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Examining General versus Condition-Specific Health Related Quality of Life across Weight Categories in an Adolescent Sample

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Abstract

Approximately 34% of adolescents are overweight or obese which can be accompanied by physical, psychosocial, and economic consequences. Increasingly, pediatric overweight/obesity research has focused on Health Related Quality of Life (HRQoL) as a health outcome. This study examined differences in HRQoL across weight categories in adolescents, specifically, the sensitivity of using a general versus condition-specific measure. Further, the influence of gender was explored.

Data were extracted from Wave 2 of *Team Up for Healthy Living*, a school-based obesity prevention program targeting adolescents in Southern Appalachia. Participants ($N = 918$; 50% Female; 93% Caucasian; 90% 9th graders) completed the Pediatric Quality of Life (PedsQL) Inventory (general) and PedsQL Multidimensional Fatigue Scale (condition-specific) measures as part of a larger survey. Body mass index-for-age and -sex percentiles were calculated using actual height and weight, and students were classified as underweight, healthy weight, overweight, or obese according to Centers for Disease Control and Prevention (CDC) criteria.

Two 4 (weight category: underweight vs. healthy weight vs. overweight vs. obese) x 2 (gender: male vs. female) factorial analyses of variance (ANOVAs) were calculated to compare mean scores of total HRQoL (both generic and condition-specific). Additionally, 7 factorial multivariate analyses of variance (MANOVAs) were conducted with each measure's subdomains. Fisher's Least Significant Difference post hoc analyses were run to assess differences between groups, at a significance level of $p<0.05$.

The current study revealed no interaction effect between total HRQoL (assessed via the generic or condition-specific measure) and weight category and gender; however, main effects were found for both weight category (assessed via a generic measure only) and gender (assessed

via both generic and condition-specific measures). Additional research is needed to examine the impact of utilizing different measures and the potential role of gender as well as other factors that may influence HRQoL across weight categories. These issues are important as researchers to date utilize a variety of HRQoL measures making interpretation of findings difficult and often do not consider other variables such as gender that may influence findings.

Introduction

Prevalence

Pediatric overweight and obesity is an epidemic in the United States (U.S.) and worldwide. For U.S. adolescents ages twelve to nineteen, the prevalence of overweight and obesity is 34% with 18.4% being obese. Additionally, 13.9% of those adolescents meet the adult parameters for obesity (BMI greater than 30; Ogden, Carroll, Kit, & Flegal, 2012). Research has shown that the rates of overweight and obesity are even higher in ethnic minority groups (Ogden et al., 2012) and rural populations (Lutifyya, Lipsky, Wisdom-Behounek, & Inpanbutr-Martinkus, 2007).

The rates of overweight and obesity in the adolescent population have remained high over the last decade, and overweight and obese groups are presenting with higher and higher levels of body fat and more central waist obesity (Wang, 2011). Additional concerns include the physical and psychosocial health consequences and associated economic costs (Dietz, 1998; Griffiths, Parsons, & Hill, 2010; Harriger & Thompson, 2012; Wolf & Colditz, 1998). Based on these considerations, researchers have focused on better understanding etiological factors in an effort to develop programs to target pediatric overweight and obesity.

Causes

To date, research suggests that overweight and obesity is the result of excess energy intake and too little energy output [Centers for Disease Control and Prevention (CDC), 2013a]. Further, the CDC notes contributors to the overweight and obesity epidemic in children and adolescents to include factors such as easily accessible sugary drinks and unhealthy food options, too little quality daily physical activity, increasing portion sizes, lack of funds for healthier food choices, increased screen time, and lack of support for breastfeeding. For instance, breastfeeding

is shown to protect children from obesity, but in the United States only 13% of mothers breastfeed exclusively for the full first six months of life. Furthermore, children between the ages of eight and eighteen engage in media viewing (i.e. computer, telephone, video games, and television) for an average of seven and a half hours per day. These hours spent in sedentary activity take away from time that could be spent in physical activity. Additionally, unhealthy food is more convenient and affordable than healthier food choices; this is especially true in rural, lower income areas of the United States.

To prevent further increase in rates and complications related to overweight and obesity, national recommendations for both diet and regular physical activity have been established. For instance, adolescents (considered age 14 and above) are advised to consume two and a half to six and a half cups of fruits and vegetables and two to three ounces of whole grains per day while restricting sodium to no greater than 2,300 milligrams. Calorie intake is recommended to be limited to between 1,800 and 2,400 for adolescent females and 2,000 to 3,200 for adolescent males; however, those with more active lifestyles have a higher caloric need (CDC, 2013b; U.S. Department of Agriculture, U.S. Department of Health and Human Services, 2010). A study conducted by Krebs-Smith and colleagues in 2010 found that most Americans do not meet the recommended nutritional guidelines. More specifically, 86.6% of males and 84.8% of females age 14 to 18 consumed less than the recommended daily amount of fruit; 97% of males and 98.6% of females age 14 to 18 did not meet the recommended vegetable intake. Additionally, in a 2005-2006 sample of adolescents, approximately 2,800 to 4,800 mg of sodium were consumed each day (U.S. Department of Agriculture, U.S. Department of Health and Human Services, 2010). Adolescents also fell short of meeting the whole grain recommendations with 99.8% of

both males and females eating less than the suggested amount (Krebs-Smith, Guenther, Subar, Kirkpatrick, & Dodd, 2010).

The nationally recommended amount of daily exercise is 60 minutes of moderate to vigorous activity (Gidding, Dennison, Birch, Daniels, Gilman, Lichtenstein, Rattay, Steinberger, Stettler, & Van Horn, 2005; U.S. Department of Agriculture, U.S. Department of Health and Human Services, 2010). Research shows that only 8% of adolescents in the U.S. participate in this recommended amount of exercise (Shultz, Anner, & Hills, 2009). Also, according to the national Youth Risk Behavior Survey, conducted in the spring every two years in all high schools, the amount of days students spend in physical education classes per week has decreased by almost 10% since 1991 (Youth Risk Behavior Surveillance System, 2009). Clearly, consideration of environmental and behavioral factors is necessary for understanding the development of overweight and obesity.

Consequences

As alluded to previously, overweight and obesity carries with it a number of potential consequences. Physical health consequences associated with obesity include musculoskeletal effects (impaired mobility, knee and back pain, increased risk of fractures, lower extremity misalignment) and increased risk of chronic illnesses, such as type two diabetes (due to abnormal glucose tolerance), hyperlipidemia, hypertension, coronary heart disease, hepatic stenosis, gall stones, sleep apnea, and certain cancers (Dietz, 1998; Shultz, Anner, & Hills, 2009; Wolf & Colditz, 1998). Examples of poorer adolescent-reported physical functioning included difficulty running and low energy (Keating, Moodie, & Swinburn, 2011). Overweight and obese adolescents are also reported to mature earlier (than healthy weight adolescents), which has been associated with increased risk of obesity throughout life (Dietz, 1998). Studies have shown that

overweight and obese children and adolescents are at a higher risk of being overweight or obese as adults (Kuhl, Rausch, Varni, & Stark, 2012).

Adolescents also report psychosocial consequences of overweight and obesity including impaired social functioning such as rejection or victimization by peers, feelings of unattractiveness, eating disorders, lower self-esteem, and poorer HRQoL (Dietz, 1998; Griffiths, et al., 2010; Keating, Moodie, & Swinburn, 2011; Neumark-sztainer, 2005; Tsiros, Olds, Buckley, Grimshaw, Brennan, Walkley, Hills, Howe, & Coates, 2009). The psychosocial consequences of overweight and obesity may also continue throughout adulthood and the effects of social isolation are thought to significantly impact young adults (Dietz, 1998; Sarwer & Dilks, 2012). Overweight/obese adolescents, particularly females, are likely to complete less education and make less money than their peers; the rates of adult poverty are higher in overweight and obese individuals than in normal weight adults. Individuals who are overweight/obese as adolescents also have lower rates of marriage than healthy weight peers (Dietz, 1998; Sarwer & Dilks, 2012).

The economic consequences of obesity include not only higher health care costs, also known as direct costs (i.e. more frequent provider visits and treatment of comorbidities), but also include production losses due to limitations of obese and overweight individuals, referred to as indirect costs (Harvard School of Public Health, 2014). In 1995, the total economic impact of overweight and obese individuals in the United States totaled around $99.2 billion (Ogden, Carroll, Kit, & Flegal, 2012; Wolf & Colditz, 1998). In 2005-2006, researchers estimated that the annual cost of obesity was between $147 billion and $190 billion depending on the analysis method used and the exclusion criteria for the sample (Cawley & Mayerhoefer, 2012; Finklestein, Trogdon, Cohen, & Dietz, 2009). Furthermore, if obesity rates remain steady,

associated health care costs could increase by $48 billion to $66 billion a year for all subsequent years (Wang, McPherson, Marsh, Gortmaker, & Brown, 2011).

HRQoL

HRQoL is recognized by the World Health Organization as an important dimension of health that is affected by chronic conditions like overweight and obesity, although the effects vary among chronic conditions and may depend on severity (Tsiros, et al, 2009). HRQoL is a concept that encompasses the assessment of well-being in various aspects of life including physical and emotional functioning, mental status, and social well-being (Riazi, Shakoor, Dundas, Eiser, & McKenzie, 2010; Swallen, Reither, Haas, & Meier, 2005). Understanding HRQoL may further define the burden caused by preventable diseases such as overweight and obesity; this understanding may then guide policies and plans for intervention (CDC, 2012). In fact, the National Institute of Health Strategic Plan, which directs future research in obesity prevention and intervention, notes the importance of a multidisciplinary approach to understanding and addressing obesity including a focus on the behavioral health consequences including HRQoL (U.S. Department of Health and Human Services, National Institutes of Health, 2011). Furthermore, *Healthy People 2020*, the latest national set of health objectives and outcomes desired to be achieved by the year 2020, includes promoting quality of life at all stages of life as an overarching goal (U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, 2010). Together, these factors suggest HRQoL is an important health outcome.

Pediatric Overweight/Obesity and HRQoL

Increasingly, pediatric obesity research has included a focus on HRQoL. Overall, the cross-sectional literature suggests that overweight or obese children and adolescents report

significantly lower HRQoL than their healthy weight peers (Tsiros, et al, 2009). However, the results from different studies examining these variables differ slightly on which of the specific dimensions of HRQoL are associated with overweight/obesity. This variability in results could potentially be attributed to variances in measures of HRQoL (Griffiths, et al, 2010).

Total or overall HRQoL is consistently lower among overweight/obese adolescents compared to healthy weight peers (Griffiths, et al, 2010; Tsiros, et al, 2009; Ul-Haq, et al, 2013). In fact, only one cross sectional study to date fails to support that overweight and obese adolescents report lower overall or total HRQoL (Khodaverdi F., Alhani, Kazemnejad, & Khodaverdi Z., 2011). Decreased physical HRQoL has been the dimension of HRQoL most consistently and strongly associated with overweight or obesity throughout cross sectional studies (Griffiths, et al, 2010; Tsiros, et al, 2009). Although the associations between obesity and psychosocial HRQoL are less supported and investigated at this time than the findings for physical HRQoL, evidence shows that social and emotional aspects of HRQoL are diminished in obese adolescents (Ul-Haq, et al, 2013). Recent reviews suggest studies report lower social HRQoL in obese adolescents to some degree, with the majority reporting significantly lower scores (Griffiths, et al, 2010; Tsiros, et al, 2009). Additionally, emotional or psychological functioning is impaired in obese adolescents in several cross sectional studies; however the level of significance varies between self- and parent-proxy measures, so overall the scores have not been considered significantly lower than scores for healthy weight youth (Griffiths, et al, 2010; Tsiros, et al, 2009). A limited number of studies to date find no association between overweight/obese youth (as compared to healthy weight) and social or emotional HRQoL (i.e.,Khodaverdi F., et al., 2011; Swallen, et al., 2005; Tsiros, et al., 2009). Inverse associations are now becoming consistent across many other quality of life dimensions, such as physical

functioning/mobility and pain, mental health, emotional role, social/interpersonal functioning, and overall health as self-reported by adolescents on a variety of measures including: the SF-36, the EQ-5D, and the IQQOL-Adolescents (Griffiths, et al., 2010; Kolotkin, Norquist, Crosby, Suryawanshi, Teixeira, Heymsfield, Erondu, & Nguyen, 2009; Riazi, et al., 2010; Tsiros, et al., 2009; Ul-Haq, et al., 2013).

Some studies have begun to examine demographic variables associated with HRQoL including gender. Although limited in number, these studies show that females tend to report lower HRQoL than males, particularly in the physical functioning subdomain (Tsiros, et al., 2009; Keating, et al., 2011), with only one study to date showing that males report lower HRQoL than females (Wake, Salmon, Waters, Wright, & Hesketh, 2002). The prevalence of overweight/obesity in adolescents has not been found to significantly differ in regard to gender. Specifically, 34.6% of male adolescents are overweight/obese and 32.6% of female adolescents are overweight/obese (Ogden, et al., 2012).

Weight Loss and HRQoL

HRQoL has also become the focus of several weight loss intervention studies. In a review by Griffiths and colleagues, all intervention studies with overweight or obese youth (n = 5) reporting significant decreases in BMI also reported significant increases in physical/general and emotional/psychological HRQoL. Another review of HRQoL literature conducted by Tsiros and colleagues revealed that seven studies that examined HRQoL related to weight loss (through camps, diet and exercise, and surgery) reported statistically significant increases in total HRQoL following weight loss. Furthermore, significant increases in physical functioning were consistently reported on the following measures: PedsQL, parent report Child Health

Questionnaire (CHQ), Impact of Weight on Quality of Life Questionnaire (IWQOL) for adolescents and kids, KINDL. Tsiros and colleagues also reported that five of seven intervention studies showed increases in all HRQoL examined areas of functioning (i.e., overall, physical functioning, social functioning, emotional functioning, and school functioning). The remaining two studies recognized improvements in all areas except psychosocial functioning. One study to date examined the role of gender in a weight loss intervention and found no significant gender differences in HRQoL at baseline or improvements of HRQoL across treatment despite boys losing significantly more weight than girls (Knopfli et al., 2007). These findings coupled with cross-sectional data showing differences in HRQoL based on gender suggest further examination of the role of gender related to both weight status and HRQoL.

Several methodological factors should be considered when interpreting results of both cross-sectional and weight loss studies assessing HRQoL such as the range of weight status and degree of overweight among the sample, whether or not the informant was the child or parent, the specific measure used, and whether or not the HRQoL measure was generic or condition-specific (Cremeens, Eiser, & Blades, 2006; Matza, Swensen, Flood, Secnik, & Leidy, 2004; Tsiros, et al, 2009).

Generic and Condition-Specific HRQoL Measures

Past research examining the relationship between weight status and HRQoL has used a variety of measures for assessing HRQoL. Questionnaires differ in scope from generic to condition-specific. The most widely used generic measure for adolescents is the Pediatric Quality of Life Inventory, Version 4.0 (PedsQL), which is a 23-item set of five-point Likert scale questions to measure total HRQoL and subdimensions including physical and psychosocial HRQoL, the latter of which includes assessment of HRQoL related to social, school, and

emotional functioning (Varni, Limbers, Bryant, & Wilson, 2010). Several other generic instruments can be found in the literature such as the UK version 4 of the PedsQL for children and adolescents, the Youth Generic Quality of Life Scale (YQOL-S) for assessing adolescent HRQoL, the SF-36 (Medical Outcomes Study Short Form Health Survey, Version 2.0), the Visual Analog Scale, the General Well-Being Scale, the General Health Rating Index, the Sickness Impact Profile, and EQ-5D for assessing older adolescent and adult HRQoL (Kolotkin, et al, 2009; Maciejewski, Patrick, & Williamson, 2005; Patrick, Skalicky, Edwards, Kuniyuki, Morales, Leng, & Kirschenbaum, 2011; Riazi, et al., 2010).

Several studies have also used condition-specific HRQoL measures intended to assess qualities most likely to be affected by specific conditions. Studies focused on this topic cite instruments such as the Impact of Weight on Quality of Life-Kids and the PedsQL Multidimensional Fatigue Scale (examining General Fatigue, Sleep/Rest Fatigue, and Cognitive Fatigue domains) for children and adolescents (Kolotkin, Zeller, Modi, Samsa, Quinlan, Yanovski, Bell, Maahs, Serna, & Roehrig , 2006; Maciejewski, Patrick, & Williamson, 2005; Varni, et al., 2010). Other measures specifically for adolescents include Sizing Them Up and the Youth Quality of Life- Weight Specific (YQOL-W) (Modi & Zeller, 2008; Patrick, et al., 2011). Finally, the Impact of Weight on Qualtiy of Life-Lite (IWQOL-Lite) or the IWQOL-Adolescents are measures used for older adolescents and adults (Griffiths, et al., 2010; Kolotkin, et al, 2009). Research has found that these condition-specific measures are reportedly more likely to identify increases in HRQoL as a result of weight loss than generic measures (Maciejewski, et al., 2005; Matza, et al., 2004). The sensitivity of the measure utilized is an important consideration when interpreting HRQoL outcomes from weight loss trials. Few of these condition-specific measures have been used alongside a generic measure to compare results within the same population

although researchers have called for this type of research (Kolotkin, et al., 2009; Maciejewski, et al., 2005).

Despite the number of available assessment instruments, little literature has compared differences in HRQoL based on the measure used. In fact, as alluded to previously, few studies to date have used both generic and condition-specific measures within the same population. One exception is a study by Varni and colleagues examining the reliability, feasibility, and validity of the Pediatric Quality of Life Inventory Multidimensional Fatigue Scale along with the Generic Pediatric Quality of Life Inventory. The findings showed that children with obesity reported significantly lower condition-specific (i.e., assessed via the Multidimensional Fatigue Scale, which focuses on pain and fatigue) HRQoL than healthy weight children (2010). However, the study did not directly compare differences in participants' HRQoL across weight categories as a function of the measure utilized (i.e., both the generic and condition-specific measures). Another study by Patrick and colleagues followed adolescents (ages eleven to nineteen) through a four week weight loss camp and demonstrated that the Youth Quality of Life-Weight Specific (YQOL-W) was more sensitive to differences in quality of life associated with weight loss than the generic Youth Quality of Life scale (YQOL-S). Although the sensitivity differences were only slight, when controlling for other variables, including gender, age, and weight at baseline, the weight-specific measure scores remained significantly associated with weight loss and the generic scores did not. Although this study is supportive of the idea that condition-specific measures are especially sensitive to weight-related issues of HRQoL, this study used one specific measure and was conducted on overweight and obese participants at a weight loss camp (2011).

Current Study

Pediatric overweight and obesity are growing problems worldwide and concerning because of research documenting that overweight and obesity tend to worsen through childhood and continue throughout adult life (Kuhl, et al., 2012). Physical and psychosocial health consequences coupled with healthcare costs (Dietz, 1998; Griffiths et al, 2010; Wolf & Colditz, 1998) direct attention to the need to better understand factors contributing to overweight and obesity in an effort to develop effective prevention and intervention programs. HRQoL has been identified as an important domain of psychosocial health as well as a target for overweight and obesity initiatives (CDC, 2012; U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion, 2010). Findings to date on the relationship between pediatric obesity and HRQoL as well as the relationship between weight loss and HRQoL are sometimes mixed. Studies frequently differ in methodology, including types of HRQoL measures used, thus potentially accounting for some of the mixed findings across studies. This study was a first step to better understanding differences associated with using the generic Pediatric Quality of Life Inventory versus the condition-specific measure of HRQoL across weight categories in a community sample of adolescents.

The primary aim of this investigation was to examine differences in HRQoL across weight categories in a school-based sample of adolescents in east Tennessee. Specifically, the researchers assessed the sensitivity of a general (Pediatric Quality of Life Inventory Version 4.0) versus condition-specific (PedsQL Multidimensional Fatigue Scale) HRQoL measure in differentiating HRQoL across weight categories. Few studies to date have utilized both generic and condition-specific HRQoL measures within the same sample, which is essential to interpreting findings and health outcomes. Based on the limited research to date, the researchers

hypothesized that overweight and obese youth (compared to healthy weight adolescents) would report significantly lower total HRQoL and that this difference would be even more pronounced using the condition-specific as compared to the generic HRQoL measure (i.e., the condition-specific measure will be more sensitive).

The secondary study aim was to explore the influence of gender on weight status and HRQoL. Literature to date has mixed findings on the relationship between HRQoL and gender; however, the trend is that female adolescents report lower HRQoL than male peers (Tsiros et al., 2009). Further, a study by Kolotkin and Crosby (2002) found that HRQoL was lower in adult women than men, controlling for BMI. Differences in HRQoL across weight categories may also be more pronounced in female adolescents compared to male adolescents due to the additional pressures of Western culture and media on young women to maintain a thin physique (Benowitz-Fredricks, Garcia, Massey, Vasagar, & Borzekowski, 2012). The researchers hypothesized that female adolescents would report lower total HRQoL than their male classmates. Furthermore, the researchers hypothesized that HRQoL would better differentiate among overweight and obese females compared to healthy weight females, specifically measuring lower HRQoL scores compared to males. Additionally, the researchers hypothesized that gender would act as a moderator between HRQoL and weight status, with more pronounced differences in HRQoL across weight categories for females.

Methods

Participants

Participants in the current study were part of a larger school-based obesity prevention study, *Team Up for Healthy Living*, which assessed the effectiveness of an 8-session peer-

delivered curriculum in *Lifetime Wellness* courses of participating high schools (Slawson, Dalton, Wang, Southerland, Schetzina, Littleton, Stoots, Mozen, Lowe, Relyea, McKeehan, & Wu, Manuscript Under Review). The larger study, which consisted of a cluster-randomized controlled trial, was initiated in two waves over the course of a year (spring 2012 and fall 2012). The current study used data collected at baseline during Wave 2 of the *Team Up for Healthy Living* project.

The inclusion criteria for participation included attendance at one of ten selected rural high schools in east Tennessee and enrollment in the *Lifetime Wellness* course during one of the two waves of data collection. Adolescents in the course were excluded if they presented with one of the following preexisting conditions or situations: a clinically diagnosed eating disorder, current participation in a weight management program, dietary or exercise restrictions at the time of the study, or underlying health conditions that could impact weight, such as Cushing's syndrome, steroid medication use, hypothyroidism, and/or a confirmed pregnancy.

Procedures

To confirm consent for participation, students were given a form for a parent to sign in the event that parents did not wish for their children to participate. If the form was not returned to the school, then parental assent was assumed. Adolescents wishing to be included in the study were then required to sign an informed consent document after the procedure was explained. Participants had the option to withdrawal from the study at any time.

Students completed a survey, which assessed a variety of health-related factors including HRQoL at baseline. The surveys were completed in the classroom or gymnasium in which the *Lifetime Wellness* class met. During the completion of the survey, trained graduate and

undergraduate research assistants as well as the *Lifetime Wellness* instructor were available to provide any needed clarification and check the surveys for completeness when finished. In addition to survey completion, participants' actual weight and height were measured by trained graduate and undergraduate research assistants.

Measures

Demographics

The demographic data collected and analyzed in this study included: age in years and months, gender, grade in high school, parental education, family income, race/ethnicity, school attended, and home address. Age was calculated using the participants' date of birth and the date of measurement or survey completion. Gender was assessed with the question: "What is your gender?" which had answer choices "A. Female" and "B. Male." Grade was measured with the self-report question, "What grade are you in?" followed by a blank for the response (i.e. "8" through "12"). Parental education was addressed in a small chart which said: "highest level of education that your parents completed." Possible responses for both mother and father included: "less than high school," "high school graduate or GED," "some college," "college degree (Bachelor's)," or "I don't know." The question regarding family income was "Family household income:" with answer options "under $20,000," "$20,000-$44,999," "$45,000-$74,999," "$75,000 or more," and "I don't know." Race or ethnicity was assessed by asking "How do you describe yourself?" Possible responses included: "American Indian or Alaska Native," "Asian," "Black or African American," "Hispanic or Latino," "Native Hawaiian or Other Pacific Islander," "White Caucasian non-Hispanic or non-Hispanic or non-African American," and "other," with the last option leaving room for an open response.

Generic Pediatric Quality of Life Inventory Version 4.0 (PedsQL)

The generic measure of HRQoL utilized in this study was the PedsQL Version 4.0. This instrument includes 23-items which measure different HRQoL dimensions for children and adolescents. Respondents are asked to rate on a five-point Likert scale the degree to which a statement has been a problem for them over the past month. Possible responses include: "never," "almost never," "sometimes," "often," or "almost always." The measure consists of four subsets of statements. The first set of statements relate to problems about participants' physical health and activities, such as "It is hard for me to run" with the previously described response choices. The second set of questions relates to respondents' emotions; for instance, "I feel sad or blue" and "I have trouble sleeping." The third set of statements involves how well participants get along with their peers or their social functioning. These statements include "Other teens do not want to be my friend" and "It is hard to keep up with my peers," for example. The final subcategory of statements relate to school functioning and assess factors like, "I forget things," "I miss school because of not feeling well," and "It is hard to pay attention in class" (Varni, 1998b). The responses to the survey questions contribute to a total HRQoL score as well as scores for two subdimensions (physical and psychosocial HRQoL). Additionally, psychosocial HRQoL is further divided into emotional, school, and social HRQoL domain scores (Varni, et al., 2010). This instrument has strong psychometric properties, and has consistently received high reliability and validity scores (Varni, Burwinkle, & Seid, 2006; Varni, Burkwinkle, Seid, & Skarr, 2003; Varni, Seid, & Kurtin, 2001). Higher scores on the instrument indicate higher levels of HRQoL, and lower scores reflect lower levels of HRQoL.

Pediatric Quality of Life Multidimensional Fatigue Scale

The condition-specific instrument for HRQoL used in this study was the Multidimensional Fatigue Scale. This measure includes 18 questions that assess fatigue levels in the pediatric population. Six questions are linked to each subdimension of fatigue, which include the General Fatigue Scale (i.e. "I feel too tired to do things that I like to do"), Sleep/Rest Fatigue Scale (i.e. "I feel tired when I wake up in the morning"), and the Cognitive Fatigue Scale (i.e. "It is hard for me to remember what I just heard"; Varni, 1998a). The Likert scale includes five response options on a continuum from "never" to "almost always". The psychometric properties of the Multidimensional Fatigue Scale have been demonstrated with children who are obese (Varni et al., 2010) as well as in populations of young adults and child and adolescent cancer patients (Tomlinson, Hinds, Ethier, Ness, Zupanec, & Sung, 2013; Varni & Limbers, 2008). Higher scores on the instrument indicate higher levels of HRQoL, and lower scores reflect lower levels of HRQoL.

Anthropometrics

Height and weight were measured and used to calculate standardized body mass index (*z*BMI) and percentile scores. Specifically, height was measured by undergraduate and graduate research assistants using a SECA 213 height rod. Students were instructed to stand with their backs to the wall and with their heels flat against the instrument; research assistants asked students to "stand up straight and keep [their] feet flat on the floor". The research assistants were trained to ensure that students followed these instructions. Weight was measured using an OHAUS Model SD200 scale. Height and weight were both recorded using metric units, and then each measurement was repeated with the same procedure. In the instances for which a

discrepancy of greater than 0.5cm for height or greater than 0.3kg for weight was recorded, a third measurement was collected. These measurements were then averaged in order to record a more accurate height and weight than was possible with only one measurement.

CDC SAS syntax was used to calculate standardized *z*BMI scores and percentile scores from the gathered measurements based on the 2000 CDC growth charts (Kuczmarski, Ogden, Guo, Grummer-Strawn, Flegal, Mei, Wei, Curtin, Roche, Johnson, 2002). Participants were assigned to one of four CDC weight categories based on their percentile scores [i.e., underweight (less than the 5th percentile for gender and age), healthy weight (5th-84th percentile for gender and age), overweight (85th-94th percentile for gender and age), or obese (equal to or more than the 95th percentile for gender and age); CDC, 2011].

Data Analysis

Descriptive statistics (i.e., means, standard deviations, and frequencies) for all demographic variables and variables of interest were calculated. A factorial analysis of variance (ANOVA) was calculated to compare mean scores of total HRQoL across weight category and gender. The first fixed factor independent variable, the weight category, had four levels (i.e., underweight, healthy weight, overweight, and obese). The second fixed factor independent variable, gender, had two categorical levels (male and female). The dependent variable was the total HRQoL score calculated with the generic measure (PedsQL). A second factorial ANOVA was then calculated with the same independent variables but total HRQoL from the condition-specific measure (Multidimensional Fatigue Scale) as the dependent variable. Each analysis assessed for interaction and main effects for weight status and gender on total generic PedsQL or total condition-specific Multidimensional Fatigue Scale scores.

Furthermore, in order to assess for interaction and main effects of weight status and gender on subdomain scores of each measure, a set of factorial multivariate analyses of variance (MANOVA) tests were conducted. The first 4 MANOVAs included two independent variables, the weight category (i.e., underweight, healthy weight, overweight, or obese) and gender (male or female). The dependent variables were the PedsQL HRQoL subdomain scores (i.e., physical, social, school, and emotional). A second set (3) of factorial MANOVAs had the same independent variables with the dependent variables being the Multidimensional Fatigue Scale subdomain scores (i.e., general fatigue, sleep/rest fatigue, and cognitive fatigue). Fisher's Least Significant Difference (LSD) post hoc analyses were run to assess differences between groups, at a significance level of 0.05.

Results

Sample Characteristics

Gender was equally distributed (50% Female) in this primarily Caucasian sample (93%) with nearly 90% of the sample being 9th graders. Approximately half of the sample fell into the healthy weight category, and the majority of remaining participants fell into the overweight or obese category (27.3% obese) with less than 2% of participants falling into the underweight category. Additional sample characteristics can be found in Table 1.

Pediatric Overweight/Obesity and Generic HRQoL

A factorial ANOVA using the PedsQL total score as the dependent variable yielded no interaction effect between weight category and gender, $p = .681$, however, a main effect for both weight category, $F(3, 910) = 3.52$, $p = .015$, and gender, $F(1, 910) = 7.87$, $p = .005$ was found. Fisher's LSD post hoc analyses identified significant differences between healthy weight and obese participants ($p = .017$) and between overweight and obese participants ($p = .018$). Obese

participants, *M* = 74.14, *SD* = 14.28, reported significantly lower health related quality of life than both healthy weight, *M* = 76.77, *SD* = 14.26, and overweight participants, *M* = 77.37, *SD* = 14.31. Female participants across all weight categories, *M* = 73.98, *SD* = 13.90, reported significantly lower HRQoL scores than male participants across all weight categories, *M* = 78.35, *SD* =14.31.

The MANOVA analyses using the PedsQL subdomains as dependent variables revealed no interaction with weight category and gender. However, a main effect for the weight category was found, $F(3,900) = 2.63$, $p=.002$. A significant difference was identified for the PedsQL physical HRQoL subdomain, $F(3,900) = 7.29$, $p<.001$. Fisher's LSD post hoc analyses showed that there was a significant difference in physical HRQoL between healthy weight and obese participants ($p < .001$) and between overweight and obese participants (p=.001). Obese participants, *M* = 77.29, *SD* = 15.53, reported significantly lower HRQoL than both healthy weight, *M* = 81.45, *SD* = 15.49, and overweight participants, *M* = 82.22, *SD* = 14.82. Means and standard deviations for generic HRQoL scores are shown in Table 2.

A main effect for gender was also found, $F(1, 900) = 3.42$, $p =.009$). Female participants, *M* = 77.24, *SD* = 15.13, had significantly lower physical HRQoL, $F(1,900) = 8.79$, $p=.003$, than male participants, *M* = 83.62, *SD* = 15.15. Female participants, *M* = 66.82, *SD* = 20.24, had significantly lower emotional HRQoL, $F(1,900) = 6.45$, $p=.011$, than male participants, *M* = 75.38, *SD* = 19.75. Female participants, *M* = 69.68, *SD* = 17.62, had significantly lower school HRQoL than male participants, *M* = 70.93,*SD* = 18.55; $F(1,900) = 5.73$, $p =.017$. No significant difference in male scores, *M* = 80.37, *SD* = 18.43, compared to female scores, *M* = 80.39, *SD* = 16.57, for social HRQoL was found.

Pediatric Overwieght/Obesity and Condition-Specific HRQoL

The factorial ANOVA utilizing the Multidimensional Fatigue Scale total score as the dependent variable also showed no interaction effect between weight category and gender, (p>.05). No main effects of total HRQoL across weight category were found; however, a main effect for gender was found, $F(1, 910) = 5.54$, p=.019. Female participants across all weight categories, $M = 67.92$, $SD = 16.06$, reported significantly lower HRQoL than male participants across all weight categories, $M = 71.84$, $SD = 16.06$.

The MANOVA analyses using the condition-specific subdomains as dependent variables showed no interaction effect between weight category and gender, p>.05. Additionally, no significant main effects across weight categories or gender for any of the subdomains were found, p>.05. Means and standard deviations for condition-specific HRQoL scores are shown in Table 3.

Discussion

Consistent with previous literature (Griffiths, et al., 2010; Tsiros et al., 2009), total HRQoL assessed via the generic PedsQL was significantly lower in obese compared to both healthy weight and overweight participants. However, HRQoL was not significantly lower in overweight compared to healthy weight participants, which was unexpected because some research suggests that overweight participants also have lower HRQoL scores than their healthy weight peers (Ul-Haq, et al., 2013). Obese participants also reported lower physical HRQoL than both overweight and healthy weight peers, which is consistent with the literature for the physical subdomain (Griffiths, et al., 2010; Tsiros et al., 2009). In the current study, no significant differences across weight categories for the remaining subdomains (psychosocial, emotional,

social, and school) were found. This is consistent with current literature reporting mixed findings for these subdomains.

The current study also examined the role of gender across weight categories and generic HRQoL. Findings revealed no interaction effects. However, females reported significantly lower total HRQoL as well as lower physical, emotional, and school subdomain scores using the generic measure. These findings build on research to date indicating females tend to report lower HRQoL than males (Tsiros, et al., 2009; Keating, et al., 2011). Therefore, the results regarding gender are also consistent with the developing literature.

The findings for condition-specific HRQoL scores were inconsistent with recent reviews of the literature (Maciejewski, et al., 2005; Matza, et al., 2004) as well as a study validating the Multidimensional Fatigue Scale for use with overweight and obese adolescents (Varni et al., 2010). Although the current literature suggests that obese adolescents report lower total HRQoL on this measure than their healthy weight peers, this study found no significant differences in scores between weight categories. Additionally, this indicates that in this study's sample the Multidimensional Fatigue Scale assessing condition-specific HRQoL was not more sensitive than the PedsQL 4.0. These findings are inconsistent with the researchers' hypothesis which was guided by related studies to date (Maciejewski et al., 2005; Matza et al., 2004).

One possible explanation for these findings is that the current sample has a higher percentage of overweight and obese participants and was not nationally representative. Specifically, 47.7% of the current sample was categorized as overweight or obese, with over 27% being obese compared to national statistics of 34% overweight or obese and 18.4% obese. Increased frequency of overweight and obesity in this sample could contribute to shifting norms or less perceived differences in HRQoL compared to healthy weight peers in this east Tennessee

region. Further, this sample reported lower mean generic total HRQoL score (M = 76.16; SD = 14.26) than a national healthy sample (M = 83.84; SD = 12.65) and slightly higher than an obese sample (M = 74; SD = 14.20); both samples were described previously (Varni, Limbers, & Burwinkle, 2007). Future research should examine potential reasons for lower HRQoL in adolescents in southern Appalachia compared to other samples.

Another explanation may be related to the use of the condition-specific measure which was validated with an obese sample. Instead, the study compared findings in the obese sample to a cancer and healthy sample. Additionally, this study did not identify the weight category of participants in the healthy sample (Varni et al., 2010). Furthermore, other studies that have examined HRQoL with this condition-specific measure focus on changes in HRQoL related to weight loss (Maciejewski et al., 2005) rather than cross-sectional comparisons based on weight status.

Similar to findings with the generic measure, use of the condition-specific measure showed that females reported lower HRQoL than males for total HRQoL as well as for the Sleep/Rest and Cognitive Fatigue subdomains. Additionally, as with the PedsQL (general HRQoL measure), no interaction effect among gender, weight category, and HRQoL score was found.

Strengths and Limitations

This study has several strengths including a relatively large sample size (n=918), even gender distribution (50% female), focus on an underserved population in southern Appalachia, the use of two different HRQoL measures within the same population, and psychometrically sound measures (Varni et al, 2006; Varni et al, 2010). However, some limitations exist as well. Namely, the condition-specific measure used was designed for chronic conditions associated

with pain and fatigue, not specifically obesity; although the measurement properties have been demonstrated for use with pediatric obesity (Varni, 2010). Additionally, the current study was a cross-sectional study, and therefore, the sensitivity of each measure related to weight loss efforts was not assessed. Lastly, the sample population was predominantly Caucasian (93.6%), which limits the generalizability of the results to other ethnic groups. Future research is needed on a variety of generic and condition-specific measures used within both cross-sectional and intervention studies with participants across all weight categories (i.e.- underweight, healthy weight, overweight, and obese) from more diverse populations. This research may guide interpretation of studies using different methodologies. Further, future research should explore the role of gender related to HRQoL and weight status because little is currently known about the influence of gender across weight categories.

Clinical Implications

Clinicians should use caution when interpreting and comparing the findings of current HRQoL studies as the variety of measures may influence outcomes. Health care providers should recognize HRQoL as a significant health outcome and explore the factors that influence HRQoL including weight status and gender, as well as other psychosocial variables such as cultural norms and weight perception. Further studies to better understand influences on HRQoL and its subdomains can guide practice interventions for improving overall HRQoLin adolescents.

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Table 1

Sample Characteristics

Demographic	N (*M*, *SD*) or N(Valid %)
Age (Calculated from Participant's Date of Birth to Date of Measurement)	918 (*M*=14.70; *SD*=0.72)
Grade in High School	
8th Grade	4(0.4)
9th Grade	800(89.2)
10th Grade	56(6.2)
11th Grade	22(2.5)
12th Grade	14(1.6)
Gender	
Male	459(50)
Female	459(50)
Race	
White/Caucasian, non-Hispanic	829(93.6)
Black or African American	4(0.5)
Hispanic or Latino	24(2.7)
Asian	3(0.3)
American Indian/Alaska Native	7(0.8)
Native Hawaiian/Pacific Islander	1(0.1)
Other	18(2.0)
Education Level (Mother)	
Less than high school	55(6.2)
High School Diploma or GED	254(28.8)
Some College	194(22.0)
College Degree	232(26.3)
I don't know	148(16.8)
Education Level (Father)	
Less than high school	74(8.4)
High School Diploma or GED	287(32.7)
Some College	139(15.8)
College Degree	180(20.5)
I don't know	197(22.5)
Family Household Income	
Under $20,000	34(3.8)
$20,000-$44,999	68(7.5)
$45,000-$74,999	67(7.4)
$75,000 or more	74(8.2)
I don't know	658(73.0)
Weight Category	
Underweight	11(1.2)
Healthy Weight	469(51.1)
Overweight	187(20.4)
Obese	251(27.3)