Robinson, 2009). This was the only measure of treatment burden for parent-report analyses.

Demographic Information

Information pertaining to the patient's demographics include age, gender, and ethnicity were obtained on the CFQ-R information cover page. Additionally, information regarding CF severity was acquired through medical records reviews. FEV_1 % during the appointment of study participations and past year hospitalizations were included in analyses to represent disease severity.

Procedure

Measures for the current study were administered as part of a larger more extensive study. After consenting, participants were informed that administration of the

study procedures would take place between provider visits, to alert them that there may be disruptions in the completion of some measures. Administration of the time-use interview and self-report questionnaires was counterbalanced. Further, administration of the questionnaires was done at random to eliminate effects of fatigue. Participants were read the instructions for each questionnaire by the researcher and asked to complete them; when age-appropriate, the researcher continued to administer the questionnaires in an interview-format. Upon completion of the study, parents were provided a copy of the consent form, HIPPAA authorization, and were thanked for their participation.

Statistical Analyses

All analyses were conducted using Statistics Package for the Social Science software (SPSS for Windows Version 20.0, 2011).

For study aims 1-4, correlation analyses were conducted to examine bivariate relationships between family functioning, HRQOL, and both measures of treatment burden for child self-report measures. Regression analyses controlling for age, FEV_1 %, and past hospitalizations were run for significant correlations. For these specific aims, total family functioning was measured by the general functioning scale on the FAD. HRQOL was measured using the total score on the PedsQL™ SF15.

Similarly, bivariate correlations were used to determine the relationships between family functioning, HRQOL, and CFQ-R treatment burden for parent-proxy report. Parent-proxy report analyses also utilized general family functioning on the FAD and total score on the PedsQL™ SF15.

To investigate study aim 5, two separate models, one for self-reported treatment burden and one for self-reported CFQ-R treatment burden, were conducted to examine the potential moderation between family functioning and HRQOL. Variables were standardized before conducting moderation analyses. Stepwise regressions were conducted entering covariate information on the first step (age, FEV_1 %, and past hospitalizations), the predictor (general family functioning) and moderator (self-report treatment burden or CFQ-R treatment burden) were entered in the subsequent step. The third step included the predictor, moderator, and their interaction term.

To investigate study aim 6, a model was conducted to determine the potential for parent-reported treatment burden, measured by the CFQ-R, to moderate the relationship between family functioning and HRQOL. All variables were standardized before conducting moderation analyses. Stepwise regressions were conducted entering the predictor (general family functioning) and moderator (parent-report CFQ-R treatment burden) in the first step. The second step included the predictor, moderator, and their interaction term.

RESULTS

Participant Characteristics

A total of 50 (mean age = 12.6 years; SD=3.1) parent-child dyads were recruited for the study. Three dyads completed most, but not all, of the necessary measures. For these three dyads completed measures were used in appropriate analyses. Demographic information for participants can be found in Table 1.

It is worth noting that the majority of participants (64%) fell within a normal range for FEV_1% which indicates a mild degree of CF severity within the current sample at the time of study participation. Further, 28% of children and 18% of parents indicated that their family functioned in an "unhealthy" range based on previously established cutoff scores (Miller et al., 1994). Means for the child-report and parent-report on the PedsQL™ were within an expected range for children with chronic health conditions.

Internal Consistency

For the current study, internal consistency for the Family Assessment Device, PedsQL™, and CFQ-R were measured using Cronbach's alpha. Reliability coefficients and mean response scores for the measures by form can be found in Table 2, Table 3, and Table 4, respectively.

The Family Assessment Device general functioning subscale demonstrated good reliability for self ($\alpha = 0.80$) and parent-proxy report ($\alpha = 0.80$). Some self-report subscales demonstrated poor to marginal reliability including roles ($\alpha = 0.35$), behavioral control ($\alpha = 0.46$), and problem solving ($\alpha = 0.59$). Similarly, marginal reliability was

seen on a number of parent-proxy report subscales including problem solving (0.49), communication (0.60), affective responsiveness (0.52), affective involvement (0.56), and behavioral control (0.54). The PedsQL^{TM} SF15 demonstrated favorable reliability in both child self-report (0.74-0.83) and parent-report (0.87-0.89).

Reliability for the CFQ-R varied across form. On the adolescent/adult report there was low reliability on the eating ($\alpha = 0.21$), social ($\alpha = 0.44$), treatment burden ($\alpha = 0.16$), and respiratory ($\alpha = -0.09$) subscales and marginal reliability on vitality ($\alpha = 0.59$), body image ($\alpha = 0.56$) and digestion ($\alpha = 0.61$) subscales. The majority of parent-report scales demonstrated good reliability, with marginal reliability on vitality ($\alpha = 0.59$), school ($\alpha = 0.42$), eating ($\alpha = 0.59$). The majority of child-report subscales demonstrated good reliability, with marginal reliability seen only on the social subscale ($\alpha = 0.52$).

Self-Report Relationships

Correlation analyses were conducted on self-report measures to examine bivariate relationships between age, gender, FEV_1 %, number of past hospitalizations, family functioning, total HRQOL on the PedsQL^{TM} SF15 , and the potential moderators (self-reported treatment burden and CFQ-R treatment burden). Means, standard deviations, and correlations can be found in Table 5. Regarding demographic variables, age was significantly negatively correlated with FEV_1% and positively correlated with past hospitalizations, indicating greater disease severity was associated with older age. Age was also significantly negatively correlated with family functioning and treatment burden, such that older patients reported greater treatment burden but better family functioning. Past hospitalizations was significantly negatively correlated to the

PedsQL™ SF15, such that greater number of hospitalizations was associated with poor HRQOL.

A series of one-way ANOVAs were conducted to determine whether self-report measures differed by gender. Gender was not associated with family functioning, $F(1,48) = 0.56$, $p = 0.46$, treatment burden, $F(1,46) = 0.23$, $p = 0.63$, or the PedsQL™ SF15, $F(1,48) = 0.27$, $p = 0.61$. Thus, gender was not included in any subsequent regression analyses.

There was a significant negative correlation between family functioning and HRQOL such that "unhealthy" family functioning was associated with poor HRQOL. Both measures of treatment burden were also significantly correlated to HRQOL, such that greater treatment burden was associated with poor HRQOL. Treatment burden and family functioning were correlated, such that those who perceived greater treatment burden reported "unhealthy" family functioning.

Multiple regression analyses were run to determine whether family functioning and treatment burden predicted HRQOL while controlling for age, FEV_1 %, and past hospitalizations. In the first regression, age, FEV_1 %, past hospitalizations, and general family functioning significantly predicted HRQOL ($F(4,43)=3.83$, $p = 0.01$, $R^2 = 0.26$, $R^2_{adjusted} = 0.20$). Family functioning accounted for a significant amount of variance in HRQOL while controlling for other variables ($\beta=-0.33$, $t(43)=-2.39$, $p = 0.02$). In the second regression, age, FEV_1 %, past hospitalizations, and self-reported treatment burden significantly predicted HRQOL ($F(4,43)=4.14$, $p = 0.01$, $R^2 = 0.28$, $R^2_{adjusted} = 0.21$). Self-reported treatment burden accounted for significant variance in HRQOL

while controlling for other variables (β=-0.35, $t(43)=-2.60$, $p = 0.01$). In the third regression, age FEV_1 %, past hospitalizations, and CFQ-R treatment burden significantly predicted HRQOL ($F(4,41)=3.20$, $p = 0.02$, $R^2 = 0.24$, $R^2_{adjusted} = 0.16$). CFQ-R treatment burden accounted for a significant amount of variance in HRQOL while controlling for other variables (β=0.31, $t(41)=2.04$, $p = 0.05$).

Parent-Proxy Report Relationships

For parent-proxy report, bivariate correlations were conducted for family functioning, HRQOL on the PedsQL™ SF15, and the moderator (CFQ-R treatment burden). Means, standard deviations, and correlation coefficients can be found in Table 6. There was a significant negative correlation between family functioning and HRQOL such that unhealthy family functioning was associated with poor HRQOL. There was also a significant correlation between CFQ-R treatment burden and HRQOL, such that greater treatment burden was associated with poor HRQOL. Gender of the parent was not significantly related to any of the measures.

Moderation Analyses

Based on the correlation results, three separate moderation analyses were run (two for self-report, one for parent-report).

The following results pertain to self-report models. Two separate models, one for self-reported treatment burden and one for CFQ-R treatment burden, were run to examine the relationships among family functioning and HRQOL on the PedsQL™ SF15. Covariates including age of the child, FEV1%, and number of past hospitalizations for CF were included in the model. Results from the hierarchical

regressions can be seen in Table 5. Collinearity statistics for all variables were within acceptable ranges for model 1 (VIF:1.05-1.20; tolerance 0.83-0.94) and model 2 (VIF: 1.14-1.67; tolerance 0.60-0.88).

In step 1, age, current FEV_1%, and past hospitalizations significantly predicted HRQOL, $R^2 = 0.165$, $F(3,44) = 2.88$, p=0.046. There was a significant main effect for past hospitalizations and there was a favorable statistical trend for FEV_1%. In step 2, family functioning and the moderator, self-reported treatment burden, were added to the model. The addition of these two variables predicted incremental variance in HRQOL, $\Delta R^2 = 0.16$, $\Delta F = 4.96$, $p = 0.01$. The main effect for past hospitalizations remained significant within step 2, but no other predictors reached statistical significance. The addition of the interaction term in step 3 did not add incrementally to the predictive value of the model, $\Delta R^2 = 0.03$, $\Delta F = 1.68$, $p = 0.20$, indicating no moderating relationship.

Similar procedures were followed for the second self-report model. In step 1, age, current FEV_1%, and past hospitalizations did not reach statistical significance in predicting HRQOL, $R^2 = 0.16$, $F(3,42) = 2.679$, $p = 0.059$, though there was a significant main effect for past hospitalizations in this model. In step 2, family functioning and the moderator, CFQ-R treatment burden, were added to the model. The addition of these two variables predicted incremental variance in HRQOL, $\Delta R^2 = 0.182$, $\Delta F = 4.786$, $p = 0.01$. The addition of the interaction term in step 3 did not add incrementally to the predictive value of the model, $\Delta R^2 = 0.02$, $\Delta F = 1.38$, $p = 0.25$, indicating no moderating relationship.

Similar procedures were followed for the parent-proxy report CFQ-R treatment burden model. Collinearity statistics were within an acceptable range for all variables in model (VIF: 1.00-1.33; Tolerance: .76-1.00) In step 1, general family functioning and CFQ-R treatment burden accounted for significant variance in predicting HRQOL, R^2 = 0.0.25, F(2,23) = 3.90, p = 0.035. There was a main effect for CFQ-R treatment burden in the model. In step 2, the addition of the interaction term did not add incrementally to the predictive value of the model, $\Delta R^2 = 0.03$, $\Delta F = 0.86$, $p = 0.37$, indicating no moderating relationship.

Exploratory Correlations

Bivariate correlation analyses were conducted for self-report FAD subscales and the PedsQL™ SF15 and CFQ-R subscales; correlation coefficients can be found in Table 9 and Table 10 respectively. There were no significant relationships between FAD subscales and either the physical subscale or psychosocial subscale on the PedsQL™ SF15. CFQ-R Body Image was significantly negatively correlated to affective responsiveness, affective involvement, and behavioral control subscales of the FAD. These correlations suggest that patients who reported difficulties with body image reported unhealthy levels of affective responsiveness, affective involvement, and behavioral control.

For parent-proxy report similar correlation analyses were conducted. PedsQL™ SF15 correlations can be found in Table 11. The psychosocial subscale of the PedsQL™ SF15 was significantly negatively correlated with the roles subscale, suggesting that those parents who reported more difficulty with role establishment also reported poor

HRQOL for their children. As seen in Table 12, several CFQ-R subscales were related to various FAD subscales. First, the CFQ-R physical subscale was significantly positively correlated to the FAD affective involvement subscale such that parents who reported poor physical HRQOL reported healthy functioning in the affective involvement domain. Both the CFQ-R eating and body image subscales were significantly positively correlated to the FAD communication scale such that poor communication was associated with better body image and eating behaviors on the CFQ-R. The CFQ-R respiratory symptoms subscale was significantly negatively correlated with the FAD problem solving subscale such that parents who reported more difficulty with problem-solving reported that their children had more respiratory symptoms on the CFQ-R. The CFQ-R digestive symptoms subscale was significantly negatively correlated with FAD roles such that parents who reported more problems with role establishment reported that their children had more digestive symptoms. The CFQ-R school subscale was significantly positively associated with FAD problem solving and negatively associated with roles. This suggests that poor problem-solving was associated with better school HRQOL, while difficulty establishing roles is associated with poor school HRQOL.

Treatment burden correlations with the PedsQL^{TM} SF15 subscales were also conducted. For child self-report, self-reported treatment burden was significantly correlated with the psychosocial subscale (r= -0.43, p = 0.002). The self-report CFQ-R treatment burden subscale was also significantly correlated to the psychosocial subscale (r = 0.32, p = 0.03). For parent-proxy report, treatment burden was significantly associated with the physical subscale (r = 0.45, p = 0.02).

CONCLUSIONS

Although HRQOL has received considerable attention as the standard procedure for measuring general well-being in pediatric chronic illnesses, few studies have examined what factors influence this construct in children and adolescents with cystic fibrosis. Previous research in adults suggests that the complex, intensive treatment regimens that individuals with CF must engage in daily to prolong negative medical complications may at some point be too burdensome and result in lower HRQOL (Sawicki, Sellers, & Robinson, 2009). Further, previous research in pediatric populations suggests that the substantial role that families play in treatment management may alter traditional dynamics of the family, and subsequently impact the well-being of the child with the medical condition (Herzer et al., 2010; Szyndler, Towns, Asperen, & McKay, 2005; Quittner et al., 2000; Drotar, 1997). Although these variables have been linked theoretically, this is the first study that seeks to understand the complex relationship between family functioning, treatment burden, and HRQOL in pediatric CF patients.

Sample Characteristics

In general, the sample in the current study responded in ways that are consistent with previous studies on pediatric CF, with the exception of a lower mean FEV_1 % (e.g. Quittner et al., 2005). This indicates that the current sample had a lower disease severity at the time of participation than samples in some other studies. The prevalence of unhealthy family functioning in both child and parent report in the current sample is consistent with prevalence rates from previous studies (e.g. Herzer, 2010). Mean HRQOL scores on both the child and parent report PedsQL™ SF15 were similar to

means for chronically ill children reported in previous studies (Varni, Limbers, & Burwinkle, 2007). Means for the treatment burden subscale on the CFQ-R were similar to reports for both child-report and parent-report in previous studies (Quittner et al., 2012). Thus, it is likely that the sample is representative of the larger pediatric CF population and improves the generalizability of the study's findings.

Family Functioning and HRQOL

It was hypothesized that family functioning would be related to HRQOL in both child self and parent-proxy reports. Specifically, it was hypothesized that when children or parents perceived there to be difficulties in family functioning, they would also perceive themselves or their child to experience diminished HRQOL. Results confirmed these hypotheses; both children and parents who reported difficulties in general functioning on the Family Assessment Device reported lower HRQOL scores on the PedsQL^{TM} SF15 total score. Further, the relationship transcended the impact of age and disease severity on HRQOL, as measured by FEV_1 % and past hospitalizations.

The findings corroborate other studies that suggest family functioning is a prominent factor in predicting the well-being of children and adolescents with CF (Szyndler, Towns, Asperen, & McKay, 2005; Cappelli et al., 1988). Given that the family plays an influential role in management of the child's medical care, it is likely that when a child feels closeness and support from their family network they thrive in both their medical and psychological health. The findings also suggest that while in general, children and parents perceive their families to function within a healthy range, there is a subset who feels they experience "unhealthy" interactions within their families,

approximately 28% and 14% respectively in the current sample. Thus, although previous studies have suggested that families with CF are generally not negatively impacted by the disease it is important to consider the subset who are. Children from these families appear to be impacted substantially by the disruption within their familial interactions and could benefit from interventions to create familial support and increase healthy interactions amongst family members, ultimately promoting improved HRQOL.

Treatment Burden and HRQOL

It was hypothesized that treatment burden would be related to HRQOL in both child self and parent-proxy reports. Specifically, it was hypothesized that when children or parents perceived there to be greater burden associated with their own or their child's CF treatment, they would perceive themselves or their child to experience diminished HRQOL. In self-report this hypothesis was confirmed using two measures- the CFQ-R treatment burden subscale and a self-report overall treatment burden score. Both were significantly related to HRQOL scores after controlling for age, FEV_1 %, and past hospitalizations. This finding contradicts findings from a previous study that found a non-significant relationship between self-reported treatment burden and HRQOL in children with CF (Ziaian et al., 2006). However, results from the current study are consistent with findings in adult populations (Sawicki, Sellers, & Robinson, 2009) and build upon findings in other pediatric populations that suggest poor familial adjustment is linked to greater daily stress (Thompson et al., 1992). Findings from the current study are the first to confirm that the perceptions of how time-consuming treatment is, how difficult the treatment regimen is to complete, and how much treatment interferes with

daily functioning directly relates to the general well-being of the child or adolescent with CF.

Findings from parent-proxy report also confirmed hypotheses that parents who perceived their child's CF treatment to be burdensome also perceived their children to have poor HRQOL. This is the first study to investigate treatment burden perceptions in parents of children with CF. Consistent with previous literature in HRQOL, findings from the current study suggest that parents may be accurate and meaningful reporters of their child's CF treatment burden although they are likely to report slightly lower treatment burden than children themselves.

The strength of the relationship between treatment burden and HRQOL across respondents suggests a need for increased attention in both research and clinical practice on measuring and monitoring treatment burden. The current study used the only known, available method for measuring treatment burden in CF - the CFQ-R treatment burden subscale. The study also sought to develop another means of measuring treatment burden in self-report using a time-recall interview to make treatment-related activities salient before participants rated their overall treatment burden. Although both of these methods were effective in the current study, it is likely that future research could benefit from more comprehensive, standardized measures of treatment burden in CF.

Although parents appear to be reliable reporters of their child's treatment burden, it is likely that their ratings are slightly skewed by their own treatment burden perceptions. Parents, particularly of younger children, spend a significant amount of time acquiring, maintaining organization, preparing, and cleaning their child's CF treatment

supplies which detracts from time spent on other activities. Currently, there is no measure that captures parents' own perceptions of the impact their child's CF treatment has on their own daily lives. However, based on previous research it is possible that if parents are negatively adjusted to the chronic disease they are more likely to impact their family and child in negative ways (Kulczycki, Robinson, & Berg, 1969; Patterson, 1990). Thus, it is important that future research develops appropriate measures to explore the role of parents' perception of their own treatment burden and the HRQOL of their child.

Findings from the current study also suggest that treatment burden is an important consideration for physicians and treatment teams in pediatric CF. It is likely that there is a point at which more prescribed medical treatments cause a decline in the general well-being of the child with CF. However, given that treatment burden is entirely subjective and unique to each individual patient, monitoring this would require consistent administration of self-report measures, particularly when medication regimens are increased in time or difficulty. Managing treatment burden would likely require more consistent conversation between patients and treatment teams in order to balance the medical needs of the child with their general well-being.

Moderation Models

It was hypothesized that children and parents who perceived greater treatment burden would also perceive more "unhealthy" functioning within their family, and as a result, the child would experience lower HRQOL. However, results from the current

study suggest that the relationship between family functioning and HRQOL is not dependent upon treatment burden perceptions.

Findings from the moderation analyses do shed light on several models that may help predict HRQOL in children with CF. In both parent-proxy and child self-report models, age, disease severity, family functioning, and treatment burden accounted for a significant portion of variance in HRQOL scores. This model highlights patient characteristics that may help identify children with CF who are at risk for poor HRQOL. Older children with CF that demonstrate greater disease severity, poor family functioning, and greater treatment burden should be monitored and targeted for prevention and interventions efforts.

Exploratory Relationships

Conclusions drawn from exploratory hypotheses are limited given there was not sufficient statistical power to run the analyses. However, it is worth noting that unlike the total scores used in the main analyses, there were no consistent trends in the correlations of family functioning subscales and HRQOL subscales on either the PedsQL^{TM} SF15 or the CFQ-R. There is a need to further examine these relationships in future studies to determine if there are significant trends in the areas of family functioning that impact the well-being of the child. Treatment burden analyses revealed consistent correlations with psychosocial HRQOL on the PedsQL^{TM} SF15. This finding may suggest that individuals who perceive their treatment to be difficult, time-consuming, and potentially interfering with other life domains are more likely to have psychological and social problems. Future studies should explore the psychological

impact of treatment burden on both children with CF and their parents, perhaps specifically within the domains of depression and anxiety.

Limitations

Although the current study is the first to examine relationships between family functioning, treatment burden and HRQOL in pediatric CF populations, there are a number of limitations that must be considered. First, the sample size of the study is relatively small and homogenous, with the majority of participants being of Caucasian descent. For this reason, the results of the current study may not generalize to all children with CF. Further, the sample is comprised of patients who regularly attend clinic visits with moderately healthy FEV_1 % at the time of participation and thus, may not be representative of individuals who do not receive appropriate medical care which may cause diminished clinical outcomes and lower HRQOL ratings.

Results from reliability analyses suggest that many of the subscales demonstrated poor to marginal reliability. There are some previous studies that have reported similar, marginal reliability on certain CFQ-R subscales, particularly the treatment burden subscale (Quittner, Sawicki, McMullen, Rasouliyan, Pasta, & Yegin, 2012). Thus, although this is consistent across studies, it demonstrates the need for continued development of measurement models for treatment burden in both children with CF and their parents. The poor reliability may also be a result of study procedures. Participants were recruited during their regularly scheduled clinic visits which tend to be lengthy in duration without research participation. As such, participants may have been completing

study questionnaires in-between provider visits or hurriedly at the conclusion of their appointments.

As a result of the small sample size and limited power, more complex statistical analyses could not be performed. Although the models tested in the current study accounted for a significant portion of HRQOL, there are other factors that likely contribute to HRQOL ratings.

Future Directions

There are a number of future research questions that need to be explored based on findings from the current study. First, it is important to replicate findings between treatment burden and HRQOL. While the current study found a significant relationship between the two constructs, future studies should utilize more diverse samples and those with greater disease severity to confirm the generalizability of the relationship. It is also important to continue investigating factors that contribute to HRQOL in children with CF. While the current study makes a significant improvement on development of a model to predict the general well-being of children with CF, however, exploration of additional factors is needed. These factors may including family SES, education level, peer relationships, and other contributing medical factors.

Future research should also focus on improving measurement of treatment burden for both self and parent-proxy report. A comprehensive, validated instrument could be useful in both research and clinical settings given the importance of treatment burden to children with CF. The current lack of comprehensive measures for treatment burden limits the ability to fully explore the construct and the impact it has on families

and children with CF. It is also important to begin exploring parents' own treatment burden perceptions. Given the role of parents in the management of their child's CF, understanding parents' own perceptions of treatment may provide insight into child adherence and medical outcomes.

Summary

The current study found that family functioning and treatment burden are related to HRQOL in pediatric CF. These relationships are consistent across child self-report and parent-proxy report beyond age and disease severity. The study findings confirm that there are a subset of families who function in the "unhealthy" range, which negatively impacts the HRQOL of the child with CF. These families could benefit from clinical interventions that promote more supportive interactions between family members and improve the general well-being in the child with CF. Further, the study is the first to suggest that treatment burden perceptions are an important predictor in the HRQOL of children with CF, emphasizing the need for improved measurement instruments for use in clinical settings. More globally, the study suggests that knowledge of the child's age, disease severity, family functioning, and treatment burden can assist in predicting the child's HRQOL and can inform prevention and intervention efforts to maintain physical and psychological well-being in children with CF.

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APPENDIX

Table 1.

Descriptive Statistics of Child and Parent Participants

	N	**%**
Child		
Gender		
Male	30	60 %
Female	20	40 %
Race/Ethnicity		
Caucasian	45	90 %
African American	2	4 %
Hispanic	3	6 %
FEV1 Score at Participation		
Normal (>80%)	32	64 %
Mild (60-80%)	8	16 %
Moderate (35-60%)	9	18 %
Severe (<35%)	1	2%
	Mean	**SD**
Age	12.6	3.1
Past Hospitalizations	1.03	1.30
	N	**%**
Parent		
Reporting Parent		
Mother	42	84%
Father	5	10%
Other	3	6%

Table 2.

Descriptive Statistics and Reliability for the FAD

	No. of Items	Mean	SD	Cronbach's Alpha
FAD Self-Report				
Problem Solving	6	1.96	0.43	0.59
Communication	9	2.41	0.29	0.62
Roles	11	2.60	0.53	0.35
Affective Responsiveness	6	2.73		0.64
Affective Involvement	7	2.91	0.60	0.76
Behavioral Control	9	2.57	0.34	0.46
General Functioning	12	2.33	0.26	0.80
FAD Parent-Report				
Problem Solving	6	1.87	0.30	0.49
Communication	9	1.94	0.33	0.60
Roles	11	2.26	0.35	0.68
Affective Responsiveness	6	1.74	0.35	0.52
Affective Involvement	7	1.92	0.35	0.56
Behavioral Control	9	1.63	0.29	0.54
General Functioning	12	1.68	0.31	0.70

Table 3.

Descriptive Statistics and Reliability for the PedsQL™

	No. of Items	Mean	SD	Cronbach's Alpha
PedsQL™ Self-Report				
Physical	5	74.20	19.32	0.74
Psychosocial	10	74.89	16.40	0.84
Total	15	74.67	14.30	0.83
PedsQL™ Parent-Report				
Physical	5	70.83	23.93	0.87
Psychosocial	10	66.82	18.73	0.87
Total	15	68.47	17.84	0.89

Table 4.

Descriptive Statistics and Reliability for the CFQ-R

	No. of Items	Mean	SD	Cronbach's Alpha
CFQR-Adolescent				
Physical	8	24.67	6.16	0.93
Roles	4	11.722	2.61	0.77
Vitality	4	10.421	1.95	0.59
Emotional	4	12.79	2.49	0.62
Social	6	10.89	3.29	0.44
Body Image	3	8.895	2.40	0.56
Eating	3	11.421	0.84	0.21
Treatment Burden	3	7.474	1.54	0.16
Health Perceptions	3	8.526	2.14	0.78
Respiratory	6	20.278	9.42	-0.09
Digestion	3	10.278	1.74	0.61
CFQR-Child				
Physical	6	19.763	3.32	0.72
Emotional	8	25.034	3.51	0.73
Social	7	20.33	3.55	0.52
Eating	3	10.00	2.26	0.84
Body Image	3	10.00	5.54	0.69
Treatment Burden	3	9.250	2.10	0.61
Respiratory	4	11.61	2.63	0.77
CFQR-Parent/Caregiver				
Physical	8	16.78	2.33	0.64
Vitality	5	15.21	2.29	0.59
School	4	12.74	2.12	0.42
Eat	2	6.27	1.71	0.59
Body Image	3	9.21	2.43	0.63
Treatment Burden	3	8.07	2.31	0.78
Health Perceptions	3	9.86	2.03	0.81
Respiratory	6	18.62	4.14	0.86
Digestion	3	9.07	2.05	0.72

Table 5.

Combined Means, Standard Deviations, and Correlations for Self-Report Predictors, Dependent Variables, and Moderators

Variables	1.	2.	3	4.	5.	6.	7.
1. Age							
2. FEV1% Current	-0.40*						
3. Past Hospitalizations	0.298*	-0.53**					
4. Peds QL SR Total	-0.18	0.04	-0.32*				
5. CFQR Treatment Burden	-0.40**	0.10	-0.17	0.36*			
6. General Family Functioning	-0.28*	0.24	-0.05	-0.29*	-0.15*		
7. SR Treatment Burden	-0.01	-0.24	-0.20	-0.31*	0.-22	0.28*	
Mean	12.6	81.54	1.02	74.83	61.94	1.71	2.87
Standard Deviation	3.07	20.49	1.30	14.14	23.60	0.43	1.66

Note. *Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)

Table 6.

Combined Means, Standard Deviations, and Correlations for Parent-Proxy Report Predictors, Dependent Variables, and Moderators

Variables	1.	2.	3.
1. PedsQL PR Total			
2. General Family Functioning	-0.34*		
3. CFQR Treatment Burden	0.46*	0.03	
Mean	67.74	1.68	56.32
Std. Deviation	18.36	0.31	25.70

Note. *Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)

Table 7.

Hierarchical Regression with Self-Report Family Functioning and Treatment Burden Predicting HRQOL.

Predictor	Beta	Se	T(df)	*p*
Step 1				
Age	-0.06	0.05	-1.19	0.24
FEV1% current	-0.01	0.01	-1.69	0.09
Past Hospitalizations	-0.32	0.13	-2.54	0.02*
Step 2				
Age	-0.07	0.05	-1.41	0.17
FEV1% current	-0.01	0.01	-1.06	0.30
Past Hospitalizations	-0.32	0.12	-2.72	0.01**
Self-Reported Treatment Burden	-0.28	0.14	-1.96	0.06
General Family Functioning	-0.25	0.15	-1.70	0.09
Step 3				
Age	-0.05	0.05	-1.07	0.30
FEV1% current	-0.01	0.01	-0.94	0.36
Past Hospitalizations	-0.31	0.12	-2.66	0.01*
Self-Reported Treatment Burden	-0.29	0.14	-2.07	0.05*
General Family Functioning	-0.22	0.15	-1.50	0.14
Family Functioning x SR Treatment Burden	-0.16	0.13	-1.30	0.20
Step 1				
Age	-0.06	0.05	-1.13	0.26
FEV1% current	-0.01	0.01	-1.60	0.12
Past Hospitalizations	-0.31	0.13	-2.46	0.02*
Step 2				
Age	-0.05	0.06	-0.85	0.40
FEV1% current	-0.01	0.01	-1.12	0.27
Past Hospitalizations	-0.27	0.12	-2.24	0.03*

CFQR Treatment Burden	0.23	0.16	1.47	0.15
General Family Functioning	-0.26	0.15	-1.74	0.09
Step 3				
Age	-0.04	0.06	-0.77	0.44
FEV1% current	-0.01	0.01	-0.78	0.44
Past Hospitalizations	-0.26	0.12	-2.09	0.04*
CFQR Treatment Burden	0.23	0.15	1.45	0.15
General Family Functioning	-0.22	0.17	-1.28	0.21
Family Functioning x CFQR Treatment Burden	0.10	0.18	0.56	0.58

Note. *Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)

Table 8.

Hierarchical Regression with Parent-Proxy Report of Family Functioning and Treatment Burden Predicting HRQOL

Predictor	Beta	Se	T(df)	*p*
Step 1				
CFQR Treatment Burden	0.35	0.14	2.51	0.19*
General Family Functioning	-0.18	0.14	-1.28	0.21
Step 2				
CFQR Treatment Burden	0.31	0.14	2.16	0.04*
General Family Functioning	-0.11	0.14	-0.72	0.48
Family Functioning x CFQR Treatment Burden	-0.15	0.16	-0.93	0.37

Note. *Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)

Table 9.

Correlations Between Self-Report FAD Subscales and PedsQL™ Subscales

Subscale	1.	2.	3.	4.	5.	6.	7.
1. FAD problem solving							
2. FAD Communication	0.59**						
3. FAD Roles	0.32*	0.27					
4. FAD Affective Responsiveness	0.41**	0.46**	0.12				
5. FAD Affective Involvement	0.25	0.46**	0.26	0.63**			
6. FAD Behavioral Control	0.26	0.34*	0.35*	0.40**	0.26		
7. PedsQL Physical Subscale	-0.22	0.01	0.01	0.19	0.22	0.20	
8. PedsQL Psychosocial Subscale	-0.10	-0.10	-0.18	-0.16	-0.17	-0.06	0.32*

Note. *Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)

Table 10.

Correlations between Self-Report FAD Subscales and CFQR Subscales

	1.	2.	3.	4.	5.	6.
1. FAD problem solving						
2. FAD Communication						
3. FAD Roles						
4. FAD Affective Responsiveness						
5. FAD Affective Involvement						
6. FAD Behavioral Control						
7. CFQR Physical	-0.10	-0.15	-0.11	0.02	0.20	0.02
8. CFQR Role	0.19	0.34	0.01	-0.17	-0.18	0.14
9. CFQR Vitality	0.15	0.04	-0.08	0.17	0.04	0.30
10. CFQR Emotion	0.04	-0.10	-0.20	-0.13	-0.14	-0.06
11. CFQR Social	0.03	0.01	-0.12	-0.15	0.09	-0.13
12. CFQR Body Image	-0.07	-0.11	-0.04	-0.45**	-0.49**	-0.29*
13. CFQR Eating	-0.11	-0.19	-0.26	0.04	-0.05	-0.07
14. CFQR Treatment Burden	0.05	0.06	-0.04	-0.08	-0.13	-0.17
15. CFQR Health	0.12	0.06	-0.09	-0.21	-0.17	-0.25
16. CFQR Weight	-0.03	-0.16	-0.26	-0.01	-0.04	-0.36
17. CFQR Respiratory	0.27	0.24	-0.10	0.08	0.32*	0.13
18. CFQR Digestive	-0.23	-0.29	-0.10	-0.20	-0.19	-0.13

Note. *Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)

Table 11.

Correlations between Parent-Proxy Report FAD Subscales and PedsQL™ Subscales

Subscale	1.	2.	3.	4.	5.	6.	7.
1. FAD Problem Solving							
2. FAD Communication	0.46**						
3. FAD Roles	-0.27	-0.02					
4. FAD Affective Responsiveness	0.40**	0.52**	0.01				
5. FAD Affective Involvement	0.33*	0.44*	0.20	0.46**			
6. FAD Behavioral Control	0.18	0.32*	0.13	0.13	0.26		
7. PedsQL Physical	0.01	-0.11	-0.28	0.19	-0.11	-0.60	
8. PedsQL Psychosocial	0.01	-0.08	-0.44**	-0.09	-0.21	0.13	0.55*

Note. *Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)

Table 12.

Correlations Between Parent-Proxy Report FAD Subscales and CFQR Subscales

	1.	2.	3.	4.	5.	6.
1. FAD problem solving						
2. FAD Communication						
3. FAD Roles						
4. FAD Affective Responsiveness						
5. FAD Affective Involvement						
6. FAD Behavioral Control						
7. CFQR Physical	0.63	0.10	-0.15	0.51**	-0.28	-0.16
8. CFQR Emotional	0.04	0.07	0.03	-0.05	-0.12	0.34
9. CFQR Vitality	0.15	0.02	-0.16	0.05	-0.30	-0.04
10. CFQR Eating	0.06	0.42*	-0.21	0.29	0.11	0.18
11. CFQR Body Image	-0.01	0.41*	-0.24	0.08	-0.16	0.11
12. CFQR Treatment Burden	0.29	0.15	-0.19	0.16	0.02	0.00
13. CFQR Health	0.19	0.26	-0.28	0.18	-0.08	0.06
14. CFQR Respiratory	-0.46*	-0.10	0.10	-0.10	-0.35	-0.31
15. CFQR Digestive	-0.05	0.29	-0.52**	0.13	-0.21	-0.03
16. CFQR Weight	-0.31	-0.05	0.27	0.02	-0.26	0.15
17. CFQR School	0.42*	0.29	-0.49*	-0.04	0.02	0.27

Note. *Correlation is significant at the 0.05 level (2-tailed) **Correlation is significant at the 0.01 level (2-tailed)