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UNDERSTANDING THE RELATION BETWEEN SOCIO-ECONOMIC STATUS AND CHILD WEIGHT STATUS WITHIN A MULTIDISCIPLINARY WEIGHT CONTROL TREATMENT (82 PP.)

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Pediatric obesity is a major health concern within the United States. Obesity risk is exacerbated among children and adolescents from low-socioeconomic status (SES) families. Low-SES status has been related to decreased success in behavioral weight control (BWC) treatment. Previous research has not examined changeable psychosocial factors in tandem in the predicting of weight status in children presenting to a BWC treatment beyond the impact of SES. Psychosocial factors may provide insight into areas that should be addressed through intervention. The goal of this study is to examine possible psychosocial factors (time demands, household routines, quality of life, and food insecurity) that further explain the relation between SES and weight status at presentation to and over the course of a pediatric weight control intervention. Participants within the present study are children and families presenting for a multidisciplinary BWC intervention within a tertiary care setting. Findings suggest that only quality of life predicts weight status at presentation to the intervention beyond the impact of SES. Adolescent weight status did not change over the course of the study, limiting interpretation of longitudinal findings. However, findings from this study support the examination of these constructs within future research to better understand the complex association between SES and weight status within an adolescent weight management program. *Keywords: obesity, adolescents, socio-economic status*

UNDERSTANDING THE RELATION BETWEEN SOCIO-ECONOMIC STATUS AND CHILD WEIGHT STATUS WITHIN A MULTIDISCIPLINARY WEIGHT CONTROL TREATMENT

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Introduction

Pediatric obesity is a major public health concern in the United States, with approximately one-third of children classified as overweight or obese (Ogden et al., 2016). Pediatric obesity is associated with significant health concerns such as Type II diabetes, hypertension, and metabolic syndrome (Fontaine, Redden, Want, Westfall, & Allison, 2003; Ogden et al., 2012), as well as negative psychosocial outcomes such as peer victimization and negative body image (Colditz, 1999; Kraak, Liverman, & Koplan, 2005). Further, obesity and related cardiometabolic risk factors in childhood are significant predictors of adult obesity and subsequent negative outcomes (Bereson et al., 1998; Porkka, Viikari, Taimela, Dahl & Akerblom, 1994; Reilly & Kelly, 2011; Singh, Mulder, Twisk, van Mechelen, & Chinapaw, 2008).

Over the past 20 years, several studies have demonstrated that children from lower socioeconomic status (SES) backgrounds are at greater risk for developing obesity (Babey, Hastert, Wolstein & Diamant, 2010; Kumanyika & Grier, 2006; Strauss & Knight, 1999; Troiano & Flegal, 1998). This negative association between SES and body mass index (BMI; kg/m^2) is especially true within wealthy or developed countries, such as the United States (Barriuso et al., 2015). The disparity in weight status between low and high-SES children appears to be growing (Chung et al., 2016), with obesity rates in high-SES children decreasing. Yet, these rates continue to increase in low-SES adolescents (Frederick, Snellman & Putnam, 2014). Obesity risk due to low-SES is found to exist beyond the influence of other, commonly related, demographic factors (e.g., race; Strauss & Knight, 1999). Further, children from lower-SES households are often less successful within behavioral weight control (BWC) interventions and are less likely to complete BWC treatments (Zeller et al., 2004). Children from ethnic minority groups, often confounded with SES, are less likely to lose weight over the course of BWC intervention and are more likely to drop-out of intervention (Jelalian et al., 2008).

While possible factors related to the association between SES and weight status have been previously examined, previous literature has lacked focus on the psychosocial factors (e.g., child and family variables) that may explain the increase in weight status beyond the impact of SES (Lindsay, Sussner, Kim, & Gortmaker, 2006). For example, the built environment, referring to the physical aspects of the neighborhood (e.g., sidewalks, playgrounds) in which a child lives (CDC, 2011; Winkleby, Jatulis, Frank, & Fortmann, 1992), and maternal smoking (Monasta et al., 2010) have been related to pediatric weight status. However, these factors are less likely to be appropriate targets for BWC treatment. Additional psychosocial factors that may help to explain increased weight status beyond the impact of SES should be further examined. The present study sought to examine psychosocial factors, beyond the impact of SES, that are associated with child weight status at the time of entry into a pediatric BWC intervention (i.e., baseline) and over the course of treatment.

Socioeconomic Status

SES reflects a person's economic and social position, and encompasses education, job status, and income level (Adler et al., 1994). These different facets of SES measure different aspects of an individual's status. For example, job status may reflect prestige and responsibility, while education indicates skills required to gain social, psychological, and economic resources (Winkleby et al., 1992). A composite measure of SES allows for comparison between individuals and households. Composite measures of SES incorporate a multidimensional concept of resources such as wealth, education, and access to goods and services. SES has been measured using multiple methods including both single-factor (e.g., income) and composite methods (e.g., Hollingshead Four Factor Index). However, composite methods of measuring SES are the most effective way to fully capture the complexities of SES, whereas univariate measures may only serve as a proxy measure of SES (Galobardes, Shaw, Lawlor, Lynch & Smith, 2006).

The Hollingshead Four-Factor Index of Socioeconomic Status is one of the most commonly used measurements of SES (Edwards-Hewitt & Gray, 1995). As a composite measurement, the Hollingshead Index is able to capture the complex social factors of SES related to childhood health outcomes (Edwards-Hewitt & Gray, 1995; Ensminger, Fothergill, Bornstein, & Bradley, 2003). Within this index, both education and occupation (retired/employed status and occupational prestige) are accounted for, as well as marital status (Hollingshead, 1975). While social researchers have yet to reach consensus on the best way to measure SES (Oakes & Rossi, 2003), the Hollingshead Index has been consistently related to health outcomes (Cirinio et al., 2002; Edwards-Hewitt & Gray, 1995). Pertaining to the present study, the Hollingshead Index of SES has previously been employed within adult and pediatric obesity research (Wamala, Wolk, & Orth-Gomer, 1997), and has been associated with weight status of children (Israel, Silverman, & Solotar, 1986).

Associations between Lower SES and Negative Health Outcomes

A substantial body of literature suggests that children from lower SES backgrounds are at heightened risk for a range of negative psychological (Chen, 2004; Chen & Paterson, 2006) and physical health (Kunz-Ebrecht, Kirshbaum, & Steptoe, 2004; Sebelius, Frieden, & Sondik, 2012) outcomes. Lower SES has been related to decreased access to healthcare and preventative services. Specifically, individuals holding a bachelor's degree are more likely to have health insurance compared to individuals with no high school degree (CDC, 2011). Negative health behaviors, such as cigarette smoking and lack of physical activity, are also more common among both low SES children and adults (CDC, 2011; Winkleby et al., 1992). Further, risk for other negative health outcomes, such as coronary heart disease, stroke, and general mortality, increases as childhood SES decreases (Galobardes, Lynch, & Davey, 2004; Galobardes, Lynch, & Smith, 2008).

SES and Pediatric Obesity Risk. Beyond the association between SES and general health outcomes, lower SES has been related to higher pediatric weight status in both longitudinal and cross-sectional literature (Babey et al., 2010; Kumanyika & Grier, 2006; Strauss & Knight, 1999; Troiano & Flegal, 1998). Multiple factors (e.g., eating and exercise) appear to contribute to this association. Specific to obesity-related eating behaviors, children from lower SES backgrounds tend to eat higher rates of energy dense, low-cost food than children from higher SES backgrounds (Drewnowski & Specter, 2004). This, in turn, increases intake of sweet and fatty foods which often do not provide adequate nutrients (James, Nelson, Talph & Leather, 1997). Higher parental education – a component of SES – is related to increased nutrient rich and health conscious food choices (North & Emmett, 2000; Xie, Gilliland, Li & Rockett, 2003). Children from lower SES households consume significantly more of their energy from snacks as compared to children from higher SES groups (Ruxton, Kirk, Belton, & Holmes, 1996). These poor eating habits increase the likelihood that children will become overweight or obese and may impede success of children from lower SES backgrounds seeking BWC intervention.

Beyond the relation between SES and eating patterns, lower SES is related to decreased physical activity (Carson, Spence, Cutumisu & Cargil, 2010; Newacheck et al., 2003). Children from lower SES families have a higher likelihood of being sedentary than peers from higher SES families (Newacheck et al., 2003). Sedentary behavior is associated with increased weight status (Hancox, Milne, & Poulton, 2004; Robinson, 2001). Additionally, children from lower-income households, especially girls, are also more likely than their higher income counterparts to have greater levels of weekly screen time (Carson et al., 2010; Fairclough, Boddy, Hackett, & Stratton, 2009). Specifically, children with overweight and obesity from lower-SES households are at even higher risk for negative health outcomes than high-SES overweight children due, in part, to inactivity.

Despite this previous association between SES and pediatric obesity, little research has examined how this association might function for children presenting to BWC intervention settings. While we know that SES is an important predictor in the development of pediatric obesity, most researchers control for SES, rather than focusing on SES as an explicit construct related to weight status (Caprio et al., 2008). Examining psychosocial variables related to SES that predict pediatric weight status beyond the impact of SES alone may aid in understanding this association at presentation to, and over the course of, a weight control intervention. These psychosocial variables may also provide possible intervention points for BWC interventions. It is important to understand whether SES predicts increased weight status, even in this population of children with overweight and obesity, as children with the highest zBMIs (z-score of BMI adjusted for age and biological sex) are the most at risk for negative health outcomes (e.g. cardiovascular and metabolic problems) related to obesity (Daniels, 2006). While decreased physical activity and less healthy eating behaviors may be possible factors that help explain the relation between SES and weight status, these are already the common and primary targets of BWC interventions (Oude Luttikhuis et al., 2009).

SES and Pediatric Weight Control Intervention. BWC is the gold standard for pediatric obesity treatment (Oude Luttikhuis et al., 2009). The overall goal of BWC is decreased caloric intake and increased energy expenditure to lose weight and lower body mass index. In a multidisciplinary BWC setting, teams often involve a behavioral specialist (e.g., psychologist or counselor), registered dietitian, medical provider (e.g., doctor or nurse practitioner), and an exercise specialist (e.g., exercise physiologist; Barlow et al., 2007; Spear et al., 2007) who collaborate with families to work toward weight management goals. Recent meta-analysis results suggest that self-management strategies, including diet, physical activity, and behavioral components, for adolescent weight control intervention are effective for weight loss in adolescents (Thomason, Lukkahatai, Kawi, Connelly, & Inouye, 2016). Other common components of BWC intervention across the lifespan include realistic goal setting, behavioral contracting (e.g. reinforcement schedules), nutritional education (Jacob & Isaac, 2012; Volpp et al., 2004), stimulus control (e.g., decreasing access to energy dense foods; Epstein, Paluch, Kilanowski, & Raynor, 2004), slowing of eating, social support (Avenell et al., 2004), and increasing physical activity (Wing & Phelan, 2005). Previous meta-analytic results have also found that moderate (26-75 hours total) to high-intensity interventions (>75 hours total) have a significantly larger impact on weight status outcomes than low-intensity interventions (<10 hours total). However, low-intensity interventions show short-term benefits (Whitlock, O'Connor, Williams, Beil & Lutz, 2010).

Poorer compliance and outcomes from BWC are seen among children from lower SES backgrounds (Hedley et al., 2004; Ogden, Flegal, Carroll & Johnson, 2002), and little is known about effective BWC treatment for children from low-SES backgrounds (Gordon-Larsen, Adair, Nelson, & Popkin, 2004; Skelton, DeMattia & Flores, 2008). One study, primarily examining children from low-SES households (as classified by Medicaid use and residence in an impoverished community), found that only 26% of patients completed this BWC program (Skelton et al., 2008) This rate was on the lower end of completion rates for pediatric BWC, which has ranged from 23-73% attrition (Skelton & Beech, 2011). Out of these children that completed the treatment, there was an increase in absolute BMI over time, with only a small decrease in zBMI over the course of treatment (>9 months; Skelton et al., 2008). While promising findings indicated a decrease in zBMI over treatment, these results suggest that more work is needed to identify the factors inhibiting effective BWC treatment for children from low-SES backgrounds.

As children from low-SES backgrounds are less likely to be successful through weight control intervention, it is important to understand the factors that might explain these poor outcomes. The family investment model posits that families with fewer resources (i.e., lower SES families) may not be able to make investments in the development of their children (Conger, Conger & Martin, 2010; Conger & Donnellan, 2007). This lower resource investment may be seen through the impact of SES on children's success in pediatric BWC. Specifically, low family income (a proxy for SES) is related to lower compliance in pediatric weight management interventions (Ligthart, Buitendijk, Koes, & van Middelkoop, 2016). This decreased compliance may be due to smaller family investment in children's health behaviors, due to more limited resources within lower-SES families. In a qualitative study of clinicians treating individuals for BWC, clinicians perceived that low-SES predicted decreased adherence (e.g., attendance, commitment, and use of resources provided) over the course of intervention (Skelton, Irby, Beech, & Rhodes, 2012). Clinicians identified that lower SES families face a number of psychosocial challenges, decreasing the priority of BWC intervention (Skelton et al., 2012).

Similarly, a study examining the barriers (e.g., transportation, time) that families face in attending appointments found that these barriers led to decreased adherence (Dhaliwal et al., 2014). Additionally, children receiving public health insurance, an indicator of lower SES, are more likely to drop out of weight control intervention (Dhaliwal et al., 2014). Previous research has not examined how this association between SES and weight status change might manifest within a hospital-based multidisciplinary weight control intervention. Therefore, it is important to examine how SES predicts weight status both at intake appointments and over the course of multidisciplinary treatment.

Social Determinants of Health Framework

As SES has been related to a multitude of health outcomes, including pediatric obesity, the Commission of Social Determinants of Health, within the World Health Organization, developed a theory of Social Determinants of Health (SDH; World Health Organization, 2010). This model posits that structural determinants of health inequalities (e.g., socioeconomic position and socioeconomic and political context), predict intermediary determinants of health (e.g., living and working conditions, biological factors, health system), which in turn predict health and well-being. Overall, this model suggests that the intermediary determinants of health, such as psychosocial factors, are the likely factors between socioeconomic position (or SES) and health/well-being (World Health Organization, 2010). The present study uses this conceptual framework within the context of pediatric obesity to specifically examine psychosocial factors that predict weight status at presentation to a BWC clinic, and outcomes from this clinic, beyond the predictive impact of SES.

Rather than examining the entirety of the SDH model (World Health Organization, 2010), the goal of the current study is to focus on the specific pathway from SES to intermediary determinants of health, and how these intermediary determinants of health in turn affect health outcomes (i.e., pediatric weight status). Consistent with this model, the current study aimed to examine the pathway from SES to pediatric weight status and weight change over the course of treatment. Within the context of the SDH model, the present study examines the additive impact of psychosocial factors (e.g., household routines, quality of life) in predicting pediatric weight status beyond SES alone.

Some mechanisms underlying the association between SES and weight status have been examined within past research (e.g., built environment). Yet, individual-level variables have not been adequately examined, especially within the context of multiple psychosocial factors that may predict pediatric weight status beyond the impact of SES (i.e., examining in a larger model, rather than individually). Multiple psychosocial, behavioral, and situational factors likely aid in explaining the impact of SES on health. Yet, previous research has not focused on this association within a treatment seeking population. BWC presents an important context in which to identify specific factors that predict weight status, especially due to heightened risks associated with further increasing weight status (e.g., cardiometabolic problems). Examining these factors within a BWC context may also provide information concerning specific intermediary determinates of health that decrease weight loss success of children from lower SES backgrounds within BWC. This may provide insight into appropriate augmentations of standard BWC to promote more positive outcomes in lower SES youth.

Possible Psychosocial Factors Predicting Pediatric Obesity Beyond SES

As guided by the Social Determinants of Health Model (World Health Organization, 2010), the present study sought to extend previous literature by simultaneously examining multiple psychosocial factors that impact pediatric weight status and weight change over the course of treatment. These psychosocial factors were consistent with the 'intermediary variables' defined by the SDH model. Specifically, the present study focused on examining the possible predictive qualities of four of these main psychosocial variables: food insecurity, time demands, household routines, and quality of life.

Food Insecurity. Food insecurity is one possible factor that may predict pediatric weight status beyond SES. Food insecurity, similar to food availability as referenced in the SDH framework (World Health Organization, 2010), refers to the experience of limited or uncertain access to food (Nord, Andrews, & Carlson, 2008). Children from low SES families are more likely to experience food insecurity (Casey et al., 2006), with food insecurity affecting approximately 20% of households with children (Coleman-Jensen, Nord & Singh, 2014). Research examining the relation between food insecurity and child BMI has been mixed, although it is clear that food insecurity and childhood obesity co-exist (Buscemi, Beech & Relyea, 2011; Casey et al., 2006; Dubois, Farmer, Girard, & Porcherie, 2006; Matheson, Varady, Varady & Killen, 2002; Metallinos-Katsaras et al., 2012). Food insecurity is one factor that may help explain the association between low-SES and increased child weight status, as it has been related to SES and has been related to increased rates of pediatric obesity (Casey et al., 2006; Martin & Ferris, 2007).

Within low-SES families, food insecurity may lead to further weight gain, as uncertain access to food may prompt families to purchase cheap, energy-dense foods that may not provide adequate nutrition for children and adolescents (Hamelin, Habicht, & Beaudry, 1999). Many families experiencing mild to moderate levels of food insecurity report that they do not have enough money to buy the variety or the quantity of foods that they would like (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2017). Therefore, children from these low-SES families experiencing food insecurity tend to consume more high-fat and high-sugar foods than higher-SES peers (Bowman, Gortmaker, Ebbeling, Pereira, & Ludwig, 2004). Children from food insecure households are also more likely to overeat and eat foods they do not like (Smith & Richards, 2008). This is consistent with the cyclical nature of food insecurity, which may lead to the experience of involuntary restriction when food is scarce and then later overeating when food is available (Polivy, 1996). This, in turn, predicts heightened weight status when presenting for a BWC intake appointment, and potentially decreased success over the course of BWC intervention.

Despite BWC participation, if food insecurity status is not addressed and parents do not receive education about purchasing low-cost healthy foods, BWC may not be effective. Yet, food insecurity has not been examined as a predictor of weight status outcomes in BWC beyond the impact of SES within previous literature. Therefore, it is important to identify how food insecurity might affect outcomes through a BWC clinic. Further, food insecurity may be identified as a BWC intervention point to discuss how to make healthy choices within a family's means.

Household Routines. Another factor that may further explain the relation between SES and childhood obesity is family household routines. Examples of household routines include eating dinner together or having a consistent bedtime for children in the family. Higher rates of household routines within a family are associated with lower rates of pediatric obesity (Anderson & Whitaker, 2010). Previous research suggests that children from racial/ethnic minority backgrounds, as well as those from lower SES backgrounds, have less consistent household routines. Specifically, these routines include higher rates of TV viewing, fewer hours of sleep, and fewer evening meals as a family (Taveras et al., 2012). Engaging in dinner as a family, obtaining adequate nighttime sleep, and limiting screen viewing are associated with a 40% decreased likelihood of obesity, compared to children from families that are not exposed to these routines (Anderson & Whitaker, 2010).

Over the course of BWC intervention, a lack of these household routines may impede a child or adolescent's weight loss. For example, families who have regular family mealtimes are more likely to consume healthy foods and increased family meal frequency may protect against increased weight status (Anderson & Whitaker, 2010; Martin-Biggers et al., 2014). However, mealtime routines have not been examined within the context of interdisciplinary pediatric BWC. In the context of screen time, one previous randomized trial sought to improve household routines as an intervention for obesity related behaviors among low-income and racially/ethnically diverse young (2-5 years old) children who had a TV in the room they slept in (Haines et al., 2013). This study found that through the 6-month intervention targeting family meals, sleep duration and TV viewing, children showed decreased TV viewing, as well as increased sleep duration. Further, children's BMI significantly decreased over the 6-month intervention period compared to a control condition of mailed education materials (Haines et al., 2013). While this randomized trial suggested the importance of examining household routines as targets of treatment in early childhood, it is important to note that this study did not specifically examine children with overweight and obesity, who are most at risk for negative health outcomes. It is also unclear how targeting household routines may function to promote more positive treatment outcomes for older children and adolescents. This finding that targeting household routines decreases negative health outcomes highlights the importance of the impact of household routines within a broader sample of treatment-seeking children and adolescents.

Household routines have been identified as an important factor to examine in relation to childhood obesity outcomes, however routines should be examined in the larger psychosocial context, as multiple psychosocial variables exist within the context of each other to affect weight status outcomes. Additionally, previous research has not examined routines as a factor predicting weight status beyond the impact of SES alone. The lack of household routines in a family may be one possible mechanism that predicts pediatric obesity risk beyond SES, both at the presentation to a BWC clinic and over the course of an intervention.

Time Demands. An additional psychosocial factor that may predict child weight status beyond the impact of SES is time demands. Time demands – a lack of time to maintain healthy eating and exercise behaviors due to work or other commitments – have been associated with increases in child weight status and lack of healthy eating in the family (Hearst et al., 2012; Jabs & Devine, 2006; Rydell et al., 2008). Further, increased time demands in the family have been related to increases in familial consumption of fast food and convenience foods (Jabs & Devine, 2006; Rydell et al., 2008). Increased consumption of these convenience foods has, in turn, been associated with increase in weight status (French et al., 2001; Guthrie, Lin & Frazo, 2002).

Time demands may be exacerbated within lower SES families, which may increase the likelihood that these children are overweight or obese (Devine et al., 2009). These time demands may be exacerbated in single-parent households (Jacobs & Berson, 2001), as being a single parent (a facet of the Hollingshead Index of SES) adds stress that often affects food choices and consumption within the family (Blake et al., 2009; Wurbach, Zellner, & Kromeyer-Hauschild, 2009). Despite the heightened time demands in low-SES families, the impact of time demands beyond SES has not been specifically examined within a treatment seeking population children who are overweight. Research in this area is important for clinicians to better understand whether time demands are related to child weight change over the course of treatment, beyond the impact of SES.

Despite the lack of focus on time demands within previous pediatric BWC research, BWC requires a significant time investment from families. Families are typically asked to attend regular appointments, make goals for change, and perform actions toward those BWC goals (Smith & Wing, 2000). This large investment from families may be particularly difficult for low-income families experiencing barriers to participation (e.g., time demands and costs for transportation; Murtagh, Dixey & Rudolf, 2006; Zabinski, Saelens, Stein, Hayden-Wade & Wilfley, 2003). Within pediatric weight management, some of the most commonly cited barriers to success and completion of a program are time related, such as family responsibilities interfering with sessions (Barlow & Ohlemeyer, 2006; Kwitowski, 2015). Similarly, adolescents who did not complete a BWC intervention reported significantly more barriers related to difficulty with time required to attend sessions and interference with work schedule compared to adolescents that completed intervention (Brennan, Walkley, & Wilks, 2012). Parents of these same children reported that family commitments interfered with engagement in treatment (Brennan et al., 2012). Overall, these familial time demands appear to significantly impact children's ability to be successful within weight control intervention, and time burden on families may need to be addressed through the both the structure of treatment, and intervention throughout treatment (Stice, Shaw & Marti, 2006).

Health Related Quality of Life. Beyond familial factors, such as time demands and food insecurity, health related quality of life of patients presenting to pediatric BWC may impact their weight status beyond the impact of SES. Health related quality of life (HRQoL) measures facets of social, emotional and physical functioning and how these have affected a child's overall satisfaction within multiple areas of their life (Modi & Zeller, 2008; Varni, Seid, & Kurtin, 2001; Varni, Seid & Rode, 1999). While HRQoL has been related to various aspects of psychosocial functioning (e.g., depressive symptoms, social support; Zeller & Modi, 2012), HRQoL is a more comprehensive measurement accounting for multiple aspects of physical and psychological functioning. At an individual level, a substantial body of literature suggests that quality of life is related to weight status in children, such that children with overweight and obesity report lower quality of life across multiple domains (Griffiths, Parsons, & Hill, 2010; Schwimmer, Burwinkle, & Varni, 2003; Williams, Wake, Hesketh, Maher, & Waters, 2005; Zellner & Modi, 2006). However, HRQoL is generally examined as an outcome variable within a cross-sectional framework (Pinhas-Hamiel et al., 2006; Schwimmer et al., 2003; Tsiros et al., 2009; Zeller & Modi, 2012).

The association between weight status and HRQoL is likely bidirectional. A five-year longitudinal study found that decreased HRQoL was predictive of an increase in weight status over the study period (Cameron et al., 2012). This relation parallels previous associations between psychological functioning and increased weight status. For example, depression in adolescence has been related to an increased risk for later obesity (Blaine, 2008). Examining a more comprehensive measure of functioning, such as HRQoL may be an important mechanism to examine and potentially target in treatment (Allison & Heshka, 1993; Atlantis & Ball, 2008; Cameron et al., 2012).

Decreased HRQoL has also been seen in children from low-SES households (Hassan, Loar, Anderson & Heptulla, 2006; Mansour et al, 2003). Within a sample of youth with obesity, lower SES significantly predicted decreased HRQoL (Zeller & Modi, 2012). However, this study did not examine weight status as a continuous variable within this sample of youth with obesity.

Therefore, this study was unable to examine the impact that HRQoL may have on weight status, beyond the impact of SES. Despite the likely bidirectional relation between HRQoL and weight status, HRQoL has not been examined as a psychosocial factor that may explain weight status beyond the impact of SES. This is likely due to the narrow focus of HRQoL as an outcome (versus predictor) variable within previous research (Drukker & van Os, 2003; Tsiros et al., 2009). While understanding the association between HRQoL and SES provides insight into the context of children presenting to BWC, it is important to also examine the impact that these constructs have on weight status within this population.

The Current Study

Overall, the primary goal of this study was to examine whether specific psychosocial factors, beyond the impact of SES, predict zBMI at presentation to an interdisciplinary pediatric weight management program. Examining multiple psychosocial variables in one model, rather than separately, allowed for a better understanding of the complex factors that may explain the association between SES and zBMI. Building a model of multiple psychosocial factors in this association between SES and zBMI may increase understanding of how each of these factors impact child zBMI in the larger context of a child and their family, rather than examining each factor separately. Examining these multiple facets together is particularly important at presentation to weight control intervention, as it is unclear whether these psychosocial variables (food insecurity, household routines, time demands, quality of life) should serve as BWC intervention targets, especially for low-SES families presenting to BWC. Past research has found that SES and weight status are negatively associated, however, there has not been exploration of this relation in the context of relevant psychosocial factors. This lack of research is notable given that children presenting for weight management intervention are likely at heightened risk for experiencing negative outcomes (e.g., metabolic disorders) due to their weight status. The present study sought to identify salient factors that can be used as intervention points for future pediatric BWC intervention.

Further, a secondary overarching goal of the present study was to identify specific psychosocial factors (food insecurity, household routines, time demands, quality of life) that may explain why children and adolescents from lower SES backgrounds have less weight-loss success through pediatric obesity interventions. Therefore, the present study sought to identify which psychosocial variables may predict weight change over the course of BWC, beyond the impact of SES. These findings will hopefully aid in identifying psychosocial factors that can be addressed to promote better outcomes for children and adolescents from lower-SES families.

Aims and Hypotheses

Aim 1: Examine the relation between SES and weight status at presentation to a multidisciplinary pediatric weight control intervention and third variable psychosocial factors that are associated with zBMI above and beyond SES.

Hypothesis 1: There will be a significant relation between SES and weight status (zBMI) at presentation to the pediatric weight control intervention, such that lower SES is related to higher zBMI.

Hypothesis 2: Food insecurity, household routines, time demands, and quality of life will each be associated with weight status at presentation to the intervention beyond the effect of SES.

Aim 2: Examine the relation between SES and weight status change over the course of a multidisciplinary pediatric weight control intervention and potential psychosocial factors that further explain the change in zBMI, above the predictive value of SES.

Hypothesis 3: There will be a significant linear relation between SES and weight status change over the course of pediatric weight control intervention, such that lower SES is related to less change in zBMI over the course of treatment.

Hypothesis 4: Food insecurity, household routines, time demands, and quality of life will each predict change in zBMI above the predictive value of SES over the course of the pediatric weight control intervention.

Methods

Design

The current study used data collected from a pediatric multidisciplinary weight management program at a Midwestern children's hospital. Patients for whom at least 6 months had elapsed since intake were included in analyses in the current study, as treatment is suggested once per month, for six months, by the clinic. Anthropometric data (i.e., height and weight) collected at each appointment were used to identify weight status at presentation to the clinic, as well as change in weight status over the course of the intervention.

Participants

Participants included 205 children between the ages of 10-18 years old and their parents who consented into the study at their initial appointment at the Healthy Weight Clinic at Akron Children's Hospital (Akron, OH). Patients were all referred to the Healthy Weight Clinic, most commonly through primary care provider referral due to excess weight or associated risk factors. Parents and children were eligible to participate in the current study if both the parent and child a) spoke English fluently and b) did not have a learning disorder or cognitive disability preventing them from completing questionnaires. Parents and children were eligible to participate if the adult presenting to the Healthy Weight Clinic was a primary parent or guardian (i.e., lives with the child at least 50% of the time) of the child they are accompanying to the appointment. Twenty-four patients chose not to have their data included in the current study, for a refusal rate of 10.4%.

Measures

Demographics. Parents completed a demographic questionnaire concerning characteristics of the parent/guardian and the child participating in the Healthy Weight Clinic. This questionnaire included items regarding their employment status, marital status, and race/ethnicity. Additional non-identifying demographic information was taken from the child's electronic medical record. This information included insurance status and child age.

Socioeconomic Status. The Hollingshead Four Factor Index (Hollingshead, 1975) was calculated using parent-reported information from the demographic questionnaire. Specifically, marital status, employment status, educational attainment and occupational prestige of the parent were utilized to calculate the Hollingshead Four Factor Index. Education was coded on a 7-point scale as follows: 7 = graduate or professional training, 6 = standard college or university graduation, 5 = partial college, at least one year of specialized training, 4 = high school graduate, 3 = partial high school (10^{th} or 11^{th} grade completed), 2 = junior high school (including 9^{th} grade), 1 = less than 7^{th} grade, and 0 = not applicable or unknown. Occupation was rated on a 9-point scale following the guidelines set forth by Hollingshead (1975).

The Hollingshead 4-factor index was calculated differently depending upon marital status (e.g. single parent or dual parent household), as set forth by published guidelines (Hollingshead, 1972). When two parents were gainfully employed, an average score was created and used to account for both employed parents (Hollingshead, 1975). For households with one parent that is employed, the Hollingshead Index was calculated for this employed parent. This methodology has been critiqued, due to possible discrepancies between one parent with a high SES score and one with a low SES score, which may artificially decrease average SES for the family. However, Cirino and colleagues (2002) calculated SES scores using Hollingshead's (1975) method of averaging scores, as well as an alternative method of correcting for occupational discrepancy between two parents and found no major changes in the SES status of children between these two methods (Cirino et al., 2002).

The Hollingshead Index has been found to have good levels of interrater agreement (overall kappa = .68) and inter-measure agreement when compared to two other commonly used measures of SES (kappa .54-.59). While there is disagreement on appropriate categorization of kappa values, some have considered over .75 as excellent, .40 to .75 as fair to good and below .40 as poor (Fleiss, 1981).

Anthropometrics. Child height and weight were both measured at each appointment within the Healthy Weight Clinic. Trained staff members within the Healthy Weight Clinic collected measurements while patients were wearing light clothing and no shoes. Weight was measured using a Scaletronix digital scale (Model #6702), and height was measured using a Seca stadiometer (Model #240). BMI z-score (zBMI) for age and gender was calculated using Center for Disease Control (CDC) guidelines (Kuczmarski et al., 2002). zBMI is a standardized measure of BMI (kg/m^2) adjusted for age and sex, which is particularly helpful to measure changes in patients with a BMI above the 99^{th} percentile. This study used zBMI instead of BMI percentile, as BMI percentile for age and sex is not sensitive to changes within the most overweight segment of children (Himes, 2009).

Food Insecurity. Food insecurity within the family was measured using the USDA Core Food Security Module – Short Form (CFSM; Bickel, Nord, Price, Hamilton & Cook, 2000) as reported by the parents. This 6-item scale is used to classify families into different food security statuses. Families scoring 0-1 on this measure are classified as food secure, scores of 2-4 indicate food insecurity without hunger, and scores of 5-6 indicate food insecurity with hunger. The following is an example item from the measure: "In the last 12 months, did you eat less than you felt you should because there wasn't enough money to buy food?" The CFSM-Short Form was developed from the 18-item long version of the CFSM through identification of the six indicators that approximated the categories of the initial food security measure with only slight loss in sensitivity and specificity (Bickel et al., 2000; Blumberg et al., 1999). In the validation study, this short form correctly identified level of food insecurity for 97.7% of households compared to the full version (Bickel et al., 2000; Blumberg et al., 1999). This 6-item short form has been shown to have minimal bias as compared to the full 18-item CFSM (Bickel et al., 2000; Blumberg et al., 1999). Due to the structure of this measure, internal consistency reliability could not be calculated for the measure in the present study.

Household Routines. The parent-reported Confusion, Hubbub, and Order Scale – Short Version (CHAOS; Hart, Petrill, Dechard, & Thompson, 2007; Matheny et al., 1995) was used to identify general routines and order within the household. This measure has been used in households with children from 12 months (Matheny et al., 1995) to 18 years old (Chatterjee, Gillman & Wong, 2015). Parents rated items on a 5-point scale from 1 (definitely untrue) to 5 (definitely true) with higher scores indicating lower levels of household routines. Example items include, "The children have a regular bedtime routine" (reverse scored), and "There is usually a television turned on somewhere in our home." The CHAOS scale has shown strong psychometric characteristics, including appropriate internal consistency (Chronbach's alpha of .78; Chatterjee et al., 2015). This measure has also shown good test-retest reliability (Matheny et al., 1995) and high convergent validity against other measures of parenting behaviors (r = .50; Haack, Gerdes, Schneider, & Hurtado, 2011). Further, this scale has been compared to direct measurement of the behaviors within the environment and shown the utility of this scale to understand household routines and structure (Matheny et al., 1995). This measure has also been shown to be an adequate measure of home confusion within diverse populations (Dumas et al., 2005). This measure showed questionable alpha reliability within the present sample (α = .66).

Time Demands. Time demands within the family was measured using the parent-reported Time Constraints subscale of the Barriers to Pediatric Weight Management (BPWM) scale developed by Darling and colleagues (2017). This 5-item scale identifies time constraints that parents identify, specific to healthy lifestyle behaviors. Example items include, "It is hard for me to find the time to prepare healthy food at home," and "If we were less busy, we would eat less prepackaged meals (e.g., mac and cheese)." Items were scored on a scale from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating higher levels of time constraints within the family. Although this measure has not been widely validated, the Time Constraints subscale of the BPWM has been validated within a sample of parents of children ages 7-17. Additionally, this measure has shown good convergent validity and appropriate internal consistency within previous studies (.78; Darling et al, 2017). Specifically, this measure has been related to general obesity-related health habits within the family (Darling et al., 2017). Within the present sample, this measure showed acceptable to questionable alpha reliability (α = .69).

Health Related Quality of Life. Parent-reported obesity-specific quality of life was measured using Sizing Them Up (Modi & Zeller, 2008). This 22-item measure contains six scales (Emotional Functioning, Physical Functioning, Teasing/Marginalization, Positive Social Attributes, Mealtime Challenges, and School Functioning) and a total score of quality of life. The total score was used in all analyses to capture overall HRQoL. Parents were asked to indicate how their child has been feeling within the past month. These items were scored on a scale from 1 (never) to 4 (always), with higher scores indicating higher quality of life. Example items include, “Was teased by peers because of their weight/shape/size (reverse scored)” and “Felt successful in daily activities.” Sizing Them Up has been validated in 5-18 year old youth with obesity, showing good convergent validity (.70 with general quality of life; Peds-QL), and appropriate (ranging from questionable to excellent) internal consistency (.59 to .91 depending on subscale) and test-retest reliabilities (.57 to .80 depending on scale, 2-4 weeks following initial measure completion) within previous samples (Modi & Zeller, 2008). This measure showed excellent alpha reliability within the present sample (α=.92).

Procedures

Prior to their intake appointment at the Healthy Weight Clinic, each new family was mailed a packet with all measures and brief information asking the family to complete the measures prior to their first Healthy Weight Clinic appointment. A trained member of the research team facilitated an informed consent and assent process for all parents and patients during their initial intake to the Healthy Weight Clinic. If families did not complete measures prior to intake at the Healthy Weight Clinic they were asked to complete the measures immediately prior to their appointment. Patients were asked to complete all measures, regardless of their consent, as part of clinical care; however, patient data were not used for this study if families opted out of participating. Patient height and weight were collected at the beginning of each appointment in the Healthy Weight Clinic. Families were asked to schedule appointments approximately one month apart for a total of six months. Extension beyond these six appointments was suggested for some families when clinicians believed patients would benefit from further intervention. Within the clinic structure, patients ideally completed the Healthy Weight Clinic protocol approximately six months following their intake appointment. However, the current study attempted to utilize the maximum number of study sessions for analyses, as it is also important examine outcomes of individuals who participate in fewer sessions (i.e., three sessions), due to high rates of attrition from BWC (Zeller et al., 2004). In order to do this, the last appointment at which at least 50% of patients attended was used as the final timepoint in analyses.

Intervention. All intervention sessions occurred at Akron Children's Hospital, within the Healthy Weight Clinic. Each patient was seen by a psychologist, exercise physiologist, dietician, and medical provider (MD or nurse practitioner) at each appointment within the clinic. Each appointment lasted approximately 2 hours (30 minutes with each provider). During the intake evaluation, the focus was on understanding children's current activity level, eating patterns, physical complaints, and psychological factors related to th eir weight status. Brief goal setting (i.e. setting specific physical activity and/or dietary goals for the family to complete during the next month) was conducted with patients during this visit and behavioral tracking (e.g. earning a sticker for each time the patient exercises over the next month) was encouraged to maintain behaviors throughout the month. A parent or guardian was required to participate with the child during the intake, and parents were encouraged to participate in each session throughout the treatment. However, participation by parents varied among families, as some older adolescents attended follow-up appointments without a parent/guardian.

Although no treatment manual was utilized, at each follow-up appointment, providers generally reviewed information previously presented, discussed problems or barriers that families faced related to behavior change, introduced new topics related to weight loss, and set new goals for the upcoming month. Psychologists collaborated with families to discuss specific strategies for behavioral changes suggested by other disciplines (e.g., behavioral reinforcement, setting specific reasonable goals), as well as review other behavioral strategies for weight loss (e.g., slowing pace of eating, self-monitoring, contingency reinforcement). While, none of the possible psychosocial factors of interest in the present study (time demands, household routines, food insecurity, and quality of life) were systematically addressed through this BWC treatment, these psychosocial factors may have been informally addressed with patients.

Data Analytic Plan

Preliminary Analyses. Tests of normality assumptions (i.e., skew and kurtosis) were conducted on all variables of interest and appropriate transformations were made for future analyses, if necessary. Descriptive statistics were conducted for all participants to illustrate characteristics of the sample. Alpha reliability statistics were calculated for each of the measures included in the current study. Pearson correlation analyses were conducted between all variables included within the present study to better understand the associations between each of these variables. Finally, independent samples *t*-tests were conducted to examine differences between participants who completed baseline assessments and those who had weight status data available at the final follow-up appointment. These analyses were conducted to assess for differences between samples due to attrition from the intervention.

Growth Curve Modeling. Growth curve modeling, within a structural equation modeling (SEM) framework, was conducted within MPlus (Muthen & Muthen, 2012). To handle missing data, maximum likelihood estimation was used through MPlus (Muthen & Muthen, 2012). To examine the model, the χ^2 statistic was used. However, χ^2 is highly sensitive to sample size (Kline, 2005). Therefore, alternative fit statistics were also used to examine model fit. Consistent with Hu and Bentler (1999), the standardized root mean square residual (SRMR) and two other indices were used to test if the model fit reasonably well: the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). SRMR values $<.10$ are generally considered acceptable and <.08 are considered good (Hu & Bentler, 1999). CFI values range from 0 to 1 with .9 representing adequate model fit (Bollen, 1989). RMSEA is considered good at <.05, acceptable at .05-.08 and marginal at .08-.10 (Hu & Bentler, 1999). If the initial models tested showed poor model fit, model respecifications were made as appropriate, when justified both statistically and theoretically. All iterations of models examined were presented within final analyses.

Primary Analyses. Primary analyses corresponding to the study aims and hypotheses were as follows:

Aim 1, hypothesis 1: There will be a significant relation between SES and weight status (zBMI) at presentation to the pediatric weight control intervention, such that lower SES is related to higher zBMI.

Analytic Plan 1: Linear regression was employed, with SES predicting zBMI at presentation to the intervention.

Aim 1, hypothesis 2: Food insecurity, household routines, time demands, and quality of life will each be associated with weight status at presentation to the intervention beyond the effect of SES.

Analytic Plan 2: A hierarchical linear model was used to test the predictive value of food insecurity, household routines, time demands, and quality of life. Specifically, zBMI at baseline was the outcome variable, with SES (as measured by the Hollingshead Index) in Step 1 of the model. Then food insecurity, household routines, time demands, and quality of life were all entered into Step 2 of the model.

Aim 2, hypothesis 3: There will be a significant linear relation between SES and weight status change over the course of pediatric weight control intervention, such that lower SES is related to less change in zBMI over the course of treatment.

Analytic Plan 3: Growth curve modeling, within a SEM framework, was used to examine the predictive value of SES on zBMI change over the course of treatment. Specifically, the zBMI of sessions attended was utilized to create a latent variable of slope and intercept for zBMI over time, with the slope indicating the change in zBMI as a function of time.

Aim 2, Hypothesis 4: Food insecurity, household routines, time demands, and quality of life will each predict weight change above the predictive value of SES over the course of the pediatric weight control intervention.

Analytic Plan 4: A similar growth curve model as used to examine hypothesis 3 was used to examine hypothesis 4. However, this analysis was conducted controlling for the effect of SES on change in zBMI over the course of treatment, with all four other psychosocial variables (food insecurity, household routines, time demands, and quality of life) predicting change in zBMI. Due to the complexity of this model, the overall model was split into two analyses. The first analysis regressed the independent variables (SES, food insecurity, household routines, time demands, and quality of life) on the intercept. The second analysis regressed the independent variables on the slope.

Results

Participants

Participants included 205 children and adolescents between the ages of 10-18 and their parents. Children and adolescents (*M* age = 13.28, *SD* = 2.19) who participated were primarily white (70.3%) and over half were female (57.1%). Parents/guardians who participated were also primarily white (78.5%) and female (86.9%). All adolescent participants had baseline zBMI data collected (*M* = 2.38; SD = .42). While the sample was primarily overweight (zBMI >1; 12.7%) and obese (zBMI >2; 86.3%), a small portion of the sample was considered healthy weight (1.0%). Approximately 68% of the sample (n = 140) attended the second session at the Healthy Weight Clinic (*M* zBMI = 2.39, *SD* = .38). By session three, 51.7% of patients presented to the Healthy Weight Clinic for their appointment (*M* zBMI = 2.41, *SD* = .41). At the fourth session, only 34.6% of participants attended a session at the clinic (*M* zBMI = 2.36, *SD* = .45). Therefore, the third session will be the final session used in the present analyses. Descriptive statistics for the sample are listed in Table 2.

Missing Data

Missing data for the total scores of the measures ranged from 0% to 4.3% for all variables. Specifically, the Core Food Security Module (Bickel et al., 2000) was missing 4.3% of data, household routines (CHAOS; Hart et al., 2007) was missing 3.4% of data, SES (Hollingshead, 1975) was missing 2.4% of data, time constraints (BPWM; Darling et al., 2017) was missing 1.9% of data, and quality of life (Sizing Them Up; Modi & Zeller, 2008) was missing 1.5% of data. Using mPlus (Muthen & Muthen, 2012) maximum likelihood estimation was used to handle missing data.

Preliminary Examination of Study Variables

Tests of normality assumptions (i.e., skew and kurtosis) were conducted for all variables of interest. No assumptions of normality were violated, and therefore no transformations were used. Pearson correlations were calculated for all variables included in the study. zBMI at intake was significantly correlated with HRQoL (r = -.28, p <.001). Additionally, significant correlations were found between routines and time demands (r = -.37, p <.001), routines and quality of life (r = .31, p <.001), and SES and food security status (r = -.26, p <.001). Correlations between all variables can be found in Table 2.

Independent samples t-tests were conducted to examine differences between participants who only attended the intake session compared to those who attended at least three appointments. Three appointments were chosen as this was the last appointment at which at least 50% of patients attended. Participants who attended only session one (M = 2.29, SD = .43) had significantly lower zBMIs at baseline than those with available data at session three (M = 2.43, SD = .43), t(169) = -2.04, p =.04. Additionally, participants who only attended session one were significantly younger (M = 12.78, SD = 2.10) than those that attended session three (M = 13.57, SD = 2.22), t(169) = -2.30, p =.02. No other differences between variables (i.e., SES, food insecurity, quality of life, household routines, and time demands) were found for patients who only attended one session compared to those who attended at least three sessions.

Relation between SES and Baseline zBMI and Impact of Psychosocial Variables

Hypothesis 1: There will be a significant relation between SES and weight status (zBMI) at presentation to the pediatric weight control intervention, such that lower SES is related to higher zBMI.

In a linear regression examining the association between SES and zBMI at intake, lower SES, as measured by the Hollingshead four-factor index, significantly predicted higher zBMI at presentation to pediatric weight control intervention, $F(1, 194) = -5.09$, $p < .05$. SES explained 2.1% of the variance in zBMI.

Hypothesis 2: Food insecurity, household routines, time demands, and quality of life will each be associated with weight status at presentation to the intervention beyond the effect of SES.

In a hierarchical linear regression model examining whether food insecurity, household routines, time demands, or quality of life significantly predict zBMI at intake beyond SES, the second step of the regression (examining all 4 predictors) was significant, $F(4, 196) = 3.43$, $p < .05$. Overall, these step 2 predictors explained another 7.4% of the variance in zBMI at intake. Quality of life was the only significant predictor of zBMI, b = -.28. Regression results are listed within Table 3.

Hypothesis 3: There will be a significant linear relation between SES and weight status change over the course of pediatric weight control intervention, such that lower SES is related to less change in zBMI over the course of treatment.

Latent growth curve modeling was used to examine the association between SES and weight status change over the course of treatment. Importantly, there was little change in zBMI over the course of treatment with the mean zBMI at baseline ($M = 2.38$; $SD =.42$) varying little from the mean zBMI at session 2 ($M = 2.39$; $SD =.38$) or session 3 ($M = 2.41$; $SD =.41$). Within this model, repeated measurement of the dependent variable (zBMI) was a directly measured indicator of the individual differences in weight change over time (latent variable). The model indicated good model fit, (χ^2 = 413.022, p<.05; CFI = 1.000; SRMR = .008; RMSEA = .000). However, SES was not a significant predictor of change in zBMI over the course of treatment. Within this model the slope was -.0003 with a standard error of 0.11. This indicates a lack of change in zBMI over time on average, with a small amount of variability surrounding the slope.

Hypothesis 4: Food insecurity, household routines, time demands, and quality of life will each predict weight change above the predictive value of SES over the course of the pediatric weight control intervention.

Growth curve modeling was also utilized to examine the impact of food insecurity, household routines, time demands and quality of life on change in weight status over the course of treatment, beyond the impact of SES. The first analysis, regressing SES, food insecurity, time demands, household routines and quality of life onto the intercept of the model showed good model fit (χ^2 =6.29, p > .05; CFI = 1.000; SRMR = .022; RMSEA = .000). Within this model, quality of life was the only significant predictor of zBMI (B = -14.44, SE = 3.49, p < .01) paralleling the baseline model within hypothesis 3. In the second analysis, examining the predictive value of the four psychosocial variables on the slope (or change in zBMI), the model did not converge. Therefore, we are unable to make conclusions concerning the impact of these four variables on weight status change over the course of a pediatric weight control intervention.

Discussion

The first overarching goal of the present study was to examine the association between SES and pediatric zBMI at presentation to and over the course of a BWC intervention. While previous research has established the negative association between SES and pediatric zBMI (Babey et al., 2010; Strauss & Knight, 1999), the present study expanded this research by focusing on a treatment-seeking population of children. Further, the present study utilized the social determinants of health framework (World Health Organization, 2010) to examine intermediary factors that may account for increased zBMI beyond SES alone. Thus, the second overarching goal of the present study was to examine the impact of multiple psychosocial variables (i.e., time constraints, food insecurity, HRQoL, and household routines), beyond the initial association between SES and zBMI. Within the context of children seeking treatment for pediatric obesity, previous research has not focused on the child and family factors that may account for the association between SES and weight status beyond the impact of SES alone (Lindsay et al., 2006). Expanding upon this previous research to examine factors influencing zBMI beyond the impact of SES is important given the increased rates of obesity in children from low-SES backgrounds and the importance of refining interventions to better address obesity in youth from low-SES households.

Hypothesis 1: SES and Weight Status at Intake

Consistent with this first hypothesis, lower SES was significantly associated with higher zBMI at time of presentation. An extensive body of previous research has examined the relation between SES and general pediatric weight status, with findings that lower SES is related to increased weight status in children and adolescents (Babey et al., 2010; Kumanyika & Grier, 2006; Strauss & Knight, 1999; Troiano & Flegal, 1998).

Even within a restricted range of primarily children with overweight and obesity encompassed in the present sample, SES accounted for a small, but statistically significant, amount (2.1%) of the variance in zBMI. Therefore, the negative association between lower SES and higher zBMI remains within a population of primarily youth with obesity. Understanding the manifestation of this association within a treatment seeking sample is important, as children with the highest zBMIs are at the highest risk for negative health outcomes (Daniels, 2006) and are therefore the most likely to be referred and seen in a clinical context. This association between SES and zBMI suggests that lower SES may put pediatric patients at a higher risk for developing obesity. However, understanding the magnitude of this association in the context of previous literature is difficult.

Unfortunately, much of previous research examining the association between SES and zBMI examines these constructs within a discrete framework (e.g., healthy weight, overweight, obese), rather than a continuous framework (e.g., Troiano & Flegal, 1998; Strauss & Knight, 1999). Previous research provides insight into the small amount of variance explained in weight-related constructs by psychosocial variables. For example, while not specific to SES, a previous meta-analysis found a statistically significant, but very small (approximately 1% of variance explain) effect of one psychosocial variable (i.e., TV viewing) on body fatness (Marshall, Biddle, Gorley, Cameron, & Murdey, 2004). Additionally, research examining HRQoL and pediatric BMI found that HRQoL explained 2% of the variance in child BMI (Wallander et al., 2009). The small percentage of variance in child weight status accounted for by specific psychosocial variables is likely due to the large number of factors predicting pediatric weight status. The clinical significance of 2.1% of variance is unclear as previous research has not focused on this association within a treatment seeking population. Therefore, understanding the other environmental factors that predict weight status at presentation to BWC may provide more insight into the development of pediatric obesity.

Interestingly, there was a statistically significant bivariate association (i.e., correlation) between SES and zBMI at timepoints 2 and 3, however no significant correlation between SES and zBMI at timepoint 1. Although regression analyses revealed a significant relation between SES and zBMI at baseline, it is important to consider the potential reasons for the increased association between SES and zBMI at the second and third timepoints. One reason for this association may be that the interaction between SES and zBMI led to a specific pattern of attrition within the present sample that led to an increased association between SES and zBMI. For example, if patients from low-SES backgrounds at lower weight statuses dropped out of treatment, this may have increased the association between SES and zBMI at later timepoints. Future research should explore patterns of attrition related to interactions between SES and zBMI in an order to target at-risk patients that might be most likely to drop out of treatment.

Understanding the association between SES and weight status at presentation to intervention may guide clinical intervention. Specifically, children from lower-SES households may benefit from interventions addressing specific behaviors that are more prominent within this population, as well as adaptations to interventions that are targeted towards children from lower-SES households. Previous pediatric obesity interventions have incorporated dietary interventions targeted at providing nutrition and healthy lifestyle information adapted to foods more commonly available through low-income assistance programs (Hollar et al., 2010). It may be important to sensitively address the health impacts of increased pediatric weight with parents from lower-SES households to promote treatment engagement.

Hypothesis 2: Psychosocial Factors Related to Pediatric Obesity

Hypothesis 2 predicted that four psychosocial variables (time constraints, HRQoL, food insecurity, and household routines) would predict zBMI at presentation to BWC intervention beyond the impact of SES. Contrary to hypothesis 2, only HRQoL significantly predicted pediatric zBMI at presentation to the BWC intervention. Interestingly, all four of the psychosocial variables examined (time constraints, quality of life, food insecurity and household routines) have been cross-sectionally associated with child weight status within past research (Anderson & Whitaker, 2010; Casey et al., 2006; Hearst et al., 2012; Williams et al., 2005). Building upon previous research suggesting a negative association between HRQoL and both weight status in childhood and SES (Hughes, Farewell, Harris, & Reilly, 2007; Mansour et al., 2003), HRQoL was related to weight status beyond the impact of SES alone within the present study.

The present study overcomes limitations of previous research by focusing on the relation between HRQoL and pediatric weight status, beyond this well-established association between SES and weight status. Previous research has established the association between HRQoL and pediatric weight status within the context of BWC (e.g., Zeller & Modi, 2006), as well as the association between HRQoL (Babey et al., 2010; Kumanyika & Grier, 2006; Strauss & Knight, 1999; Troiano & Flegal, 1998). However, previous literature has not examined the impact that HRQoL may have on zBMI beyond the impact of SES. Following the Social Determinants of Health framework (World Health Organization, 2010) of examining intermediary determinants of health, the present study establishes the importance of HRQoL beyond SES alone, even within this clinical population of youth presenting for weight management intervention.

This finding, HRQoL impacting weight status beyond SES at presentation to pediatric BWC intervention, highlights the possible role of HRQoL in pediatric obesity interventions. Previous research has suggested utilizing decreased HRQoL as a motivator to engage in BWC treatment (Fallon et al., 2005). In particular, the study hypothesized that clinicians may be able to motivate adolescents to engage in treatment by focusing on the facets of HRQoL causing them distress (Fallon et al., 2005). However, HRQoL facets have not been examined within an identified treatment. As patients from lower-SES backgrounds tend to have poorer treatment outcomes in pediatric BWC (Zeller et al., 2004), it is important to address factors that may promote treatment engagement and more positive outcomes.

Given the cross-sectional nature of the present analysis, the potentially bidirectional association should be considered between HRQoL and zBMI. Similar to the present study, the majority of previous research has been cross-sectional in nature and have framed this association within the context of higher weight status leading to poorer quality of life (Tsiros et al., 2009; Zeller & Modi, 2006). However, a small body of literature has examined this association in a longitudinal framework with a focus on the bidirectional impact of zBMI and HRQoL on each other (Cameron et al., 2012; Williams et al., 2011). For example, adolescents with impaired HRQoL may be less willing to engage in social or physical activity with peers, potentially leading to increased weight status. While the present study examined the impact of HRQoL on zBMI beyond SES within a cross-sectional manner, it provides the basis for examining the bidirectional association between HRQoL and pediatric zBMI within the context of SES in future research.

Upon further examination of hypothesis 2, none of the three other psychosocial variables (time constraints, household routines and food insecurity) were significantly associated with baseline zBMI when controlling for SES. With respect to food insecurity, this finding is surprising as food insecurity is more common among low-SES families (e.g., Casey et al., 2006) and has been previously associated with increased weight status (Martin & Ferris, 2007). This finding is inconsistent with the social determinants of health model (World Health Organization, 2010), as this model specifically posits food availability as one factor contributing to overall child health. Yet, this model did not specifically address pediatric obesity and food security status may be associated with other measures of health. Additionally, the association between food insecurity and pediatric weight status has been mixed within past literature (Larson & Story, 2011), and some studies have found no association between food security status and weight status in children (Gundersen, Garasky, & Lohman, 2009). While these previous studies have not been within the context of pediatric obesity intervention, the results of the present study suggest that addressing food security status should not be a primary focus of interventions for pediatric obesity. Rather, addressing food insecurity within children may be more fruitful if addressed outside of the context of pediatric BWC.

In contrast to hypothesis 2, the current study also failed to find an association between household routines and zBMI within a treatment-seeking sample of parents and children. This finding is also inconsistent with previous research that has found higher levels of routines to be related to decreased risk for pediatric obesity (Anderson & Whitaker, 2010), as well as decreased household routines in children from lower SES and more racially/ethnically diverse families (Taveras et al., 2012). One possible explanation of this lack of significant association is that household routines are primarily less common in lower-SES families, limiting the potential for household routines to explain variance in child weight status beyond SES. Additionally, previous research examining the impact of household routines on pediatric weight status have included children across the weight spectrum, rather than the limited weight status range included within the present study (Anderson & Whitaker, 2010; Taveras et al., 2012). The relation between household routines and weight status may not hold true for families within this restricted range of weight status, while other more salient factors may account for differences in zBMI within this population.

This study also failed to detect a significant effect of time demands on zBMI beyond the impact of SES, which was the final aspect of hypothesis 2. Again, this finding is inconsistent with previous research which has found that increased time demands have been related to increased pediatric weight status (Hearst et al. 2012; Jabs & Devine, 2006; Rydell et al., 2008). The present study hypothesized that increased time demands within the family would promote increased weight status (Guthrie et al., 2002; Jabs & Devine, 2006; Rydell et al., 2008). Similar to findings related to household routines, previous research examining the association between time demands and pediatric weight status has primarily included children across the weight spectrum (i.e., from healthy to obese; Hearst et al., 2012; Lytle et al., 2011). It may be possible that time constraints predict pediatric weight status across this spectrum; however, in children that are already categorized as overweight or obese, time constraints do not predict further increased weight status. Findings of the present study do not point to a benefit of focusing on time constraints without considering the larger impact of SES on weight status.

The partial support for hypothesis 2 may also be informed by examination of the bivariate or correlational associations between key variables. Given the significant relation between HRQoL and zBMI, it is unsurprising that HRQoL was significantly associated with zBMI at baseline. However, other findings may provide information concerning the lack of relation between food insecurity, time constraints, and household routines and zBMI at baseline. Food insecurity, for example, was significantly associated with SES, as expected based upon past literature (Casey et al., 2006). This significant association may indicate that food insecurity does not impact pediatric weight status beyond the impact of SES alone, as they may account for the same variance.

Additionally, there was a significant bivariate relation between household routines and time constraints in the family, such that decreased household routines was related to fewer time constraints in the family, while neither of these variables was significantly associated with either zBMI or SES. This may be due to a true lack of association, however may also be due to differences in experiences in household routines and time constraints within different families. As some families may benefit from increased time constraints as they promote more rigidity around meals and pre-planning meals, other families may be more likely to eat quick, energy dense foods due to their increased time constraints. Future research should further explore families' perceptions of these experiences, rather than relying solely on use of a single family member's subjective report.

Hypothesis 3: SES and Weight Status Change

Contrary to the third hypothesis, the current study did not find that SES predicted weight status change over the course of BWC. Although the finding that SES does not predict weight status change over the course of treatment may be a true finding, this lack of effect may be due to the lack of change in zBMI over the course of treatment. This finding is in contrast to previous meta-analyses which have found a small but consistent effect of behavioral interventions on pediatric weight status within the context of randomized controlled trials (RCTs; Janicke et al., 2014; McGovern et al., 2008). For example, previous studies have documented an average -.14 change (decrease) in zBMI (Johnston et al., 2007; Savoye et al., 2007; Williamson et al., 2005).

There are several reasons that may explain the lack of zBMI change in the present study. One potential explanation for the lack of weight change within the present study may have been the relatively high rate of attrition from the intervention. Specifically, although the treatment within the clinic is recommended for at least six sessions (once per month for at least six months), less than half of patients attended a fourth appointment within the clinic. This finding is similar to a review of other hospital based pediatric weight management programs, with previous studies reporting attrition rates greater than 50 percent (Sallinen Gaffka, Hampl, Frank, Santos & Rhodes, 2013). The high attrition in pediatric weight management is particularly notable given that effective pediatric BWC interventions with at least 26 hours of contact have demonstrated success compared to interventions with less contact (O'Connor et al., 2017), based upon randomized controlled trials. In contrast, the three sessions examined within the current study represent a total of six hours of contact (two-hour appointments). This relatively smaller "dose" of intervention may be one possible explanation for the lack of change in zBMI over the course of treatment. This small treatment effect with a small treatment dose is consistent with previous findings that fewer minutes in overall treatment is related to less positive outcomes from BWC (Janicke et al., 2014).

The majority of previous research within the context of hospital-based multidisciplinary BWC has focused on attrition, rather than weight-related outcomes (e.g., Farnesi, Newton, Holt, Sharma, & Ball, 2012; Jensen, Aylward, & Steel, 2012). Attrition within pediatric weight management clinics is particularly important as patients within this weight management structure are typically seen for a smaller dose of intervention and may be seen with less regularity (Jensen et al., 2012) than standard BWC often employed within clinical trials. However, even compared to similar multidisciplinary clinics, it appears that the intervention examined within the present study may have involved a lower frequency of contact. Previous research examining multidisciplinary weight management programs within hospitals found that within approximately two-thirds or programs, patients are seen at least once per week (Children's Hospital Association, 2013). The same survey also found 52 percent of programs are designed to last less than six months (Children's Hospital Association, 2013). Therefore, when compared to other similar hospital programs, the current program had a lower recommended frequency of patient contact (once per month), but a longer duration of contact (at least six months).

The lack of weight change found within the current study may have also been due to differences between the present BWC intervention and previous BWC treatment interventions, as most previous research has been in the context of an RCT (Janicke et al., 2014). RCTs do not account for variability in treatment provided and patients seen within clinical settings due to exclusion criteria limiting participation of many children (Feinstein & Horwitz, 1997). In addition, RCTs generally have lower rates of attrition (Wilfley et al., 2007), more contact hours (Janicke et al., 2014), and a greater proportion of children from higher SES families (e.g., Jelalian, Mehlenbeck, Lloyd-Richardson, Birmaher, & Wing, 2006) compared to hospital-based clinics. The lack of change in zBMI change over the course of the present study may reflect a disparity between the level of intervention intensity and intervention components characteristic of pediatric behavioral weight control RCTs, and the feasibility of interventions within clinical practice.

Hypothesis 4: Psychosocial Factors Related to Weight Status Change

Finally, the fourth hypothesis examined the impact of the four psychosocial variables (time constraints, quality of life, food insecurity, and household routines) on child weight status (zBMI) change. Contrary to the fourth hypothesis, the current study failed to find that the four psychosocial variables predicted weight status change over the course of treatment beyond the impact of SES. Specifically, the model which was tested to examine household routines, time constraints, quality of life and food insecurity as predictors of the slope of change in zBMI over the course of treatment did not converge. While the model examining the impact on the intercept (baseline zBMI) did converge, this association between SES and weight status at baseline parallels the analysis conducted within hypothesis 2.

There are multiple reasons why this model may not have converged. Within the present study, it is most likely that the lack of model convergence was due to the lack of zBMI change over the course of treatment. Lack of convergence may be due to a lack of consistency between the theory and the data (Little, Lindenberger, & Nesselroade, 1999). Specific to the present study, non-convergence may have also been caused by zero random slope variance (indicating a slope may be fixed rather than random), which is reflected by the lack of change in zBMI. Therefore, the model may not have converged because the current model was a poor fit for the data, as the model assumed change in zBMI over time, and we are unable to predict the change over time if there is very little change over time (Little, 2013).

Strengths and Limitations

The present study sought to expand previous research by examining the impact of quality of life, household routines, food insecurity and time constraints on baseline zBMI and zBMI throughout the course of weight control intervention, beyond the impact of SES alone. However, a number of strengths and limitations likely affect the findings of the present study. First, all psychosocial measures utilized within the present study were assessed from the perspective of the parents. While parents may be accurate reporters of some constructs included within the present study (e.g., time constraints, food insecurity), previous research has demonstrated disparities in parent and child reporting of HRQoL. Parents of children with obesity tend to report lower HRQoL than their children (Hughes et al., 2007). As HRQoL was the only construct that was related to baseline zBMI beyond SES, future research should incorporate multiple informants of HRQoL to examine differential associations between parent and child perspective. Further, future research should employ multi-method techniques to more fully understand the manifestation of these constructs within the home. For example, coding objective food insecurity within the home may provide insight into both the objective and subjective experiences of food insecurity (Webb et al., 2006).

A strength of the present study is the use of the Hollingshead four factor index as a comprehensive measure of SES (Galobardes et al., 2006). As SES is a complex factor that encompasses both economic and social position, a composite measure of SES accounts for multiple aspects of SES (Adler et al., 1994). A comprehensive measure of SES, such as used in the present study, more fully captures the different facets of SES that impact pediatric weight status. Incorporating a comprehensive measure of SES at presentation to BWC may aide in clinician identification of risk factors for increased weight status.

While the Hollingshead index has the strength of being a composite measure of SES and being widely used within past research (Edwards-Hewitt & Gray, 1995), limitations also exist in using the Hollingshead index. Specifically, using composite measures of SES does not allow for understanding of the individual facets of SES that are related to zBMI (Duncan & Magnuson, 2000). For example, a consistent negative association between parental education and child weight status has been found within previous studies (Shrewsbury & Wardle, 2012). However, understanding the differential impact of education cannot be disentangled within the present study, due to the composite measure of SES. Further, total family income was not measured within the present study. Although income does not fully capture the complexities of SES, lower income has been related to poorer health outcomes and decreased access to services such as healthcare (Newacheck, Hughes, & Stoddard, 1996). While income is often used as a proxy for a more complex understanding of SES, it is important to understand the differential impact that low income may have on pediatric weight status (e.g., Lee, Kim, Choi, & Lee, 2017), as compared to other measures of SES.

Related to methodology, two of the scales within the present study had alpha reliability coefficients below the standard adequate level of 0.7. While the low alpha reliability of the currently used measures of household routines and time constraints should be considered when interpreting these scales, previous researchers have argued against using an alpha cut-off of 0.7 (Schmitt, 1996). Both the presently used measure of time constraints (Darling et al., 2017) and the measure of household routines (Hart et al., 2007; Matheny et al., 1995) have been found to be unidimensional and content valid. However, results related to both the household routines and time constraints measures should be interpreted with caution due to the low alpha reliability within the present study.

The present study was also limited in the lack of weight status change over the course of treatment. Specifically, there was virtually no change in zBMI over the course of the first three treatment sessions. Although weight status change is generally the primary outcome of BWC intervention, it is not always the best indicator of health changes and other physical variables may also be appropriate indicators of success within BWC (Himes, 2009). Measurement of variables such as body fat percentage, lean body mass, triglycerides, fasting glucose and fasting insulin are all concurrent measurements that may provide a more comprehensive understanding of the physical changes that occur over the course of pediatric BWC (Ho et al., 2013). Further, consideration should be given to whether the interdisciplinary outpatient model for treating pediatric obesity is successful for children and adolescents presenting for BWC. Research should continue examining alternative options to implement successful interventions for weight change across the SES spectrum.

Unfortunately, due to the scope of the present study examining the association between SES and weight status change over the course of treatment, patterns of attrition were unable to be examined. However, understanding patterns of attrition from this program, and hospital-based weight management programs more generally may provide insight concerning the lack of effective treatment. A review of the literature (Skelton & Beech, 2011) found attrition rates from 27% to 73% in previous studies, however patterns in reasons for attrition are unclear. Specifically, some previous studies have found economically disadvantaged individuals, and those with higher levels or obesity are at increased risk for attrition, while other studies have not found this pattern. One study examining a mid-western multidisciplinary outpatient clinic, similar to that of the present study, had attrition over 73% before completing five visits in nine months (Skelton, DeMattia, & Flores, 2008). However, upon examining specific reasons for attrition, no significant differences were found between completers and non-completers of the program on race/ethnicity, zBMI, age, insurance coverage, gender, and household structure. Within RCTs for pediatric weight management, rates of attrition are comparable to those of hospital-based weight management program (Skelton & Beech, 2011). Overall, attrition in weight management is of significant concern, with previous research identifying that patients are most likely to drop out early from treatment, but no other consistent indicators of attrition have been identified (Skelton & Beech, 2011). Future research should explore patterns of attrition in pediatric weight management, as well as potential methods to improve engagement of families and children in weight management programs.

A central limitation of the intervention employed within the current study is the high rate of attrition. Only three time points were employed in the present analyses, as more than half of patients had dropped out of the intervention before the fourth appointment. Although none of the four psychosocial predictors examined within the present study were different between patients that attended one session as compared to those that attended at least three sessions, there may have been other factors impacting the change in weight status over the course of treatment. While pediatric weight management attrition tends to be high (27% to 73%; Skelton & Beech, 2011), this limits the understanding of factors predicting weight status change.

Specifically, some studies have found that children from racial/ethnic minority backgrounds, those from economically disadvantaged backgrounds, and those with higher levels of obesity may be more likely to drop out of weight management treatment (Skelton & Beech, 2011). These findings highlight difficulties in understanding the complex relation between SES and success within pediatric BWC. Understanding the association found between SES and zBMI at presentation to treatment may aide clinicians in more fully considering SES within treatment. For example, clinicians may focus on more structural environmental changes, such as working with schools to incorporate physical activity into after-school activities, which may be more successful for children from lower SES backgrounds (Beauchamp, Backholer, Magliano, & Peeters, 2014; Sanigorski, Bell, Kremer, Cuttler, & Swinburn, 2008). Hospitals should continue to explore and adapt pediatric obesity interventions to better maximize medical care as patients from lower-SES households are likely at a higher weight status at presentation to treatment (Skelton & Beech, 2011).

Future Directions

Despite limitations of the present study, findings from this study support the examination of these constructs within future research to better understand the complex association between SES and weight status within a weight control program. One future direction should involve longitudinal measurement of the psychosocial variables examined within the present study. As quality of life, time constraints, food insecurity, and household routines may be changeable over the course of treatment, future studies should examine these variables throughout treatment. Longitudinal measurement of multiple variables would allow for conclusions regarding developmental changes over the course of childhood and adolescence (Little, Card, Preacher, & McConnell, 2009). Further, longitudinal data could be useful for understanding mechanisms of change that may be present over the course of intervention and may aide in more fully understanding and evaluating causality of change within treatment (Card & Little, 2007). Therefore, future research should aim to incorporate measurement of multiple variables over time, rather than only utilizing baseline measurements to predict change in weight status over time.

Additionally, future research should aim to overcome limitations of the present study related to measurement concerns. Specifically, the measures employed for time constraints and household routines demonstrated sub-optimal alpha reliability within the present sample. Future researchers should examine the association between SES, household routines, time constraints, and weight status within a treatment seeking sample of children using multiple measures of these constructs (e.g., other self-report measures, more objective measurement). Future research should also consider capturing multiple measurements of SES within one study to better understand the impact that different measures of SES (e.g., composite measurement, education, occupation, income) have on weight-related outcomes.

Overall, the aims of the present study (i.e., examining the impact of SES and associated psychosocial variables on weight status change in BWC) are important to understanding the impact of SES on treatment outcomes. However, this aim could not be fully examined within the present study, due to the lack of weight change as a result of the intervention. This primary research question should be further examined within BWC interventions that have demonstrated successful weight status change across the SES spectrum, to more adequately examine differences by SES.

Future research should consider a multifaceted approach to increasing success through BWC. First, outpatient clinic BWC interventions should be further explored in terms of overall efficacy of clinical changes. Specifically, it is important for future research to explore if adaptations to BWC intervention recommended based on RCTs is successful within outpatient clinics. Alternatively, outpatient pediatric BWC clinics, such as the clinic examined within the present study, may need to be adapted to improve outcomes. Following the USPSTF (US Preventive Services Task Force, 2017) guidelines of at least 26 contact hours through successful pediatric weight control interventions, it may be important for outpatient clinics to identify methods to increasing contact hours given hospital and staffing constraints. Other important measures of clinical change should also be examined in conjunction with weight status, such as insulin concentrations, that may also be used in the diagnosis of pediatric obesity (Styne et al., 2017), as well as show changes through treatment that may not be measured through zBMI (Himes, 2009).

Conclusions

Overall, the present study replicated findings suggesting an inverse association between zBMI and SES within a clinical population of children seeking BWC. Further, the present study found that HRQoL at presentation to BWC predicted baseline zBMI, beyond the impact of SES alone. These findings highlight the importance of addressing the impact of both SES and HRQoL within BWC and considering the consequences that these psychosocial variables have on weight status at presentation to BWC. Despite the goal of the present study to examine the longitudinal relation between SES and pediatric obesity over the course of weight control intervention, conclusions cannot be drawn related to longitudinal measurement, likely due to the lack of change in weight status over the course of treatment. Findings from the current study present multiple considerations for future research in terms of understanding the association between SES, psychosocial factors, and pediatric weight status within pediatric BWC intervention.

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Table 1. *Descriptive Characteristics of Demographic Variables (N = 205 unless otherwise noted).*

Characteristic	N (or *Mean*)	% (or *SD*)
Child Characteristics		
Biological sex		
Female	117	57.1%
Male	88	42.9%
Ethnicity		
Hispanic or Latino	5	2.4%
Not Hispanic or Latino	182	88.8%
Don't Know/Declined to Respond	18	8.8%
Race		
White/Caucasian	142	70.3%
Black/African American	33	16.3%
Other/Don't Know	30	13.4%
Age	M = 13.28	SD = 2.22
zBMI for age-and-gender at Session 1	M = 2.38	SD = .42
zBMI for age-and-gender at Session 2 (N=140)	M = 2.39	SD = .38
zBMI for age-and-gender at Session 3 (N=106)	M = 2.41	SD = .41
Parent Characteristics		
Biological sex		
Female	173	84.4%
Male	26	12.7%
Declined to Respond	18	8.8%
Age	M = 43.68	SD = 8.35
Education (of clinic-attending parent)		
Did not complete high school	9	4.6%
High school graduate	57	27.8%
Partial college (at least one year) or specialized training	59	28.8%
Standard college or university graduation	49	23.9%
Graduate professional training (graduate degree)	23	11.2%
Hollingshead Four Factor Index[a]	M = 36.92	SD = 15.40
Unskilled laborers, menial service workers	41	20.0%
Machine operators, semiskilled workers	19	9.5%
Skilled craftsmen, clerical, sales workers	48	23.5%
Medium business, minor professional, technical	69	33.5%
Major business and professional	28	13.5%

Note. All percentages may not equate to 100 due to rounding.
SD = standard deviation; *M* = sample mean
[a]Hollingshead, 1975

Table 2. *Correlations Between All Variables (N=205 unless noted)*.

Variables	1	2	3	4	5	6	7	Mean	SD
1. zBMI at Session 1	-							2.38	.42
2. zBMI at Session 2 (*N*=140)	.88**	-						2.39	.38
3. zBMI at Session 3 (*N*=106)	.80**	.92**	-					2.41	.41
4. SES (Hollingshead Four-Factor Index)	-.14	-.28**	-.28**	-				36.93	15.40
5. Family Time Constraints	-.07	-.12	-.03	.14	-			2.71	.82
6. Food Insecurity (Core Food Security Module)	.09	.13	.06	-.26**	.01	-		1.05	1.76
7. Household Routines (CHAOS)	-.11	-.09	-.05	.03	-.37**	-.05	–	3.42	.67
8. Quality of Life (Sizing Them Up)	-.28**	-.26**	-.20**	-.04	-.08	-.13	.32**	66.03	18.62

$^{*}p < .05$. $^{**}p < .01$.

Table 3. *Regression with SES and Psychosocial Variables Predicting Baseline zBMI (N = 205)*.

	B	S.E.	Beta (β)	R^2	ΔR^2
zBMI at Intake					
Step 1:				.03	.03*
SES	-.01	.00	-.16		
Step 2:				.10	.07*
Time Constraints	-.04	.04	-.09		
HRQoL	-.01	.00	-.24*		
Household Routines	-.05	.06	-.07		
Food Insecurity	.00	.02	.00		

Note. * $p < .05$.

Appendix A

DEMOGRAPHICS QUESTIONNAIRE

Please fill out the following questions about yourself and your family.

Questions about your child:

1. Which of the following do you consider to be **your child's** racial group? (Circle one.)
   1 = American Indian/Alaskan Native
   2 = Asian
   3 = Native Hawaiian or Other Pacific Islander
   4 = Black or African American
   5 = White
   6 = More than one race (Please choose all that apply)
   7 = Other (Please describe): ____
   8 = Don't know

2. Which of the following do you consider to be **your child's** ethnic group? (Circle One)
   1 = Hispanic or Latino
   2 = Not Hispanic or Latino

Questions about yourself:

3. ***Gender (Circle one): 0 = Male 1 = Female***

4. ***What is your age in years?______________years***

5. ***What is your marital status?***
   0 = Single
   1 = Married
   2 = Divorced
   3 = Other _________________________

6. Which of the following do you consider to be your racial group? (Circle one.)
   1 = American Indian/Alaskan Native
   2 = Asian
   3 = Native Hawaiian or Other Pacific Islander
   4 = Black or African American
   5 = White
   6 = More than one race (please choose all that apply)
   7 = Other (Please describe): ____
   8 = Don't know

7. Which of the following do you consider to be **your** ethnic group? (Circle One)
   1 = Hispanic or Latino
   2 = Not Hispanic or Latino

8. What best describes your family structure?

1 = Single Parent (never married, divorced, widowed or separated)
2 = Partnered (married or living with partner)

9. Are you currently employed?
   1 = Yes
   2 = No
   3 = Homemaker

   11a. What is your current occupation?___________________________

   11b. If yes, how many hours per week do you work on average? _____________

10. Is your spouse/partner/significant other employed?
   1 = Yes
   2 = No
   3 = Homemaker
   4 = Not Applicable

11. What is the highest grade you have completed? ____________________________

12. What is the highest grade your spouse or significant other has completed (if applicable)?__________

13. Does your child receive free or reduced lunch?
   1 = Yes
   2 = No

Appendix B

Core Food Security Module

In the last 12 months:

1. The food we bought just didn't last and we didn't have enough money to get more.	Often True	Sometimes True	Never True
2. We couldn't afford to eat balanced meals.	Often True	Sometimes True	Never True

3. In the last 12 months, did you or the other adults in your household ever cut the size of your meals, or skip meals because there wasn't enough money for food?
    a. Yes
    b. No

4. If yes, how often did this happen?
    a. Almost every month
    b. Some months but not every month
    c. Only 1 or 2 months

5. In the last 12 months, did you every eat less than you felt you should because there wasn't enough money to buy food?
    a. Yes
    b. No

6. In the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food?
    a. Yes
    b. No

Appendix C

Chaos, Hubbub and Order Scale

	Definitely Untrue	Sometimes Untrue	Not really true or untrue	Somewhat True	Definitely True
1. The children have a regular bedtime routine.	1	2	3	4	5
2. You can't hear yourself think in our home.	1	2	3	4	5
3. It's a real zoo in our home.	1	2	3	4	5
4. We are usually able to stay on top of things.	1	2	3	4	5
5. There is usually a television turned on somewhere in our home.	1	2	3	4	5
6. The atmosphere in our house is calm.	1	2	3	4	5

Appendix D

Barriers to Health in the Family (Only used Time Constraints Subscale in the Present Analyses)

Please indicate how much each of the following applies to your family.

	Strongly Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly Agree
1. Our whole family participates in physical activity together.	1	2	3	4	5
2. Our family makes an effort to eat healthy foods.	1	2	3	4	5
3. Our family always has enough food to eat.	1	2	3	4	5
4. It is hard for me to find the time to prepare healthy foods at home.	1	2	3	4	5
5. It is hard for me to find the time for physical activity.	1	2	3	4	5
6. In our house, decisions about what to eat are based on cost.	1	2	3	4	5
7. I praise my child for physical activity.	1	2	3	4	5
8. I compliment my child when he/she makes healthy eating choices.	1	2	3	4	5
9. Our family is too busy to eat meals together.	1	2	3	4	5
10. I talk to my child about how to make healthy eating choices.	1	2	3	4	5
11. Having a gym membership is too expensive for our family.	1	2	3	4	5
12. Being healthy is important in our family.	1	2	3	4	5
13. I encourage my child to exercise regularly.	1	2	3	4	5
14. Our family eats dinner at a similar time and in the same place most nights.	1	2	3	4	5
15. Extracurricular sports are too expensive for my child to participate.	1	2	3	4	5
16. I talk to my child about different ways to get physical activity.	1	2	3	4	5
17. Fruits and vegetables are too expensive for our family to buy.	1	2	3	4	5
18. When our family goes to restaurants we try to make healthy choices.	1	2	3	4	5
19. If I were less busy we could eat less prepackaged meals (e.g. mac and cheese).	1	2	3	4	5

Appendix E

Sizing Them Up

Please indicate how your child has been feeling within the past MONTH regarding their weight/shape/size by circling the option that best fits your child.

	Never	Sometimes	Often	Always
1. Had difficulty participating in physical activities (e.g. sports) because of their weight/shape/size	1	2	3	4
2. Was teased by peers because of their weight/shape/size	1	2	3	4
3. Chose not to go to school because of their weight/shape/size	1	2	3	4
4. Felt sad because of their weight/shape/size	1	2	3	4
5. Had to make changes to surroundings (e.g. furniture, school desks) because of their weight/shape/size	1	2	3	4
6. Argued about when, what and how much to eat	1	2	3	4
7. Chose not to participate in gym/recess/physical education at school because of their weight/shape/size	1	2	3	4
8. Felt frustrated because of their size	1	2	3	4
9. Avoided dressing or undressing in front of others because of their weight/shape/size	1	2	3	4
10. Kept their body fresh and clean	1	2	3	4
11. Felt worried because of their weight/shape/size	1	2	3	4
12. Felt left out because of their weight/shape/size	1	2	3	4
13. Felt mad because of their weight/shape/size	1	2	3	4
14. Was teased by others when physically active because of their weight/shape/size	1	2	3	4
15. Seen as having a good sense of humor	1	2	3	4
16. Felt concerned about their weight/shape/size	1	2	3	4
17. Perceived by others as healthy	1	2	3	4
18. Became upset at mealtimes (e.g. cried, fussed, argued)	1	2	3	4
19. Had difficulty keeping up with other children because of their weight/shape/size	1	2	3	4
20. Felt successful in daily activities	1	2	3	4
21. Became out of breath and had to slow down because of their weight/shape/size	1	2	3	4
22. Had low self-esteem because of their weight/shape/size	1	2	3	4