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MOTIVATION, MINDFULNESS, AND METABOLIC FACTORS PREDICTING ADOLESCENT ADHERENCE AND ATTRITION IN A MULTIDISCIPLINARY WEIGHT MANAGEMENT PROGRAM

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

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Abstract

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Estimated rates of obesity are notably high in the United States and pose a significant public health concern. A number of deleterious physical and psychosocial conditions are associated with pediatric obesity and the cost of its treatment is considerable. Accordingly, the number of weight management treatments has increased to meet this growing public health challenge. Unfortunately, insufficient participation in weight management treatment, namely low adherence and high attrition, often impede the effectiveness of these programs. Although the barriers associated with inadequate adherence and elevated rates of attrition are documented, there is a dearth of research on the predictors of the low participation in pediatric weight management. To address this gap in the literature, the current study examined whether psychosocial (e.g., motivation, mindfulness, depression), biological (e.g., anthropometric, biochemical), and demographic variables predicted adherence and attrition. A series of backward elimination regressions were modeled to identify the biopsychosocial factors that best predicted adherence and attrition in a pediatric weight management program. The study utilized a sample of parent-adolescent dyads (N = 143) from the T.E.E.N.S. program, a multidisciplinary weight management treatment involving behavioral, nutrition, and exercise components for adolescents with obesity. Several demographic characteristics were associated with lower adherence. Parent basic psychological need fulfillment was also significantly associated with six-month attrition. This finding underscores the importance of the parents' role in the successful completion of a pediatric weight management program. This study contributes to an increased understanding of the factors related to participation in weight management programs, and can inform the refinements of interventions, such as T.E.E.N.S. and related programs.

Motivation, Mindfulness, and Metabolic Factors Predicting Attrition and Adherence in a Multidisciplinary Weight Management Program

Adult obesity rates have dramatically increased in the United States (US) since 1980 (Ogden, Carroll, Kit, & Flegal, 2014). It is currently estimated that 33.7% of adult men and 36.5% of adult women in the US are obese (Body Mass Index[BMI] •30 kg/m^2). High rates of obesity are also evident in children and adolescents; indeed, obesity rates in US children and adolescents have tripled since 1980. Currently, 20.5% of children (ages 12-19 years) are obese (BMI for age • 95^{th} percentile on the Centers for Disease Control [CDC] growth charts) and 34.5% are either overweight or obese (BMI for age • 85^{th} percentile on the CDC growth charts; Ogden et al., 2014).

Obesity rates in children and adolescents have remained at elevated for several years, but recently appear to have stabilized (Ogden, Carrol, Kit, & Flegal, 2012; Ogden et al., 2014). Although the plateau in pediatric obesity is encouraging, these rates remain notably high and comorbid health conditions continue to pose a significant public health concern for the US (Han, Lawlor, & Kimm, 2010; Parekh & Barton, 2010). In addition to the direct health effects of childhood obesity, costs for treatment of this condition are estimated at 168.4 billion dollars annually (Cawley & Meyerhoefer, 2012; Yanovski & Yanovski, 2011).

Although a number of obesity treatments exist (e.g., pharmacological, surgical), behavioral interventions are the most frequently utilized approach (Ebbeling, Pawlak, & Ludwig, 2002; Fisberg et al., 2004; Sherafat-Kazemzadeh, Yanovski, & Yanovski, 2012; Strauss, Bradley, & Brolin, 2002). Unfortunately, the effectiveness of these treatments is often limited by poor participation, including high attrition and non-adherence (Bean et al., 2011; Kelly et al., 2011; Zeller; Saelens & McGrath, 2003; Halvorson & Skelton, 2012; Jelalian et al., 2012; Skelton & Beech, 2011; Zeller et al., 2004). A number of psychosocial variables are associated with nonadherence to weight management treatments, including demographic characteristics including African American race and low socioeconomic status (SES, Barlow, Ohlemeyer, 2006; Cote et al., 2004; Denzer, Reithofer, Wabitsch, & Widhalm, 2004; Jelalian et al., 2012; Zeller et al., 2004), motivation (Skelton, Irby, Beech, & Rhodes, 2012) and mental health characteristics (Zeller et al., 2004). In addition to these psychosocial correlates, there are suggestions that biological factors, such as genetics and metabolic mechanisms, might influence adherence behaviors (McBride, Bryan, Bray, Swan, & Green, 2012). In the current study, a range of biopsychosocial variables (e.g., motivation, mindfulness, metabolic factors) are examined in relation to participation (e.g., adherence, attrition) in weight management treatment. Results from this study have the potential to inform future weight management interventions to optimize adherence and retention.

Overview of the Review of Literature

The first sections of the Introduction review the current literature on pediatric obesity, its treatment, and how attrition and non-adherence influence outcomes. First, the assessment of obesity and its etiology, the related negative health effects, and the associated health condition of pediatric overweight are reviewed. Characteristics of pediatric weight management treatment are then discussed. Specifically, weight management modalities, the T.E.E.N.S. program (from which the data for the current project are derived), and the important role of parents in pediatric obesity treatment are examined. The difficulties related to participation in pediatric weight management programs, namely low adherence and high attrition are considered.

Next, potential psychosocial correlates of attrition and adherence in pediatric weight management treatment are reviewed. Specifically, the roles of motivation, mindfulness, and childhood depression are examined. Potential biological correlates of adherence and attrition in pediatric weight management treatment are also reviewed, including the Negative Feedback Regulation of Food Intake model (NFRFI; Morton, Cummings, Baskin, Barsh, & Schwartz, 2006), and its potential relation to participation in weight management treatment. Metabolic syndrome is characterized as a potential biomarker of NFRFI and treatment participation.

The literature search was primarily conducted using PsycInfo and Pubmed/Medline databases, and Google Scholar search engine. Only peer-reviewed articles related to the topics of the current research study were included in the literature review. Although gaps in the literature are evident, this review highlights the value of the current research question. Despite these gaps, there was a solid foundation of evidence to support the goals of the current study.

Childhood Obesity

A number of assessment indices for body mass exist, such as the International Obesity Task Force approach (Cole, Bellizzi, Flegal, & Dietz, 2000). A review of measurement approaches determined that BMI based on age and national reference percentiles provided better diagnostic accuracy for both clinical and epidemiological purposes (Reilly, Kelly, & Wilson, 2010). Factors such as gene-environment interactions and maternal behaviors might explain some of the variance in the development of obesity (Dubois & Girard, 2006; O'Rahilly & Farooqi, 2006), but a primary causal factor in childhood obesity is an imbalance between the intake and utilization of energy (Hill, 2006). Obese status is therefore commonly developed and maintained through the consumption of more calories than those expended through physical activity.

Multiple early life risk factors for childhood obesity also exist. In a large-scale study of 909 children, a number of parent and child risk factors were identified (Reilly et al., 2005). A primary parent factor included parental obesity. Child factors included: birth weight, early elevated BMI and adiposity rebound, standard deviation score for weight at eight-months, standard deviation score for weight at 18-months, weight gain at year one, ≥8 hours weekly screen time at three years of age, and short sleep duration at three years. Although direct causal links cannot be derived from these results, possible origins of the identified factors might range from genetic associations to environmental and behavioral practices by the family system (e.g., screen time, activities related to feeding and exercise).

A range of demographic features is associated with pediatric obesity. Specifically, female gender, low-SES, and racial minority status are often associated with higher estimated rates of obesity and overweight among children (Gordon-Larsen, Adair, & Popkin, 2003; Hoelscher et al., 2015; Ogden et al., 2014; Miech, Kumanyika, Stettler, Link, Phelan, & Chang, 2006; Ng et al., 2014). Although these associations do not indicate causality, these demographic characteristics are important to consider when working with individuals at a higher risk for obesity and its comorbid health conditions.

Negative Health Effects of Childhood Obesity

Children and adolescents who are obese have many of the same comorbid health concerns as their adult counterparts, such as an increased risk for pulmonary, musculoskeletal, renal, gastrointestinal, endocrine, cardiovascular, and psychosocial challenges (Deckelbaum & Williams, 2001; Freedman et al., 2007; Stern et al., 2007; Stern et al., 2006; Sutherland, 2008; Taylor et al., 2006; Van Cleave, Gortmaker, Perrin, 2010). There is also evidence that children and adolescents with obesity have an elevated risk of obesity in adulthood (Ludwig, 2007). Overall, obesity in childhood and adolescence is predictive of both pediatric health risks and later adult comorbidities.

In addition to long-term health effects, childhood obesity is associated with a range of negative short-term health effects. Medical conditions formerly uncommon in pediatric populations, such as type 2 diabetes and hypertension, are increasingly prevalent in children with obesity, compared with their healthy weight peers (Deckelbaum & Williams, 2001; Lobstein, Baur, & Uauy, 2004; Van Cleave, Gortmaker, & Perrin, 2010). Further, psychosocial challenges are associated with childhood obesity. In studies examining psychosocial comorbidities in children with obesity, associations were found with decreased self-esteem (Griffiths, Tessa, Parsons, & Hill, 2010; Strauss, 2000), poor health related quality of life (Williams et al., 2011), anxiety (Pruder & Munsch, 2010), depression (Goodman, & Whitaker, 2002), body dissatisfaction (Porter, Stern, Mazzeo, Evans, & Laver, 2012; Thompson, Shroff, Herbozo, Cafri, Rodriguez, & Rodriguez, 2007), high-risk behaviors (Strauss, 2000), and poor social functioning (Strauss & Pollack, 2003).

Childhood Overweight

Children are considered overweight, but not obese, if their BMI is between the $\geq 85^{th}$ percentile and $<95^{th}$ percentile for age and gender (Krebs, Himes, Jacobson, Nicklas, Guilday, & Styne, 2007). Although there is debate regarding the role of overweight as a predictor of poor long-term health (Flegal, Kit, Orpana, & Graubard, 2013; Hill & Wyatt, 2013; Sims, 2001; Stefan et al., 2008), research has found that children classified as overweight can exhibit many of the same health risks as those of obese status. Specifically, overweight is associated with increased risks for elevated blood pressure, type 2 diabetes, high cholesterol, and future obesity (Deckelbaum & Williams, 2001; Falkner et al., 2006; Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007; Guo, Wu, Chumlea, & Roche, 2002; Ludwig, 2007; Nader et al., 2006). Further, obese individuals who were metabolically healthy were still at a greater risk than their healthy weight peers for future obesity and associated negative health conditions (Kramer, Zinman, & Retnakaran, 2013; Kuk & Nardern, 2009).

Pediatric Weight Management Treatment

Because of the significant increase in the prevalence of obesity and its comorbid health risks, weight-related research and interventions have become a critical topic for health care workers globally (James, 2008; Peters, 2012). The three primary intervention approaches are pharmacological, surgical, and behavioral treatments. Because of the invasiveness of surgical interventions and associated complications with pharmacological approaches, especially within the pediatric population, these modalities are often considered last resort treatments, and all are adjunctive to behavioral intervention. Behavioral interventions are therefore implemented most often (Ebbeling, Pawlak, & Ludwig, 2002; Fisberg et al., 2004; McGovern et al., 2008; Sherafat-Kazemzadeh, Yanovski, & Yanovski, 2012; Strauss, Bradley, & Brolin, 2002).

Psychosocial components of lifestyle, such as motivation to exercise and food choice, make behavioral interventions an effective option for obesity treatment (Bautista-Castano, Doreste, & Serra-Majem, 2004; Campbell, Waters, O'Meara, & Summerbell, 2001; Shaw, O'rourke, Del Mar, & Kenardy, 2005; Wadden, Butryn, & Wilson, 2007). Specifically, comprehensive lifestyle programs that use behavioral treatments to target diet and physical activity are considered a primary treatment for overweight and obesity (Spear et al., 2007; Wadden, Butryn, Byrne, 2004; World Health Organization, 2000). A review of behavioral weight loss approaches concluded that comprehensive lifestyle modification programs targeting weight loss are an effective means for weight management (Wadden, Butryn, & Wilson, 2007).

Pediatric weight management treatments range in focus. A recent meta-analysis demonstrated that diet-only and diet-plus exercise components yielded healthy changes in weight and metabolic functioning (Ho et al., 2013). Some treatments focus on single factor interventions that primarily target diet (Ebbeling, Leidig, Sinclair, Hangen, & Ludwig, 2003) or exercise (Atlantis, Barnes, & Singh, 2006). Comprehensive lifestyle programs are multidisciplinary in nature and seek to treat the multifactorial aspects of obesity (Kirk, Scott, & Daniels, 2005; Nemet et al., 2005; Luttikhuis et al., 2009). One such multidisciplinary treatment that has demonstrated a range of positive health outcomes related to adolescent obesity is Virginia Commonwealth University's Teaching Encouraging Exercise Nutrition Support program (T.E.E.N.S.; Bean et al., 2011; Evans, et al., 2009; Stern et al., 2006; 2007; Wickham et al., 2009). The T.E.E.N.S. program is a multidisciplinary weight loss intervention that includes clinicians from internal medicine, psychology, nutrition, and exercise science on the treatment team. Participants are required to participate in a supervised exercise session three days a week, and to attend separate bi-weekly appointments with the program's dietitian and behavior specialists (i.e., doctoral students in psychology supervised by a licensed clinical psychologist). T.E.E.N.S. takes into consideration family systems factors, with many of the appointments (e.g., diet and behavior) attended by both the adolescent and her/his designated legal guardian (most often the parent). Previous findings from T.E.E.N.S. demonstrate that enrolled adolescents reduced their intake of total fat, saturated fat, carbohydrates, sodium, and sugar, and increased their intake of vegetables, fruits, and fiber (Bean et al., 2011). Further, T.E.E.N.S.'s participants manifested significant, positive changes in cardiorespiratory fitness after engaging in the program for six months (Evans et al., 2009). Biomarkers related to metabolic syndrome, such as percentage body fat, total cholesterol, and BMI *z*-score, also decreased over the course of the program (Wickham et al., 2009). Further, family systems factors, namely child perceptions of parental autonomy support and cohesion in the home, were predictive of BMI declines at three-months (Woods, Stern, Trapp, Mazzeo, Thacker, & Wickham, in preparation). Despite the encouraging results related to the T.E.E.N.S. program, high attrition and non-adherence to treatment protocols remain a significant limitation (Bean et al., 2011; Kelly et al., 2011).

Role of Parents in Pediatric Weight Management Treatment

Characteristics of the family system (e.g., SES, parent education, parenting styles, family cohesion) are important psychosocial factors to consider when treating pediatric overweight and obesity (Epstein, Myers, Raynor, & Saelens, 1998; Kitzmann & Beech, 2011). For example, family structure (Gable & Lutz, 2004; Zeller et al., 2007), family stress (Garasky et al., 2009; Puder & Musch, 2009) and perceived home conflict (Garasky et al., 2009; Hooper et al, 2009) are associated with child weight status. Communication variables, such as low levels of family communication (Chen & Kennedy, 2004) and emotional expression in the home (Mellin, Neumark-Stainer, Story, Ireland, & Resnick, 2002; Topham et al., 2011) are linked with child weight and eating behaviors, respectively. Further, research has demonstrated that treatments that include the family system, particularly parents, are more often beneficial than those that solely target the child (Barlow & Dietz, 1998; Collins et al., 2011; Graber & Brooks-Gunn, 1996; Jelalian & Saelens, 1999; Kitzmann & Beech, 2011; McLean, Griffin, Toney, & Hardeman, 2003). Together, the role of the family is considered a critical factor in pediatric weight management.

Parents in particular play a particularly critical role in supporting the treatment of pediatric obesity (Boutelle, Cafri, & Crow, 2011; Golan & Crow, 2004a; Lindsay, Sussner, Kim, & Gortmaker, 2006; Janicke, 2013; Janicke et al., 2008; McLean, Griffin, Toney, & Hardeman, 2003). Across the child's development, parents have a unique opportunity to control or modify a variety of obesogenic factors, such as diet and exercise (Lindsay, Sussner, Kim, & Gortmaker, 2006). Targeting parents to affect health behavior change includes addressing parenting behaviors regarding specific eating and exercise habits (e.g., food, exercise) as well as targeting general parenting behaviors, including parenting skills and styles (Kitzmann & Beech, 2011). A number of parenting factors are associated with child weight: parenting style (Golan & Crow, 2004), level of parent involvement (Heinberg et al., 2010), nutrition knowledge (Gable & Lutz, 2004), modeling of healthy behaviors (Wrotniak, Epstein, Paluch, & Roemmich, 2004; Wrotniak, Epstein, Paluch, & Roemmich, 2005), reinforcing healthy food practices (Laessle, Uhl, & Lindel, 2001), monitoring screen time (Reilly et al., 2005), and facilitating children's physical activity (Epstein, Kilanowski, Consalvi, & Paluch, 1999). Because of their influence on pediatric health behaviors, parents are critical to include within the context of pediatric weight management treatment (Epstein, Valoski, Wing, McCurleu, 1990; Gerards, Sleddens, Dagnelie, De Vries, & Kremers, 2011; Golley, Magarey, Baur, Steinbeck, & Daniels, 2007). To a large extent, parents regulate their child's lifestyle. Thus, including them in pediatric weight management treatment capitalizes on their ability to affect child behavioral change.

Treatment Attrition

In spite of the many benefits of pediatric weight management interventions, a notable challenge to treatment success is attrition (Bean et al., 2011; Beliard, Kirrschenbaum, & Fitzgibbon, 1992; Halvorson & Skelton, 2012; Jelalian et al., 2012; Kelly et al., 2011; Pinelli et al., 1999; Skelton & Beech, 2011; Skelton et al., 2012; Steele et al., 2012; Wing, Vendetti, Jakicic, Polley, & Lang, 1998; Zeller et al., 2004). In a review of the literature on attrition in pediatric weight management, Skelton and Beech (2011), found that dropout rates ranged from 12.5% to 73%, with a mean of 46.1%. Overall, these authors note that attrition is poorly detailed in the literature and often defined differently across studies. Most commonly, attrition is defined as not completing the primary treatment period of a specific intervention. Alternatively, attrition is defined as failure to return to a program before completion. However, cautious interpretation of the reviewed attrition data is recommended because the duration of the studied interventions was highly variable (i.e., ranging from 12-weeks to 12-months) and included open-ended programs.

A number of barriers to completing a pediatric weight loss intervention have been identified in the literature. For example, in a study surveying healthcare professionals affiliated with 24 different children's hospital-based weight loss programs, the most common barriers to completion included challenges with scheduling and transportation (Hampl, Paves, Laubscher, & Eneli, 2011). In samples of adults, predictors of attrition from obesity-related interventions included baseline health behaviors (e.g., greater attempts at weight loss, less exercise per day,), psychosocial variables (e.g., greater depression, lower quality of life), and greater pre-intervention body weight (Teixeira et al., 2004).

Variables predictive of attrition from pediatric weight management treatment include greater child pre-intervention body weight, parental factors (e.g., receipt of Medicaid, greater parental BMI, lower caregiver quality of care), psychosocial factors (e.g., depression, low self-concept, externalizing behavior), and racial minority status (Barlow, Ohlemeyer, 2006; Cote et al., 2004; Denzer, Reithofer, Wabitsch, & Widhalm, 2004; Jelalian et al., 2012; Zeller et al., 2004). Similar findings were demonstrated in other studies surveying patient participants. When parents and children were queried, common reasons for attrition included lack of insurance coverage for services, parent and child interest, and time burden (Barlow & Ohlemeyer, 2006; Cote, Byczkowski, Kotagal, Kirk, Zeller, & Daniels, 2004; Grimes-Robison, & Evans, 2008). Considering the notable health risks of childhood obesity and the wide range of factors associated with attrition, there is an identified need for more attention to the factors predictive of attrition from pediatric weight management programs (Hampl, Paves, Laubscher, & Eneli, 2011; Skelton & Beech, 2011). One variable noted to be a potential, but not adequately researched, predictor of pediatric attrition from weight management programs was motivation (Skelton & Breech, 2011).

Treatment Adherence

Success in pediatric weight management treatment is positively associated with adherence (Israel, Silverman, & Solotar, 1989; Saelens & McGrath, 2003; Wrotniak, Epstein, Paluch, & Roemmich, 2005). Although no gold standard exists for measuring health behavior adherence (Vitolins, Rand, Rapp, Ribisl, & Sevick, 2000), it is often defined as the extent to which a patient follows specific health recommendations within a treatment plan (Dunbar-Jacob & Mortimer-Stephens, 2001). For example, weight management studies have used a number of measures to assess adherence behaviors for nutrition, such as dietary self-report and recall (Kirkpatrick et al., 2013; Thompson & Byers, 1994), and physical activity with energy expenditure (Seale & Rumbler, 1997; Shephard & Aoyagi, 2012). Although assessment of adherence should optimally be multifaceted in nature, a percentage of attendance to intervention activities is a widely used measure (Brewer, 1999; Brewer et al., 2000). Alternative definitions conceptualize adherence as the patient's ability and volition to participate in treatment (Franca, Sahade, Nunes, & Ardan, 2013). This patient-centered definition implies that motivational qualities of competence and autonomy might be critical to treatment adherence. Unfortunately, research has indicated that a majority of participants in weight loss programs do not adhere to the recommended regimen.

Although the evidence base demonstrating the critical role of adherence for treatment success is emerging (Elfhag & Rossner, 2005; Sousa, 2014; Walpole et al., 2011), a recent review reported that there was a dearth of research on adherence rates, their measurement, and related weight management outcomes for adolescents (Franca et al., 2013). Specific barriers to adherence included lack of time, unhealthy food preference, mental health concerns, and low motivation. Adherence was also associated with ecological systems level factors ranging from the individual level characteristics to wider systems, such as a family socioeconomic status. Positive outcomes related to higher rates of adherence include consistent engagement in physical activity, decreasing fat intake, and maintaining caloric intake within a healthy range (Han, Lawlor, & Kimm, 2010; Israel, Silverman, & Solotar, 1989; Kirschenbaum & Gierut, 2013).

Literature examining parent-child adherence in pediatric weight management has also found that this construct is linked to beneficial health outcomes. Specifically, treatment success was associated with adherence to protocols that recommended parent praise, parent modeling of healthy eating behaviors, child weighing, and child dietary planning before social gatherings comprised of high calorie/fat foods (Wrotniak, Epstein, Paluch, & Roemmich, 2005). Further, evidence suggests that weight loss programs can improve adherence by using specific treatment approaches, such as motivational interviewing (Bean, Powell, Quinoy, Ingersoll, Wickham, & Mazzeo, 2014).

Motivation

Self-determination Theory (SDT; Deci & Ryan, 1984, 1985) offers a framework for understanding the role of motivation in an individual's positive engagement in a pediatric weight loss program. In this meta-theory, motivation is defined as the organismic tendency of individuals to engage in activities (Ryan & Deci, 2000a; Ryan & Deci, 2000b; Ryan & Deci, 2000c) that is both inherent and socially bound. First, motivation is described as an inherent tendency based on an internal predisposition, or evolutionary drive to engage in activities. Under this premise, motivation is not simply a behavioral process based on external factors, such as reinforcement. Second, SDT specifies that an individual's social context influences the manner in which s/he engages in an activity, also referred to as a person's motivation orientation. Social contexts include any social environment, such as a classroom or an intervention program. For example, an individual might be interested in engaging in an exercise program, however, social pressures, such as a non-affirming parent, could decrease his/her motivation orientation to do so.

Motivation Orientation. An individual's motivation orientation can be characterized by two primary cognitive and behavioral qualities: locus of causality and self-regulated behavior (Deci & Ryan, 1985; Ryan & Deci, 2000a; Ryan & Deci, 2000b; Ryan & Deci, 2000c). Locus of causality identifies the source that initiates and sustains behaviors as either internally-based (i.e., self-directed) or externally-based (DeCharms, 1968; Deci & Ryan, 1985). This differs from locus of control, as locus of control describes the source that affects outcomes of events (Rotter, 1966). Self-regulated behaviors can be measured by the degree of self-directed organization and governing one has over her or his behaviors (Ryan, Kuhl, & Deci, 1997).

Three basic motivation orientations are categorized on a continuum constrained by two extreme points (Deci & Ryan, 1985; Ryan & Deci, 2000a; Ryan & Deci, 2000b; Ryan & Deci, 2000c). See Figure 1 for details. This continuum characterizes an individual's motivation orientation in terms of internal and external reasons to engage in an activity. The extreme points of the continuum include amotivation and intrinsic motivation orientations. Amotivation is the state in which an individual does not engage in activities at all or lacks the intent to engage in activities. Individuals with this motivation orientation will perceive that behaviors are solely initiated and regulated by external sources (e.g., external locus of causality; DeCharms, 1968) and demonstrate lower levels of self-regulation. On the other extreme point of the continuum lies the intrinsic motivation orientation. Intrinsic motivation is the state in which an individual engages in an activity because of pure interest in and enjoyment of it without being influenced by external pressures to do so. Individuals with this orientation will perceive that their behaviors are initiated and regulated by personal sources (e.g., internal locus of causality; DeCharms, 1968) and will autonomously self-regulate.

There are differences between individuals with externally-based and internally-based motivation orientations. For example, externally-based motivation is often associated with fewer positive outcomes (e.g., lower vitality, more physical symptoms). Within the context of an obesity intervention, a participant with an extrinsic orientation would likely perceive her or his reasons for participating to be determined by outside sources (e.g., parents, trainers) and have poor behavioral self-regulation regarding the related activities. However, internally-based motivation is associated with positive outcomes, such as greater overall well-being and better physical health (Kasser & Ryan, 1996). Within the context of an obesity intervention, a participant with internally-based motivation would perceive that her/his reason for participating was personally determined and would thereby have greater behavioral regulation regarding the related activities.

Extrinsic motivation is the third orientation and falls between the two extreme points on the continuum (Deci & Ryan, 1985; Ryan & Deci, 2000a; Ryan & Deci, 2000b; Ryan & Deci, 2000c). An extrinsic motivation orientation is characterized both by internal and external reasons for engaging in an activity. Depending on the degree to which the person perceives her or his motivated behavior to be based on internal and external reasons, the presentation of an extrinsic motivation orientation will vary. Similar to amotivated and intrinsic motivation orientations, the qualities of an extrinsically motivated individual will vary in terms of personal locus of causality and self-regulated behavior. Specifically, the motivation orientation of individuals who perceive their locus of causality to be more externally determined, and who self-regulate based on external rewards, will fall closer to the amotivated pole. For example, within the context of an obesity intervention, a participant with an extrinsic motivation orientation falling closer to the amotivated pole would believe that the reason for participating was mostly, but not all, determined by outside sources (e.g., parents, trainers). In this instance, s/he will generally have lower self regulation regarding the related activities. Conversely, individuals who perceive their locus of causality to be more personally determined and self-regulated based on personal choice will fall closer to the intrinsic motivation pole. For example, within the context of an obesity intervention, a participant with an extrinsic motivation orientation falling closer to the intrinsic pole would believe that the reason for participating was mostly, but not all, self-determined and he/she will generally have higher self regulation regarding the related activities. See Figure 1 for further details.

Motivation Orientation	**Amotivation**	**Extrinsic Motivation**	**Intrinsic Motivation**

Locus of Causality	Impersonal	External	Somewhat External	Somewhat Internal	Internal	Internal
Regulatory Processes	Nonintentional, nonvaluaing, incompetence, lack of control	Compliance, external rewards and punishments	Self-control, internal rewards and punishments	Personal importance, conscious valuing	Congruence, awareness	Interest, enjoyment, inherent satisfaction

Figure 1. Motivation Orientations

Basic psychological needs. The qualities of a person's motivation orientation (e.g., amotivated, extrinsic motivation, intrinsic motivation) are influenced by factors within her/his social context (Ryan & Deci, 2000b). In the context of SDT, basic psychological needs include autonomy, competence, and relatedness, and are described as the nutrients that, when satisfied, lead to greater intrinsically motivated behavior (Ryan, 2006). Conversely, when fulfillment of the basic psychological needs is hindered, individuals' motivation orientation will tend to be characterized as extrinsic or amotivated. Although overall need fulfillment is positively associated with greater salutary outcomes (Sheldon & Niemiec, 2006), there is no sequential order to the fulfillment of the basic psychological needs, and the context can fulfill each need to differing degrees.

The need for autonomy support refers to the degree to which an individual perceives the environment to foster a sense of self-determined choice, or self-governance (Ryan & Deci, 2000a; Ryan & Deci, 2000c). For example, a participants' need for autonomy in an obesity intervention could be supported if he/she perceived freely available choices within the parameters of the intervention. In a comprehensive intervention like T.E.E.N.S., providing the participant dietary or gym activity options to choose from could potentially satisfy autonomy needs.

The need for competence support refers to the degree to which an individual perceives that the environment allows for successful completion of goal-oriented behaviors (Ryan & Deci, 2000a; Ryan & Deci, 2000c). For example, a participant's need for competence in an obesity intervention could be supported if he/she perceived the tasks associated with the intervention as achievable. In a comprehensive intervention like T.E.E.N.S., providing realistic weight loss goals could support the need for competence.

The need for relatedness support refers to the degree to which an individual perceives the environment to allow for mutual and meaningful relationships (Ryan & Deci, 2000a; Ryan & Deci, 2000c). For example, relatedness needs could be supported in an obesity intervention if the participant believed the environment promoted interpersonal safety and enjoyable social connections with other people. In a comprehensive intervention like T.E.E.N.S., the need for relatedness could be supported through safe and enjoyable relationships with the other participants, the interventionists, or in group modalities.

According to SDT, the fulfillment of basic psychological needs is associated with greater intrinsic motivation and generally greater positive outcomes related to the motivated behavior (Ryan, 2006). Conversely, if an intervention does not support the fulfillment of basic psychological needs, individuals will act with greater extrinsic motivation and experience fewer positive outcomes related to the motivated behavior. Specifically, Sheldon and Niemiec (2006) found that overall need satisfaction was more strongly associated with overall well-being, than when needs were fulfilled in an unbalanced manner. For example, when basic psychological needs were concurrently fulfilled in the domain of physical activity, positive outcomes included increased interest in and enjoyment of exercise, increased intention for long-term engagement in physical activity, and higher rates of weekly exercise (Vlachopoulos & Michailidou, 2006). Studies examining a range of life domains (e.g., health care, education, vocation, sport, relationships, leadership), demonstrate support for the role of basic psychological need fulfillment on optimal functioning (Halvari, Halvari, Bjonebekk, & Deci, 2010; Hetland, Hetland, Andreassen, Pallesen, & Notelaers, 2011; Mack et al., 2011; Patrick, Knee, Canevello, & Lonsbary, 2007; Vallerand, Fortier, & Guay, 1997; Vansteenkiste et al., 2007; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004; Williams et el., 2006).

Family systems and basic psychological need fulfillment. Under the tenets of SDT, parents are considered the primary developmental agent who can shape their childrens' social context to support their offsprings' three basic psychological needs (LaGuardia, Ryan, Couchman, & Deci, 2000). Thus, contextual factors such as family systems (e.g., parent-child dyads) are integral to consider when examining childhood health outcomes (Bronfenbrenner, 1986). These system's qualities, specifically the parent-child relationship, are also considered the prime contexts for shaping intrinsically motivated behavior by fostering the fulfillment of basic psychological needs for the child (Grolnick, Deci, & Ryan, 1997). Beyond SDT, the role of parents is considered especially important with regard to adolescent obesity and its treatment (Gable & Lutz, 2004; Patrick & Nicklas, 2005; Zeller et al., 2012).

SDT research has examined parents' role in affecting the motivations of their adolescent children. One study examining adolescent need satisfaction found that fulfillment of needs for autonomy, competence, and relatedness in adolescents was associated with and predictive of future experiences of overall well being (Véronneau, Koestner, & Abela, 2005). A study of mother-child play interactions demonstrated that controlling maternal behaviors (i.e. less autonomy support) were associated with less intrinsically motivated child behaviors (Deci, Driver, Hotchkiss, Robbins, & Wilson, 1993). Further, multiple studies have linked maternal autonomy support with children's autonomous self-regulation with tasks, increased competence in school activities, adaptive school adjustment, and increased school performance (Grolnick & Ryan, 1989; Joussemet, Koestner, Lekes, & Landry, 2005). Cross-cultural evidence for parental autonomy support has demonstrated relations with higher academic functioning and greater overall well-being in both Russian and U.S. adolescent student samples (Chirkov & Ryan, 2001). Taken together, these findings indicate that autonomy supportive parenting styles and parental provision of basic psychological need fulfillment might foster intrinsically motivated behavior in children.

Although much of the research on parent-child motivation has focused on parenting and academic domains, some investigations have begun to explore health behavior outcomes. For example, one study found that parental autonomy support was negatively related to adolescent girls' maladaptive weight control behaviors, such as skipping meals, use of diet pills, and purging (Thøgersen-Ntoumani & Ntoumanis, 2009). In the context of organized sports, a study found that compared to their peers, adolescents with unfulfilled basic psychological needs of relatedness and autonomy were more likely to drop out of the sport (Calvo, Murcia, Cervelló, Jiménez, & Iglesias, 2010). Similar findings are demonstrated in the context of physical education; teachers who were more sensitive to their students' needs had greater class participation (Ntoumanis, 2005). Considering that adolescents' eating and exercise behaviors are associated with the degree of fulfillment of basic psychological needs, it is reasonable to hypothesize that other adolescent health behaviors, such as treatment attendance, might share a similar relation with needs fulfillment. However, there is a dearth of research in this area and no known studies have examined motivational aspects as delineated by SDT as predictors of attrition in adolescent obesity interventions. This gap in the research will be addressed in the current study.

Mindfulness

One variable strongly associated with motivation is mindfulness (Brown & Ryan, 2003, 2004; Levesque & Brown, 2007). Mindfulness, a construct grounded in Buddhist traditions, is defined as a form of human consciousness that brings open awareness and attention to one's immediate experience (Brown & Ryan, 2003; Brown, Ryan, & Creswell, 2007). In the context of this definition, experience includes both internal states such as affect and cognitions, as well as external events. Mindfulness is described in both state and dispositional forms (Brown & Ryan, 2003). State mindfulness is *present-moment* awareness and attention whereas dispositional mindfulness is an individual's *general* receptive awareness and attention in daily experiences. Dispositional mindfulness is consistently associated with a number of positive outcomes in multiple domains including well-being, emotion regulation, cognitive flexibility, information processing, self-regulation, and motivation (Brown et al., 2007; Davis & Hayes, 2011; Koole, 2009; Levesque & Brown, 2007; Moore & Malinowski, 2009; Shapiro, Oman, Thoresen, Plante, & Flinders, 2008; Shapiro & Schwartz, 2000). Further, beneficial outcomes of mindfulness are noted in various contexts including educational settings, vocation, health-care/medicine, relationships, and family systems (Barnes, Brown, Krusemark, Campbell, & Rogge, 2007; Duncan & Bardacke, 2010; Jacobs & Blustein, 2008; Ludwig & Kabat-Zinn, 2008; Shapiro, Astin, Bishop, & Cordova, 2005; Shapiro, Brown, & Astin, 2008; Singh, Lancioni, et al., 2010). The range of contexts in which mindfulness is examined demonstrates its applicability to a number of domains of human functioning, namely with health behaviors.

Mindfulness and motivation. Several studies demonstrated links between mindfulness and motivation (Brown & Ryan, 2003, 2004; Levesque & Brown, 2007). Mindfulness is not purported to delineate the specific goals of motivated behavior, but is rather associated with the motivational process. Specifically, mindful awareness of the present experience might provide greater clarity of options and thereby increase the opportunity for self-determined choices (Deci & Ryan, 1980; Levesque & Brown, 2007). Dispositional mindfulness is associated with greater autonomous behavioral regulation of daily activities (Brown & Ryan, 2004), greater endorsement of intrinsic goals (Brown & Kasser, 2005), and is considered to empower individuals to behave more autonomously, even during externally regulated tasks (Levesque & Brown, 2007). Further, mindfulness was recently demonstrated to mediate the association between perceived support for the basic psychological needs of autonomy and competence and evaluation threat (Goodman, Trapp, & Davis, under review).

Mindfulness and food behaviors. Mindfulness has been examined in the context of obesity (Dalen et al., 2010; Daubenmier et al., 2011; Ludwig & Kabat-Zinn, 2008; Olson & Emery, 2015; Singh et al., 2008; Tapper et al., 2009) and eating disorder treatment (Kristeller, Baer, & Quillian-Wolever, 2006; Proulx, 2007; Smith, Shelley, Leahigh, & Vanleit, 2006). These studies typically hypothesize that increased mindfulness will allow for greater attention and awareness to a person's experience with food, whether it is emotional, cognitive, or behavioral. For example, greater mindfulness might increase an individual's awareness of food-related impulses, judgments about food, and the self. Notably, greater levels of mindfulness are believed to be associated with greater conscious processing, which subsequently might affect healthier food behaviors. For example, a pilot treatment in which a sample of obese adults was given six weekly two-hour mindfulness-based group classes demonstrated a range of salutary health changes (Dalen et al., 2010), including greater cognitive restraint around eating, decreased weight up to two-months post intervention, less disinhibited eating, and decreased binge eating (Dalen et al., 2010).

Family systems and mindfulness. In the same way that the family context can foster self-determined behavior (Grolnick et al., 1997), mindfulness parent training was associated with positive parent and child outcomes, such as increased parent mindfulness, decreased child aggression, increased child social behavior, and greater child compliance with maternal requests (Altmaier & Maloney, 2007; Duncan, Coatsworth, & Greenberg, 2009; Singh et al., 2007; Singh, Singh, et al., 2010). Although the emerging literature has demonstrated encouraging evidence that mindfulness training provides positive outcomes within the family context, there are calls for more research to enhance understanding of how mindful parenting techniques benefit both the parents and children (Sawyer, Cohen, & Semple, 2010). Previous research has not examined motivational characteristics and mindfulness, two highly related constructs (Ryan & Brown, 2003) with regard to attrition in an adolescent weight management program. This gap in the research will be addressed in the current study.

Depression and Adolescent Obesity

Depression is a notable mental health correlate of obesity (Faith, Matz, & Jorge, 2002). Although research has demonstrated a range of evidence regarding the degree and directionality of the association, results from a large-scale meta-analysis concluded that depression and obesity are likely reciprocal in nature (Luppino et al., 2010). Obese individuals were at 55% increased risk of developing depression, and depressed individuals were at a 58% increased risk for developing obesity. There are a number of biopsychosocial explanations for the association between obesity and depression. Depression in obese individuals was connected to biological associations, such as HPA-axis dysregulation (Holsboer, 2000), and psychosocial explanations, such as emotional reactions to sociocultural stigma (Atlantis & Ball, 2008; Derenne & Beresin, 2006). Although the etiology is unclear, the comorbidity between obesity and depressive symptoms is common.

Similar to the adult literature, evidence for the relation between obesity and depression in adolescents is mixed (Faith, Matz, & Jorge, 2002). However, a host of research has demonstrated notable associations between obesity and depression in child and adolescent samples (Anderson, Cohen, Naumova, Jacques, & Must, 2007; Mustillo, Worthman, Keeler, Angold, & Costello, 2003). Despite the associations, the etiology and specifics of the relation are unclear. There is evidence that adolescent depression predicts both the development of obesity and its persistence throughout adolescence (Goodman & Whitaker, 2002). Further, depression is associated with physical inactivity in adolescents (Gray, Janicke, Ingerski, Silverstein, 2008), a common correlate of obesity. Further, adolescent obesity is predictive of depression related to sociocultural weight stigma, such as shame (Sjoberg, Nilsson, & Leppert, 2005).

Depression has implications for obese adolescents engaging in weight management programs. In a range of medical treatments, adolescents with depression manifest low adherence to medical directives (Rosina, Crisp, & Steinbeck, 2003; Smith & Schuchman, 2005). Further, depression is predictive of poor adherence (White et al., 2004) and attrition in adolescent weight management treatment (Zeller et al., 2004). However, previous research has not examined the influence of depression on motivational factors and participation in an adolescent weight management program. This gap in the research will be addressed in the current study.

Relations Between Psychosocial and Biological Indicators

In line with the biopsychosocial model (Engel, 1977), strong associations are found between psychosocial (e.g., psychological, behavioral, demographic) and biological (e.g., anthropometric, biochemical) factors in the conceptualization and treatment of obese adolescents (Getz & Caron, 1999). One model pertinent to the current study that illustrates the interaction between biological mechanisms and psychological responses related to food behavior is the Negative Feedback Regulation of Food Intake (NFRFI; Morton, Cummings, Baskin, Barsh, & Schwartz, 2006). The NFRFI describes the interactions between metabolic functioning and psychological aspects related to eating, such as satiety and food reward.

The NFRFI is a process involving a range of metabolic features that have implications for weight management, namely leptin resistance and the factors that comprise metabolic syndrome. Leptin is a hormone that helps maintain stores of fat by influencing satiety (Friedman & Halass, 1998). In metabolically healthy individuals, a loss of body fat will correspond to a decrease in leptin, thereby signaling the person to increase food intake to compensate. Conversely, increased adiposity will correspond with an increase of leptin, thus signaling the person to decrease food intake accordingly. Leptin resistance, a condition often comorbid with obesity, is characterized by high levels of leptin that the hypothalamus does not respond to appropriately. Specifically, leptin resistance is related to increased neuronal responses of food reward and decreased neuronal responses of food satiety (Morton, Cummings, Baskin, Barsh, & Schwartz, 2006). This increase of food reward and decrease in food satiety is considered to influence eating behaviors, such as increased motivation for food seeking and consumption.

Evidence suggests a strong relation between leptin resistance and metabolic syndrome (Esteghamatic, Khalizadeh, Anvari, Rashidi, Mokhtari, & Nakhjavani, 2009; Franks et al., 2005; Galletti, 2007; Unger, 2003). Considering this association, it is plausible that the features of metabolic syndrome might also be related to the impaired cues for satiety associated with NFRFI. In the context of weight management, impaired metabolic features related to satiety cues could impede achievement of food intake goals. This experience could decrease a participant's sense of competence and thereby lesson her/his motivation to participate in treatment. However, previous research has not examined the role of metabolic features associated with NFRFI, psychosocial factors of motivation, and participation (e.g., attrition, adherence) in an adolescent weight management program. This gap in the research will be addressed in the current study.

Metabolic syndrome. Metabolic syndrome is made up of a collection of factors that increase the risk of type 2 diabetes and cardiovascular disease (Kassi, Pervanidou, Kaltsas, & Chrousos, 2011). Although there is debate as to the specific cluster of features that define metabolic syndrome in children (De Ferranti & Osganian, 2008), common risk factors include BMI, waist circumference, elevated blood pressure, increased triglycerides, decreased HDL, and raised glucose (Grundy et al., 2005). In pediatric weight management research, ratios including three out of the five aforementioned risk factors were used as cut-offs for diagnosis (Wickham et al., 2009). These criteria were established from National Cholesterol Education Program ATOP III adapted for adolescents between 12 and 19 years of age (Cook, Weitzman, Auinger, Nguyen, & Dietz, 2003).

Metabolic syndrome is relatively rare in children that are not obese (i.e., estimated prevalence rate of 4%), but has an estimated prevalence rate of 30% in children with obesity (Cook, Weitzman, Auinger, Nguyen, & Dietz, 2003). Similar rates are found in research involving obese adolescents in a pediatric weight management program (Wickham et al., 2009). Further, children with obesity were 50% more likely to have metabolic syndrome as their BMI z score increased by half unit increments (Weiss et al., 2004). There is also a body of pediatric weight management literature that has identified associations between higher pre-intervention body weight and likelihood of attrition (Huang et al., 2007; Jelalian et al., 2006; Resnicow et al., 2005). Considering these associations and the potential explanation offered by the NFRFI model, it is plausible that baseline presence of metabolic syndrome and BMI might be predictors of adherence and attrition in a pediatric weight management program.

Aims

A range of biopsychosocial factors is associated with successful completion of pediatric weight management treatment (Wadden, Butryn, & Wilson, 2007). Namely, factors related to adherence and attrition were reported as notable barriers to success in a number of weight management programs (Hampl, Paves, Laubscher, & Eneli, 2011; Israel, Silverman, & Solotar, 1989; Saelens & McGrath, 2003; Skelton et al., 2011; Wrotniak, Epstein, Paluch, & Roemmich, 2005). Literature on motivation and mindfulness demonstrate associations with beneficial outcomes related to a number of health domains, including weight management (Dalen et al., 2010; Daubenmier et al., 2011; Ludwig & Kabat-Zinn, 2008; Edmunds, Ntoumanis, & Duda, 2006; Ryan, Patrick, Deci, & Williams, 2008; Singh et al., 2008; Tapper et al., 2009). However, no extant studies directly examined the roles of adolescent and parent motivation and mindfulness factors with adherence and attrition in pediatric weight management programs. Evidence also suggests that biological factors, such as anthropometric and metabolic indicators might be related to motivated food behaviors.

Given this background, the current study tests two exploratory aims. The first aim is to examine whether adolescent and parent psychosocial (e.g., motivation, mindfulness, depression), biological (e.g., anthropometric, biochemical), and demographic variables predict adherence in a pediatric weight loss program in participants who complete the program through three- and six-month time points. A second aim of the study is to examine whether adolescent and parent psychosocial (e.g., motivation, mindfulness, depression), biological (e.g., anthropometric, biochemical), and demographic variables predict attrition from a pediatric weight loss program in participants who complete the program through three- and six-months of participation. Increasing our understanding of the factors related to participation in weight management programs will inform the refinements of interventions, such as T.E.E.N.S. and related programs.

Hypotheses

It was hypothesized that baseline adolescent and parent biopsychosocial variables will be associated with adherence and attrition in TEENS. Psychosocial factors include the motivational supports of basic psychological need fulfillment, mindfulness, and the mental health correlate of depression. Among these variables, it was hypothesized that greater levels of basic psychological need fulfillment and dispositional mindfulness would be associated with greater adherence and lower attrition, while greater levels of depression would be associated with lower adherence and higher attrition. Biological predictors included baseline measures of body mass and presence of metabolic syndrome (three or more of five biological indicators: BMI $>97^{th}$ percentile for age and gender; fasting glucose of $\geq$100 mg/dL; HDL $\leq$40 mg/dL; systolic or diastolic blood pressure $>90^{th}$ percentile for age, gender, and height; triglycerides $\geq$110 mg/dL). Among these variables it was hypothesized that greater BMI for adolescents and parents would be associated with lower adherence and greater attrition. Presence of metabolic syndrome for the adolescent was hypothesized to be associated with lower adherence and greater attrition. The demographic characteristics associated with the adolescents included age, gender, and race. Among these demographic variables, it was hypothesized that older age, female gender, and African American status will be associated with higher attrition and lower adherence. Parent demographic characteristics included education and income. Among these variables it was hypothesized that higher income and greater level of education would be associated with greater child adherence and lower attrition.

Method

Description of the Intervention

Teaching, Encouragement, Exercise, Nutrition, Support (T.E.E.N.S.) Healthy Weight Management Program. T.E.E.N.S. is a multidisciplinary weight loss intervention that combines the departmental efforts of Psychology, Pediatric Medicine, and Exercise Science at Virginia Commonwealth University (Stern et al., 2006). Although the protocol for T.E.E.N.S. has varied somewhat since its in inception in 2003, the two protocols (e.g., #904, #13833) share some similarities. Specifically, participants were required to engage in supervised exercise sessions at the dedicated study gym three days a week, as well as maintain separate bi-weekly appointments with the program's dietitian and behavior specialists (e.g., psychology doctoral students under the supervision of a licensed clinical psychologist). The activities at the T.E.E.N.S. gym include personal training from undergraduate exercise science interns, supervised by faculty members and graduate students in Virginia Commonwealth University's Exercise Science program. Exercise sessions include 30 minutes of cardiorespiratory training (e.g., running on a treadmill, stationary biking) and 30 minutes of resistance training (e.g., weight lifting). The nutrition appointments with the program's registered dietitian are 30 minutes long and include education and guidance on managing weight through healthy nutritional changes. Appointments with behavior support (either group or individual) are generally 30 to 45 minutes long and are conducted with doctoral students in clinical and counseling psychology. Behavior support sessions address issues including motivation, health-behavior goal setting, problem solving, body image, and peer victimization; a licensed psychologist provides weekly supervision.

At its start in late 2003, the T.E.E.N.S. program required a two-year commitment from participants (i.e., defined as the first protocol or protocol #904), but a 2012 evaluation of the program's findings suggested that the protocol would be more effective if reduced to a one-year commitment (i.e., defined as the second protocol or protocol #13833).

Participants

A sample of parent-adolescent dyads ($N=143$) participating in T.E.E.N.S. was included in the study. The sample was comprised of a subset of participants from the ongoing T.E.E.N.S program. These participants were selected from a range of time between 2/2011-12/2014 in which the tests pertinent to the current study were administered. Female and male adolescent participants were eligible for T.E.E.N.S. if they were between the ages of 11-17 years for the first protocol (e.g., #904) and 11-16 years in the second protocol (e.g., #13833). Adolescents with a BMI percentile $\geq 85^{th}$ for their gender and age (Ogden et al., 2014) were eligible to participate in the program. Additionally, each adolescent needed one adult caregiver to participate in the T.E.E.N.S. program. Parent participants were eligible if they were the primary guardians of the child. Written informed consent was gathered from the parents and formal assent was collected from the adolescents participating in the study. Exclusionary criteria included: prior participation in T.E.E.N.S. protocol, the presence of any underlying genetic, neurologic, endocrine, or metabolic condition that might interfere with conventional diet and exercise programs (e.g., Prader-Willi, Cushing's syndrome, etc.), a baseline weight greater than 400lbs, pregnancy in female participants during any part of the protocol, inability to understand program instructions due to a physical or intellectual disability, and living more than 30 miles from the T.E.E.N.S. clinic.

Participants were informed of the program through health care provider referrals, online searches, school nurses, and word of mouth from community members, friends, family, and others with knowledge of the program. Apart from the benefits of the program (e.g., free use of the TEENS's gym, a one-year gym family membership to a local YMCA, dietary counseling, and health-related behavioral support), small incentives valued at less than $20 (e.g., water bottles, t-shirts) were given to the adolescent participants at three-month follow-up visits and program completion. Further, parents received a $100 grocery gift card upon program completion. Upon program entry, baseline psychosocial questionnaires were administered, and anthropometric and biochemical measurements were taken at a hospital-based research unit.

T.E.E.N.S. is longitudinal in nature and, as noted, has undergone a number of protocol changes since its inception. Over the course of data collection for the current study, participants included in the total sample were comprised of 54 participants from the first protocol (e.g., #904) and 89 participants from the second protocol (e.g., #13833). The primary change in the protocols was the overall length of treatment time (2 years vs. 1 year).

These protocol differences were not considered a design flaw of the current study for a number of reasons. First, the aims of the research were to examine pre-treatment participant characteristics as potential indicators of adherence and attrition. In this case, the motivation-related variable was assessed at baseline and intended to measure the participants' pre-treatment motivational qualities. Dispositional mindfulness was also assessed at baseline and is considered a relatively stable characteristic. Specifically, changes in mindfulness are considered to primarily occur with consistent meditative practice (Brown & Ryan, 2003) or associated with targeted mindfulness meditation interventions (Cohen-Katz, Wiley, Capuano, Baker, & Shapiro, 2005). Further, the anthropometric and biochemical features of the participants were also evaluated before study treatment and therefore reflected baseline participant features not influenced by differences in the protocols. As these variables should account for participant characteristics before the influence of the treatment, none should be unduly affected by the protocol differences. Nonetheless, design characteristics (i.e., treatment protocol, randomized treatments conditions) were assessed as potential covariates. This will be discussed further in the Analyses section.

Procedure

For the purposes of the current study, additional questionnaires were added to the T.E.E.N.S.' (Stern et al., 2006) intake to assess baseline motivation characteristics of the participants. Institutional Review Board approval for the additions was granted in January 2011 and data collection began February 2011. Data for the current study were collected in two locations. Psychosocial data were collected at the baseline visit in which the parent and adolescent participants completed a packet of self-report questionnaires at the T.E.E.N.S. clinic. Anthropometric and biochemical data were collected at the Clinical Research Services Unit (CRSU), an 11-bed research clinic directed by Virginia Commonwealth University Health System's Center for Clinical and Translational Research. Medical staff, including physicians to registered nurses, collected data at the CRSU.

Measures

Demographics. At baseline, adolescents reported age, race/ethnicity, and gender. Because of the high percentage of children identifying as African American (e.g., 61.2%), race was dichotomized into African American identity or other.

Adolescent psychosocial measures.

Adolescent Basic Psychological Needs. The Children's Intrinsic Needs Satisfaction Scale (CINSS) measured the degree to which adolescents perceived their basic psychological needs to be fulfilled (Véronneau et al., 2005). The CINSS is comprised of three factors (e.g., autonomy, competence, and relatedness) and contains six items for each subscale. The scale can be summed for an overall indication of basic psychological need fulfillment, separated into individual factors of basic psychological need fulfillment, and divided into contexts (e.g., home, school, friends). For purposes of the current study, the total score was used as a primary independent variable. Items were rated on a scale ranging from one to five. Example questions included: autonomy, "I feel free to express myself at home;" competence, "I feel my parents think that I am good at things;" and relatedness, "My friends like me and care about me." Evidence for convergent and discriminant validity were found on measures of affect (e.g., Children's Depression Inventory, Children's Multiple Affect Adjective Checklist; Véronneau et al., 2005). In the current study, Cronbach's alpha was 0.88. See Appendix A for the questionnaire.

Adolescent Mindful Attention Awareness Scale. Adolescents' dispositional mindfulness was measured with the Adolescent Mindful Attention Awareness Scale (A-MAAS; Brown, West, Loverich, & Biegel, 2011). The A-MAAS is a 14-item, single factor scale that measures trait mindfulness. Items were rated on a scale ranging from one to seven. In the validation study, study coefficient alpha was 0.82 (A-MAAS; Brown, West, Loverich, & Biegel, 2011). Evidence for structural, criterion, and incremental validity were also demonstrated (Brown, West, Loverich, & Biegel, 2011). Sample items included: "I find it difficult to stay focused on what's happening in the present," and "I tend to walk quickly to get where I'm going without paying attention to what I experience along the way." In the current study, Cronbach's alpha was 0.89. See Appendix B for the questionnaire.

The Child Depression Inventory. Depressive symptoms were measured with the Child Depression Inventory (CDI; Kovacs, 1984), a 27-item measure examining presence and severity of depressive symptoms in pediatric samples. The CDI is considered an appropriate self-report measure for both children and adolescents. Each item is rated as a 0 (asymptomatic), 1 (somewhat symptomatic), and 2 (clinically symptomatic). Research has demonstrated acceptable internal consistency, test-retest reliability, and evidence for the validity of the scale (Kovacs, 1981). Example questions included: “I do not have any friends,” and “I am sure that terrible things will happen to me.” In the current study, Cronbach’s alpha was 0.88.

Adolescent anthropometric and biochemical measures.

Metabolic syndrome. Metabolic syndrome is comprised of a collection of factors including BMI, waist circumference, elevated blood pressure, increased triglycerides, decreased HDL, and raised glucose (Grundy et al., 2005). For the purposes of the current study, risk factors for metabolic syndrome included: BMI >97th percentile for age and gender; fasting glucose of ≥100 mg/dL; HDL ≤40 mg/dL; systolic or diastolic blood pressure >90th percentile for age, gender, and height; and triglycerides ≥110 mg/dL. Participants were categorized as either having metabolic syndrome or not having metabolic syndrome based on whether three or more of five biological indicators were present (Kassi, Pervanidou, Kaltsas, & Chrousos, 2011). This ratio has been used in pediatric weight management research to diagnose metabolic syndrome (Wickham et al., 2009). These criteria were established from National Cholesterol Education Program ATOP III, adapted for adolescents between 12 and 19 years of age (Cook, Weitzman, Auinger, Nguyen, & Dietz, 2003).

***BMI, BMI percentile, and BMI z*-score.** To calculate BMI, height and weight were measured to the nearest 0.1cm and 0.1 kg, respectively and mass was divided by height squared.

BMI percentile was calculated by plotting the participants' BMI on the CDC BMI growth charts according to gender and age. BMI *z*-score was calculated using Epi Info software, a freely distributed epidemiology analysis software program from the Centers of Disease Control. For the purposes of the current study, BMI percentile was used for calculating metabolic syndrome and BMI *z*-score was used as a measure of adiposity. Although BMI is considered an acceptable measure of adiposity, there is evidence to demonstrate that BMI *z*-score is superior for measuring adiposity at one time point (Cole, Pietrobelli, & Heo, 2005). As the current study required the most accurate assessment at a single time point, BMI *z*-score was used for the analyses of adiposity.

Blood pressure. Blood pressure is the measure of force pushing against the arterial walls as the heart contracts (systolic) and rests (diastolic). Systolic and diastolic blood pressures were measured with a Dynamap Pro 100, an automated blood pressure reader found to be accurate for pediatric samples (Park & Menard, 1987). Participants were requested to sit quietly for five minutes before administering the test. One reading was taken in the first protocol (e.g., #904) and three consecutive readings were taken and averaged to increase validity in the second protocol (e.g., #13833). This variable was not used as an independent predictor in the subsequent analyses, but rather, was used to compute metabolic syndrome for the adolescent participants.

Cholesterol. Cholesterol is a lipid acquired through the consumption of saturated fats and produced in the liver. These lipids are carried through the bloodstream by two types of lipoproteins: low-density lipoprotein (LDL), which contributes to the development of atherosclerosis through the build up of plaque; and high-density lipoprotein (HDL), which facilitates the removal of cholesterol from the blood stream (Cleeman, Grundy, Becker, & Clark, 2001). Triglycerides are another fat found in the bloodstream related to body fat tissue and overall cardiovascular functioning. Total cholesterol, high-density lipoproteins (HDL), and triglycerides were measured with an automated clinical chemistry analyzer (Roche Diagnostics, Mannheim, Germany). The concentration of low-density lipoprotein (LDL) was estimated with the Friedewald equation (Friedewald, Levy, & Frederickson, 1972): LDL = (total cholesterol – high-density lipoprotein – [triglycerides/5]). This variable was not used as an independent predictor in the subsequent analyses, but rather, was used to compute metabolic syndrome for the adolescent participants.

Glucose and insulin. A two-hour glucose tolerance test (OGTT) was administered to each adolescent. The OGTT included a baseline reading of fasting glucose, fasting insulin, and glucose and insulin tests at intervals of 30, 60, 90, and 120 minutes. The baseline readings of fasting glucose, two-hour glucose reading, and fasting insulin provided independent baseline measures of impaired fasting glucose, impaired glucose tolerance, insulin resistance, and diabetes mellitus. Specifically, impaired fasting glucose (IFG) was determined at 100-125mg/dL and an indicator of diabetes mellitus was measured at ≥126mg/dL at fasting. Impaired glucose tolerance (IGT) was determined at 140-199mg/dL and an indicator of diabetes mellitus was measured at ≥200mg/dL from the two-hour glucose reading. Insulin resistance was estimated using an equation based on the homeostasis model of insulin resistance: HOMA-IR = fasting glucose x fasting insulin/405 (Matthews, Hosker, Rudenski, Naylor, Treacher, & Turner, 1985).

As part of the OGTT, the participant was given 75 g of oral glucose solution between each time interval to provide indicators of insulin sensitivity (Keskin et al., 2005). Insulin sensitivity was estimated using the Whole Body Insulin Sensitivity Index (WBISI; Matsuda & DeFronzo, 1999). The WBISI was calculated by 10,000/ √ ([fasting glucose x fasting insulin] x [mean glucose from 30, 60, 90, 120 readings x mean insulin from 30, 60, 90, 120 readings]).

WBISI scores ranged from 0-14, with higher scores indicating greater sensitivity to insulin. The glucose readings (e.g., fasting glucose) were not used as independent predictors in the subsequent analyses, but rather, were used to compute metabolic syndrome for the adolescent participants. Due to high collinearity with Metabolic Syndrome, insulin resistance and insulin sensitivity were not used independently in the analyses.

Adolescent participation.

Adherence. Adherence was calculated as a percentage of attendance (i.e., visits attended/total possible visits) within each of the three targeted domains: gym, visits with the dietitian, and behavioral support meetings, assessed at the three- and six-month time points. Total adherence percentage was calculated by averaging the adherence scores for gym, visits with the dietitian, and behavioral support meetings at three- and six-month time points. Only participants who completed the full three- or six-month time periods were included in the respective time points.

Attrition. Attrition was computed as a dichotomous variable that indicated whether the participant had completed the required total days of the protocol. Total duration of participation was calculated by subtracting the participant's first day of participation from the last day of participation. These two attrition variables were computed from scores taken at three-month and six-month time points.

Parent demographics. Parents reported their age, level of education, race/ethnicity, gender, and family income. Parent gender was not included in the inferential analyses because the sample included 93% female caregivers. Because of the high percentage of parents identifying as African American (e.g., 60.4%), race was dichotomized into African American identity or other. In addition, a high percentage of parents reported family incomes greater than or equal to $50,000 (e.g., 52.9%); thus, income was dichotomized into greater than or equal to

$50,000 or less than $50,000. Parent age was not collected in the first protocol (e.g., #904) and is therefore not included in the current study. All other parent demographic variables were collected in both samples. See Appendix C for the questionnaire.

Parent psychosocial measures.

Parent Need Satisfaction Scale. Parent perceptions of basic psychological need fulfillment were measured with the Basic Psychological Needs Scale-general version (BPNS; LaGuardia, Ryan, Couchman, & Deci, 2000). The scale was originally modified from a work-specific version developed by Ilardi, Leone, Kasser, and Ryan (1993). The general BPNS assesses overall basic psychological need fulfillment or can assess for the three factors (i.e., autonomy, competence, and relatedness) independently. Coefficient alphas are adequate for each factor and overall basic psychological need fulfillment: 0.68 for autonomy; 0.75 for competence; 0.85 for relatedness, and 0.90 for the total score (Wei, Shaffer, Young, & Zakalik, 2005). Research has demonstrated acceptable internal consistency, test-retest reliability, and evidence for the validity of the scale in this current form and in other domains (LaGuardia, Ryan, Couchman, & Deci, 2000; Patrick, H., Knee, Canevello, & Lonsbary, 2007; Ryan & Deci, 2000; Vlachopoulos & Michailidou, 2006). Items were rated on a scale ranging from 1 to 7. Sample questions include: “I feel like I am free to decide for myself how to live my life,” and “Often I do not feel very competent”. For purposes of the current study, total scores of the 21 items were used to provide a measure of overall basic psychological need fulfillment. Cronbach’s alpha for this scale was 0.86. See Appendix D for the questionnaire.

Parent Mindful Attention Awareness Scale. Parent participants’ dispositional mindfulness was measured with the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003). The MAAS assesses dispositional mindfulness and contains 15 items, which are rated on a scale ranging from one to seven. Sample questions included: “I find myself listening to someone with one ear, doing something else at the same time,” and “I do jobs or tasks automatically, without being aware of what I’m doing.” Research has demonstrated acceptable internal consistency, test-retest reliability, and evidence for the validity of the scale (Brown & Ryan, 2003; Carlson & Brown, 2005; MacKillop & Anderson, 2007). In the current study, Cronbach’s alpha was 0.92. See Appendix E for the questionnaire.

Parent anthropometric measures.

BMI. Body mass index (BMI) is a valid measure of body adiposity for adults (Gallagher, Visser, Sepulveda, Pierson, Harris, & Heymsfield, 1996). To calculate BMI, height and weight were measured to the nearest 0.1 cm and 0.1 kg, respectively, and mass was divided by height squared.

Data Analyses

SPSS 22 (2013) was used to analyze the data. The survey data were entered by a combination of the T.E.E.N.S. study research assistants and the present author. The T.E.E.N.S. study data manager and the present author verified the data for accuracy. Analyses were conducted in six stages: 1) preliminary analyses were conducted for data cleaning and assumption checking (e.g., plotting the relations, computing diagnostic statistics); 2) *t*-tests and chi-square analyses examined differences between the samples from the two protocols and MI Values treatment; 3) descriptive statistics provided summaries about the sample and observations; 4) a series of linear regression analyses examined whether the demographic, psychosocial (e.g., motivation, mindfulness, depression), and biological (e.g., anthropometric, biochemical) variables were predictive of adherence and attrition to the gym requirements, visits with the dietitian, behavioral support meetings, and total adherence at three-month and six-month time points; 5) a series of point-biserial correlations examined the demographic, psychosocial (e.g., motivation, mindfulness, depression), and biological (e.g., anthropometric, biochemical) variables were related to the participation variables (e.g., adherence, attrition); and 6) a series of logistic regression analyses examined whether the demographic, psychosocial (e.g., motivation, mindfulness, depression), and biological (e.g., anthropometric, biochemical) variables were predictive in estimating the probabilities of attrition from T.E.E.N.S. at three-month and six-month time points.

Preliminary data cleaning. Upon completion of data collection, the data were examined for normality of the dependent variables, univariate and multivariate outliers, missing data, and multicollinearity. Recommendations from Cohen, Cohen, Aiken, and West (2003) guided the parametric assumption checking. Histograms, normal probability plots, and box plots of the distribution were visually examined for normality of the dependent variables. Skewness, kurtosis, and univariate outliers were examined to identify issues with normality. In cases where a variable was significantly non-normal, transformations were conducted. Consecutive transformations utilizing square root, log, and log10 transformations were conducted and the transformation that more closely approximated normality was utilized for the analyses. No mean substitutions or imputations were conducted for missing data. Multivariate outliers were checked with the Mahalanobis distance cutoff.

Differences between samples. Differences in the sample were examined. Specifically, two factors were considered: study cohorts and treatment cohorts. The sample was comprised of participants from two different protocol cohorts in the T.E.E.N.S. study. This occurred because data were collected midway through the first protocol and continued into the second protocol. Additionally, a motivational interviewing treatment (Bean, Jeffers, Tully, Thornton, & Mazzeo, 2014; Bean, Powell, Quinoy, Ingersoll, Wickham, & Mazzeo, 2014) was being conducted during part of the data collection for the current study. A series of *t*-tests and chi-square analyses were conducted on the attrition and adherence variables to uncover any significant differences in the sample. When differences were found, a covariate for the study or treatment cohort was added to the regression analyses to compensate for the differences in the cohorts.

Descriptive analyses. Standard descriptive analyses were conducted to obtain means, standard deviations, ranges, percentages and frequencies to describe the sample and observations. Cronbach's alpha was calculated for each self-report scale to evaluate internal consistency.

Inferential analyses. Correlations were conducted to identify associations among the biopsychosocial variables and the participation (e.g., adherence, attrition) variables. Linear and logistic regression analyses were conducted to draw conclusions about the associations in the data. Statistical significance was based on p-values of < 0.05. For the linear regression analyses, residual plots were completed to check for homoscedacity and multivariate linearity. Durbin-Watson tests examined independence of errors; the assumption of normality of errors was checked with the Shapiro-Wilk test. Tolerance of < 0.1 and Variance Inflation Factor (VIF) of >3.0 were used to identify values indicative of multicollinearity.

Correlations. Point-biserial correlations examined associations among the demographic, psychosocial (e.g., motivation, mindfulness, depression), biological (e.g., anthropometric, biochemical), and participation variables (e.g., adherence, attrition). Statistics for each pair of variables in the correlations used the cases of valid data for that pair.

Linear regressions. A series of multiple linear regressions were conducted. Multiple linear regressions allow for the examination of the associations of a range of independent variables to one dependent variable (Aiken, West, & Pitts, 2003). Specifically, backward elimination linear regressions were modeled to create the best fitting model. This is done by iteratively deleting variables that improve the model because of their removal (Draper & Smith, 1998). These analyses were conducted in blocks of psychosocial (e.g., motivation, mindfulness, depression), demographic (e.g., child age, child gender, child race, parent education, parent income), and biological (e.g., anthropometric, biochemical) variables. If significant predictors were identified in the blocks of analyses, they were aggregated into a final parsimonious model. By analyzing the data in this manner, it met recommendations of at least 15 participants per predictor (Stevens, 2012). The regressions approached missing data by excluding cases listwise.

Logistic regressions. Logistic regression allows for the prediction of discrete outcomes with categorical and continuous predictors (Tabachnick & Fidell, 2007). Specifically, backward elimination logistic regressions were modeled in which a change in maximum likelihood results through iteratively excluding variables that do not improve the model (Hosmer & Lemeshow, 2004). A likelihood ratio backward selection process was used because it is more reliable with smaller samples that alternatives, such as a backward elimination procedures using the Wald statistic (Vittinghoff, Glidden, Shiboski, & McCulloch, 2005). These analyses were conducted with the attrition variables in blocks of psychosocial (e.g., motivation, mindfulness, depression), demographic (e.g., child age, child gender, child race, parent education, parent income), and biological (e.g., anthropometric, biochemical) variables. If multiple significant predictors were identified in the blocks of analyses, they were aggregated into a final parsimonious model. By analyzing the data in this manner, it met recommendations of at least ten outcome events per predictor (Perduzzi, Concato, Kemper, Holfpord, & Feinstein, 1996). The regressions approached missing data by excluding cases listwise.

Results

Preliminary Analyses

Demographics.

***Adolescent participant characteristics*.** A total of 143 adolescents between the ages of 11 and 17 (*M* = 13.10, *SD* = 1.58) completed baseline assessments. A majority were female (71.1%). Participants' racial identities were African American (61.2%), White (30.2%), Latino (4.3%), or other (4.3%). Mean baseline BMI *z*-score was 2.36 (*SD* = 0.32) with a range of 1.47 to 3.02. Mean BMI percentile was 98.75 (*SD* = 1.27) with a range of 92.9 to 99.87. See Table 1.

Table 1.

Adolescent Participant Characteristics

Variable	*n*	%	*M*	*SD*
Gender				
Female	101	71.1		

Male	41	28.9		
Race/Ethnicity				
African American		61.2		
Caucasian		30.2		
Latino		4.3		
Other		4.3		
BMI (kg/m^2)			35.87	6.32
BMI *z*-score			2.36	0.32
BMI Percentile			98.75	1.27
Age (years)			13.10	1.58

Note. BMI = body mass index.

Parent participant characteristics. The sample consisted of 143 parents/guardians ranging in age between 30 - 67 years (M = 42.29, SD = 7.03; protocol #13833 only). A majority were female (93.5%). Parents' racial identities were African American (60.4%), White (33.1%), Latino (4.3%), or other (1.4%). A majority of families' incomes were skewed to rates greater than or equal to $50,000 (52.9%). Incomplete data prevented accounting for the number of people in the household. Parent education levels included graduate degree (18.7%), some graduate school (5.6%), college diploma (23.4%), some college (35.5%), high school diploma (13.1%), and some or less than high school (3.7%). Mean BMI was 35.68 kg/m^2 (SD = 9.15) with a range of 21.70 to 64.18 kg/m^2. See Table 2.

Table 2.

Parent Participant Characteristics

Variable	*n*	%	*M*	*SD*
Gender				
Female	115	93.5		
Male	8	6.5		

Race/Ethnicity		
African American	84	60.4
Caucasian	46	33.1
Latino	6	4.3
Other	2	1.4
Unknown	1	0.7
Income		
•$50,000	64	52.9
$49,999-$40,000	15	12.4
$39,999-$30,000	14	11.6
$29,999-$20,000	15	12.4
$19,999-$10,000	9	7.4
<$10,000	4	3.3
Education		
Graduate degree	20	18.7
Some graduate school	6	5.6
College diploma	25	23.4
Some college	38	35.5
High school diploma	14	13.1
Some high school	4	3.7

Note. Table 2. continues.

Table 2. continued.

Parent Participant Characteristics

Variable	*n*	%	*M*	*SD*
BMI (kg/m^2)	129		35.68	9.15
Age	82*		42.29	7.03

Note. *Denotes subsample collected in the protocol #13833; BMI = body mass index

Adherence and attrition.

Adherence was measured in the three specific domains of required participant activities and as a total adherence variable. Only participants who fully completed the study through each time point were included in these calculations. The mean percentage of gym adherence at three-months was 73.3%; at six months it was 66.5%. The mean percentage of nutrition support adherence at three-months was 73.0%; at six months it was 74.5%. The mean percentage of behavioral support adherence at three-months was 73.7% and 66.4% at six-months. The mean percentage of total adherence at three-months was 72.8%; at six months it was 69.8%.

Attrition was computed as a dichotomous variable indicating whether the participant completed the required total days of the protocol. This score was calculated for three-month and sixth-month time points. Only participants who fully completed the study through each time point were included in the calculations. Attrition was 23.8% at three months, 51.1% at six-months.

Overall participation was also calculated. The average number of days attended overall was 225.80 (*SD* = 175.86). The average number of days attended overall in the first protocol (e.g., #904) was 222.30 (*SD* = 207.53) and 228.23 (*SD* = 151.51) days in the second protocol (e.g., #13833). The average number of days attended within three-months of participating in the program was 79.48 (*SD* = 24.42). The average number of days within the three-months of participating in the first protocol (e.g., #904) was 79.35 (*SD* = 24.22) and 77.55 (*SD* = 24.68) days in the second protocol (e.g., #13833). The average number of days attended within six-months of participating in the program was 133.92 (*SD* = 60.89). The average number of days within the six-months of participating in the first protocol (e.g., #904) was 129.98 (*SD* = 58.85) and 136.61 (*SD* = 62.48) days in the second protocol (e.g., #13833).

Differences between samples. A series of independent samples *t*-tests and chi-square analyses were conducted on the adherence and attrition variables to uncover any significant differences across protocols. Specifically, differences related to protocol and a motivational interviewing condition were examined. Independent samples *t*-tests were conducted on the adherence variables. Chi-square analyses were conducted on the attrition variables.

A number of significant differences were found among the variables. Specifically, a significant difference between protocols was found for gym adherence six-months, t (54)=2.01, p = 0.05; nutrition adherence at three-months, t (90)=5.14, $p < 0.001$; nutrition adherence at six-months, t (55)=2.91, $p = 0.005$; behavioral support at three-months, t (97)=4.44, $p < 0.001$; behavioral support at six-months, t (59)=3.02, $p = 0.004$; total adherence at three-months, t (100)=3.64, $p < 0.001$; and total adherence at six-months, t (61)=3.48, $p = 0.001$. Accordingly, covariates were included for these variables in the regression analyses. No significant differences were found in gym adherence at three-months. See Table 3 for mean scores for both groups.

Table 3.

Group Differences for Protocol

Outcome	Group						
	Protocol #904			Protocol #13833			
	M	*SD*	*n*	*M*	*SD*	*n*	*t*
Gym Adherence	0.74	0.18	35	0.73	0.21	60	0.29

3-Month							
Gym Adherence 6-Month	0.74	0.17	20	0.63	0.26	42	2.01*
Nutrition Adherence 3-Month	0.85	0.17	32	0.67	0.16	60	5.14***
Nutrition Adherence 6-Month	0.83	0.15	18	0.71	0.15	39	2.91**
Behavioral Adherence 3-Month	0.85	0.17	34	0.68	0.19	65	4.44***
Behavioral Adherence 6-Month	0.76	0.15	18	0.62	0.17	43	3.02**
Total Adherence 3-Month	0.79	0.15	36	0.69	0.14	66	3.64***
Total Adherence 6-Month	0.79	0.10	19	0.66	0.15	44	3.48***

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A series of independent-samples *t*-tests examined whether receiving a motivational interviewing treatment as part of the MI Values study (Bean, Powell, Quinoy, Ingersoll, Wickham, & Mazzeo, 2014) was related to significant differences in adherence. The two groups included: a group comprised of participants who received the randomized MI intervention, and a group comprised of the randomized active control group associated with the MI intervention and all other participants that did not receive the MI Values treatment. A number of significant differences was found among the variables. Specifically, significant difference between protocols was found for nutrition adherence at three-months, t (90)= 2.62, p = 0.01; nutrition adherence at six-months, t (55)= 2.03, p = 0.05; behavioral support at three-months, t (97)= 2.63, p = 0.01; and total adherence at six-months, t (61)= 2.35, p = 0.02. Accordingly, covariates were included for these variables in the regression analyses. No significant differences were found in gym adherence at three-months and six-months. See Table 4 for mean scores for both groups.

Table 4.

Group Differences for MI Values Treatment

Outcome	Group						
	MI Values Treatment			No MI Values Treatment (Control and Non-MI Values Study Participants)			
	M	*SD*	*n*	*M*	*SD*	*n*	*t*
Gym Adherence	0.74	0.21	30	0.73	0.20	65	-0.35

3-Month							
Gym Adherence 6-Month	0.63	0.28	23	0.68	0.22	39	0.78
Nutrition Adherence 3-Month	0.66	0.17	32	0.77	0.19	60	2.62**
Nutrition Adherence 6-Month	0.69	0.14	21	0.78	0.17	36	2.03*
Behavioral Adherence 3-Month	0.66	0.20	32	0.77	0.19	67	2.63**
Behavioral Adherence 6-Month	0.61	0.20	25	0.70	0.15	36	1.99
Total Adherence 3-Month	0.69	0.16	32	0.75	0.15	70	1.79
Total Adherence 6-Month	0.64	0.17	25	0.73	0.13	38	2.35*

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Chi-square analyses were conducted to examined differences in attrition between protocols. Specifically, attrition at three-months did not differ by protocol, X^2 (1, N = 143) = 0.77, $p = 0.38$. However, attrition at six-months was significantly different by protocol, X^2 (1, N = 133) = 5.10, $p = 0.02$. Accordingly, a covariate was included in the regressions for attrition at six-months, but not at three-months. The results of the chi-square analyses also demonstrated differences for attrition as related to MI Values treatment. Specifically, attrition at both three-months X^2 (1, N = 143) = 12.86, $p < 0.001$, and six-months significantly differed by MI Values treatment, X^2 (1, N = 133) = 18.41, $p < 0.001$. Accordingly, a covariate was included in the regressions for attrition at three-months and six-months.

Descriptive statistics.

See Table 5 for full descriptive statistics for each self-report measure.

Table 5.

Means and Internal Consistency of Self-report Variables

	Mean	*SD*	Range	Cronbach's Alpha
CINSS	3.92	0.64	2.22-4.94	0.88
A-MAAS	3.94	0.97	1.21-5.79	0.89
BPNS	5.52	0.76	3.24-7.00	0.86
MAAS	4.42	0.97	1.80-6.00	0.92
CDI	7.57	6.45	0.00-33.00	0.88

Note. CINSS = Child Intrinsic Need Satisfaction Scale. A-MAAS = Adolescent Mindful Attention Awareness Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. CDI = Child Depression Inventory

Normality and multicollinearity. Relations among variables were plotted and a number of diagnostic statistics were computed to identify any violations of the statistical assumptions. Several anthropometric and biochemical indices (e.g., Child BMI, Child BMI *z*-score, Triglycerides, HOMA-IR, WBISI, and Parent BMI) were skewed and kurtotic. These findings were not unexpected and log10 transformations were performed accordingly. The tolerance scores and variance inflator factor scores suggested multicollinearity was not a concern.

Biological indicators: Anthropometric and biochemical. No participants met criteria for diabetes mellitus, and 32.3% (n = 40) met the criteria of at least three or more of the five metabolic features. These results were consistent with a previous study examining anthropometric and biochemical features of the T.E.E.N.S. participants (Wickham et al., 2009). See table 6 and table 7 for full details.

Table 6.

Adolescent Anthropometric and Biochemical Descriptive Statistics

Indicator	Mean	*SD*	Range
BMI (kg/m²)	35.87	6.32	23.19-57.41
BMI z-score	2.36	0.32	1.47-3.02
Systolic BP (mmHg)	117.10	11.32	87.00-145.50

Diastolic BP (mmHg)	67.85	8.08	46.00-87.50
Triglycerides (mg/dL)	96.95	53.21	30.00-324.00
Total cholesterol (mg/dL)	153.59	26.88	80.00-243.00
HDL – C (mg/dL)	42.62	10.23	25.00-96.00
LDL – C (mg/dL)	92.47	21.55	48.00-154.00
Fasting glucose (mg/dL)	83.14	7.61	67.00-107.00
Fasting insulin (mg/dL)	13.63	10.74	1.80-54.10
HOMA-IR	2.74	2.05	.31-9.51
WBISI	4.65	3.47	.63-14.89

Note. BMI = body mass index. BP = blood pressure. HDL-C = high density lipoprotein cholesterol. LDL-C = low density lipoprotein cholesterol. HOMA-IR = homeostatic model assessment insulin resistance. WBISI = whole body insulin sensitivity index.

Table 7.

Percentages of Adolescent Metabolic Conditions

Indicator	Frequency	Percent
Impaired Fasting Glucose	2.0	2.2
Impaired Glucose Tolerance	18	20.5
Metabolic Syndrome	40	32.3

Diabetes	0.0	0.0

Correlations

A series of point-biserial and Pearson correlations were conducted among the psychosocial (e.g., motivation, mindfulness, depression), biological (e.g., anthropometric, biochemical), demographic (e.g., child gender, parent gender, child age, parent age), and participation variables (e.g., adherence, attrition) according to level of measurement. Point-biserial correlations were conducted to examine associations among dichotomous and continuous variables. Pearson correlations were conducted to examine associations among two or more continuous variables. A number of statistically significant correlations were identified among the adherence variables and the psychosocial, biological, and demographic variables (see tables 8-13). Gym adherence at three-months was negatively correlated with parent BMI, $r(93) = -0.21$, $p = 0.05$, and child gender, $r(93) = -0.21$, $p = 0.04$. Female children had lower gym adherence at three-months. Gym adherence at six-months was negatively correlated with child gender, $r(59) = -0.32$, $p = 0.01$; specifically female children manifested less gym adherence at six-months. No statistically significant correlations were found between any of the variables and nutrition adherence at three-or six-months. Behavioral support adherence at three-months and six-months were negatively correlated with child age, $r(95) = -0.28$, $p = 0.005$ and $r(59) = -0.37$, $p = 0.003$, respectively. No statistically significant correlations were found between any of the variables and total adherence at 3-months. Total adherence at six-months was correlated with child gender, $r(61) = -0.26$, $p = 0.04$, and child age, $r(61) = -0.27$, $p = 0.03$; younger and female children were less likely to adhere to TEENS at six-months.

No statistically significant correlations were found between the measured variables and attrition at three-months. However, at six-months, attrition was correlated with parent basic psychological need satisfaction, $r(113) = 0.21$, $p = 0.03$, parent BMI, $r(121) = 0.18$, $p = 0.05$, and parent gender, $r(121) = 0.19$, $p = 0.03$. Specifically, greater parent need satisfaction, greater parent BMI, and female parent gender were associated with attrition.

Table 8.

Results of Correlation Analyses: Gym Adherence at Three-Months & Six-Months

		M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Gym Adherence 3-Months	0.73 (0.20)	1													
2	Gym Adherence 6-Months	0.67 (0.24)	0.75***	1												
3	CINSS	3.92 (0.64)	-0.01	-0.07	1											
4	Parent BPNS	5.52 (0.76)	-0.03	-0.06	0.16	1										
5	Child MAAS	3.94 (0.97)	-0.04	0.09	0.40***	0.10	1									
6	Parent MAAS	4.43 (0.97)	-0.02	-0.24	0.03	0.40***	0.06	1								
7	Child Depression	7.57 (6.45)	0.10	0.02	-0.57***	-0.18	-0.42***	-0.11	1							
8	Child BMI *z*-score	2.36 (0.32)	-0.08	-0.04	-0.07	0.15	-0.08	0.19*	0.14	1						
9	Parent BMI	35.68 (9.15)	-0.21*	-0.00	-0.04	-0.00	0.05	0.10	0.14	0.37***	1					
10	Metabolic Syndrome	0.32 (0.47)	-0.05	0.07	-0.10	-0.04	0.10	-0.06	0.02	0.29**	0.09	1				
11	Child Gender	0.71 (0.45)	-0.21*	-0.32*	0.03	0.09	-0.01	0.25**	-0.02	-0.06	0.06	-0.29**	1			
12	Parent Gender	0.93 (0.25)	-0.08	-0.01	0.19	0.11	0.15	-0.05	-0.17	-0.11	0.01	-0.24**	0.32***	1		
13	Child Age	13.10 (1.58)	-0.04	-0.17	-0.06	0.02	-0.06	-0.01	0.04	-0.05	-0.00	-0.07	0.04	-0.05	1	
14	Parent Age	42.29 (7.03)	0.19	0.19	0.01	-0.03	-0.24*	-0.13	-0.04	-0.05	-0.07	0.01	-0.14	-0.24	0.14	1

Note. *N*'s range from 62 to 142 due to occasional missing data. For gender, 1 = male, 2 = female. CINSS – Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Needs Scale. MAAS = Mindful Attention Awareness Scale. BMI = Body Mass Index.* $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.

Table 9.

Results of Correlation Analyses: Nutrition Adherence at Three-Months & Six-Months

		M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Nutrition Adherence 3-Months	0.73 (0.19)	1													
2	Nutrition Adherence 6-Months	0.74 (0.16)	0.87***	1												
3	CINSS	3.92 (0.64)	-0.12	-0.15	1											
4	Parent BPNS	5.52 (0.76)	0.09	0.16	0.16	1										
5	Child MAAS	3.94 (0.97)	-0.07	0.06	0.40***	0.10	1									
6	Parent MAAS	4.43 (0.97)	-0.14	-0.11	0.03	0.40***	0.06	1								
7	Child Depression	7.57 (6.45)	0.02	-0.02	-0.57***	-0.18	-0.42***	-0.11	1							
8	Child BMI *z*-score	2.36 (0.32)	0.05	0.02	-0.07	0.15	-0.08	0.19*	0.14	1						
9	Parent BMI	35.68 (9.15)	-0.12	-0.04	-0.04	-0.00	0.05	0.10	0.14	0.37***	1					
10	Metabolic Syndrome	0.32 (0.47)	0.06	0.05	-0.10	-0.04	0.10	-0.06	0.02	0.29**	0.09	1				
11	Child Gender	0.71 (0.45)	-0.15	-0.22	0.03	0.09	-0.01	0.25**	-0.02	-0.06	0.06	-0.29**	1			
12	Parent Gender	0.93 (0.25)	0.06	-0.02	0.19	0.11	0.15	-0.05	-0.17	-0.11	0.01	-0.24**	0.32***	1		
13	Child Age	13.10 (1.58)	0.02	-0.06	-0.06	0.02	-0.06	-0.01	0.04	-0.05	-0.00	-0.07	0.04	-0.05	1	
14	Parent Age	42.29 (7.03)	0.02	-0.03	0.01	-0.03	-0.24*	-0.13	-0.04	-0.05	-0.07	0.01	-0.14	-0.24	0.14	1

Note. *N*'s range from 57 to 142 due to occasional missing data. For gender, 1 = male, 2 = female. CINSS – Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Needs Scale. MAAS = Mindful Attention Awareness Scale. BMI = Body Mass Index.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 10.

Results of Correlation Analyses: Behavioral Support Adherence at Three-Months & Six-Months

		M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Behavioral Support Adherence 3-Months	0.74 (0.20)	1													
2	Behavioral Support Adherence 6-Months	0.66 (0.18)	0.83***	1												
3	CINSS	3.92 (0.64)	-0.12	-0.13	1											
4	Parent BPNS	5.52 (0.76)	0.08	0.15	0.16	1										
5	Child MAAS	3.94 (0.97)	0.05	0.17	0.40***	0.10	1									
6	Parent MAAS	4.43 (0.97)	-0.06	-0.10	0.03	0.40***	0.06	1								
7	Child Depression	7.57 (6.45)	0.11	-0.05	-0.57***	-0.18	-0.42***	-0.11	1							
8	Child BMI *z*-score	2.36 (0.32)	0.09	-0.01	-0.07	0.15	-0.08	0.19*	0.14	1						
9	Parent BMI	35.68 (9.15)	0.16	0.06	-0.04	-0.00	0.05	0.10	0.14	0.37***	1					
10	Metabolic Syndrome	0.32 (0.47)	0.04	0.08	-0.10	-0.04	0.10	-0.06	0.02	0.29**	0.09	1				
11	Child Gender	0.71 (0.45)	-0.06	-0.24	0.03	0.09	-0.01	0.25**	-0.02	-0.06	0.06	-0.29**	1			
12	Parent Gender	0.93 (0.25)	-0.02	0.02	0.19	0.11	0.15	-0.05	-0.17	-0.11	0.01	-0.24**	0.32***	1		
13	Child Age	13.10 (1.58)	-0.28**	-0.37**	-0.06	0.02	-0.06	-0.01	0.04	-0.05	-0.00	-0.07	0.04	-0.05	1	
14	Parent Age	42.29 (7.03)	0.02	-0.03	0.01	-0.03	-0.24*	-0.13	-0.04	-0.05	-0.07	0.01	-0.14	-0.24	0.14	1

Note. *N*'s range from 61 to 142 due to occasional missing data. For gender, 1 = male, 2 = female. CINSS – Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Needs Scale. MAAS = Mindful Attention Awareness Scale. BMI = Body Mass Index.* $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.

Table 11.

Results of Correlation Analyses: Total Adherence at Three-Months & Six-Months

		M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Total Adherence 3-Months	0.73 (0.15)	1													
2	Total Adherence 6-Months	0.70 (0.15)	0.82***	1												
3	CINSS	3.92 (0.64)	-0.08	-0.14	1											
4	Parent BPNS	5.52 (0.76)	0.04	0.18	0.16	1										
5	Child MAAS	3.94 (0.97)	0.01	0.14	0.40***	0.10	1									
6	Parent MAAS	4.43 (0.97)	-0.11	-0.04	0.03	0.40***	0.06	1								
7	Child Depression	7.57 (6.45)	0.09	-0.06	-0.57***	-0.18	-0.42***	-0.11	1							
8	Child BMI *z*-score	2.36 (0.32)	0.01	0.05	-0.07	0.15	-0.08	0.19*	0.14	1						
9	Parent BMI	35.68 (9.15)	-0.07	0.01	-0.04	-0.00	0.05	0.10	0.14	0.37***	1					
10	Metabolic Syndrome	0.32 (0.47)	0.03	0.06	-0.10	-0.04	0.10	-0.06	0.02	0.29**	0.09	1				
11	Child Gender	0.71 (0.45)	-0.18	-0.27*	0.03	0.09	-0.01	0.25**	-0.02	-0.06	0.06	-0.29**	1			
12	Parent Gender	0.93 (0.25)	-0.03	-0.01	0.19	0.11	0.15	-0.05	-0.17	-0.11	0.01	-0.24**	0.32***	1		
13	Child Age	13.10 (1.58)	-0.17	-0.27*	-0.06	0.02	-0.06	-0.01	0.04	-0.05	-0.00	-0.07	0.04	-0.05	1	
14	Parent Age	42.29 (7.03)	0.11	0.00	0.01	-0.03	-0.24*	-0.13	-0.04	-0.05	-0.07	0.01	-0.14	-0.24	0.14	1

Note. *N*'s range from 63 to 142 due to occasional missing data. For gender, 1 = male, 2 = female. CINSS – Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Needs Scale. MAAS = Mindful Attention Awareness Scale. BMI = Body Mass Index.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 12.

Results of Correlation Analyses: Attrition at Three-Months

		M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Attrition 3-Months	0.24 (0.43)	1												
2	CINSS	3.92 (0.64)	0.03	1											
3	Parent BPNS	5.52 (0.76)	0.06	0.16	1										
4	Child MAAS	3.94 (0.97)	0.10	0.40***	0.10	1									
5	Parent MAAS	4.43 (0.97)	-0.04	0.03	0.40***	0.06	1								
6	Child Depression	7.57 (6.45)	-0.02	-0.57***	-0.18	-0.42***	-0.11	1							
7	Child BMI *z*-score	2.36 (0.32)	-0.06	-0.07	0.15	-0.08	0.19*	0.14	1						
8	Parent BMI	35.68 (9.15)	0.06	-0.04	-0.00	0.05	0.10	0.14	0.37***	1					
9	Metabolic Syndrome	0.32 (0.47)	-0.16	-0.10	-0.04	0.10	-0.06	0.02	0.29**	0.09	1				
10	Child Gender	0.71 (0.45)	0.03	0.03	0.09	-0.01	0.25**	-0.02	-0.06	0.06	-0.29**	1			
11	Parent Gender	0.93 (0.25)	0.07	0.19	0.11	0.15	-0.05	-0.17	-0.11	0.01	-0.24**	0.32***	1		
12	Child Age	13.10 (1.58)	0.03	-0.06	0.02	-0.06	-0.01	0.04	-0.05	-0.00	-0.07	0.04	-0.05	1	
13	Parent Age	42.29 (7.03)	-0.03	0.01	-0.03	-0.24*	-0.13	-0.04	-0.05	-0.07	0.01	-0.14	-0.24	0.14	1

Note. *N*'s range from 82 to 143 due to occasional missing data. For gender, 1 = male, 2 = female. CINSS – Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Needs Scale. MAAS = Mindful Attention Awareness Scale. BMI = Body Mass Index.* $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.

Table 13.

Results of Correlation Analyses: Attrition at Six-Months

		M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Attrition 6-Months	0.51 (0.50)	1												
2	CINSS	3.92 (0.64)	-0.09	1											
3	Parent BPNS	5.52 (0.76)	0.21*	0.16	1										
4	Child MAAS	3.94 (0.97)	-0.02	0.40***	0.10	1									
5	Parent MAAS	4.43 (0.97)	-0.03	0.03	0.40***	0.06	1								
6	Child Depression	7.57 (6.45)	0.14	-0.57***	-0.18	-0.42***	-0.11	1							
7	Child BMI *z*-score	2.36 (0.32)	0.01	-0.07	0.15	-0.08	0.19*	0.14	1						
8	Parent BMI	35.68 (9.15)	0.18*	-0.04	-0.00	0.05	0.10	0.14	0.37***	1					
9	Metabolic Syndrome	0.32 (0.47)	-0.06	-0.10	-0.04	0.10	-0.06	0.02	0.29**	0.09	1				
10	Child Gender	0.71 (0.45)	0.11	0.03	0.09	-0.01	0.25**	-0.02	-0.06	0.06	-0.29**	1			
11	Parent Gender	0.93 (0.25)	0.19*	0.19	0.11	0.15	-0.05	-0.17	-0.11	0.01	-0.24**	0.32***	1		
12	Child Age	13.10 (1.58)	0.07	-0.06	0.02	-0.06	-0.01	0.04	-0.05	-0.00	-0.07	0.04	-0.05	1	
13	Parent Age	42.29 (7.03)	-0.19	0.01	-0.03	-0.24*	-0.13	-0.04	-0.05	-0.07	0.01	-0.14	-0.24	0.14	1

Note. *N*'s range from 82 to 142 due to occasional missing data. For gender, 1 = male, 2 = female. CINSS – Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Needs Scale. MAAS = Mindful Attention Awareness Scale. BMI = Body Mass Index.* $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.

Linear Regressions: Adherence

A series of backward elimination multiple regressions examined predictors of adherence to gym visits, nutrition visits, behavioral support visits, and total adherence. The regressions were conducted in blocks of psychosocial (e.g., motivation, mindfulness, depression), biological (e.g., anthropometric, biochemical), and demographic (e.g., child age, child gender, child race, parent education, parent income) variables. Significant predictors identified in the blocks of analyses were then aggregated into final parsimonious models for each dependent variable. Covariates of protocol and participation in the MI Values study (Bean et al., 2014) were included in the models associated with the significant group differences found in the t-test analyses. Specifically, these covariates were included in final aggregated regression models examining: gym adherence at six-months (e.g., protocol), nutrition adherence at three-months (e.g., protocol, MI Values), nutrition adherence at six-months (e.g., protocol, MI Values), behavioral support adherence at three-months (e.g., protocol, MI Values), behavioral support adherence at six-months (e.g., protocol), total adherence at three-months (e.g., protocol), and total adherence at six-months (e.g., protocol, MI Values).

Gym adherence three-months. A backward elimination multiple regression examined the psychosocial predictors of gym adherence at three-months. The overall model including all of the predictors was not statistically significant, $F(5, 71) = 0.25$, $p = 0.94$; $R^2 = 0.02$. The most parsimonious model was not statistically significant, $F(1, 75) = 0.81$, $p = 0.37$; $R^2 = 0.01$. Together, none of the psychosocial variables are collectively or independently predictors of gym adherence at three-months. See Table 14.

Next, a backward elimination multiple regression examined the biological predictors of gym adherence at three-months. The overall model including all of the predictors was not statistically significant, $F(3, 79) = 0.81$, $p = 0.49$; $R^2 = 0.03$. At its most parsimonious, the model was not statistically significant, $F(1, 81) = 2.35$, $p = 0.13$; $R^2 = 0.03$. Together, the biological variables neither collectively nor independently are associated with gym adherence at three-months. See table 15.

Demographic predictors of gym adherence at three-months were then examined with a backward elimination multiple regression. The overall model including all of the predictors was statistically significant, $F(5, 73) = 2.68$, $p = 0.03$; $R^2 = 0.16$. Together, the demographic variables collectively account for 16% of the variance in gym adherence at three-months. At its most parsimonious, the model was statistically significant, $F(1, 77) = 9.51$, $p = 0.003$; $R^2 = 0.11$. The model accounted for 11% of the variance and child race significantly predicted gym adherence at three-months (= -0.33, $p = 0.003$). Specifically, child African American identity was associated with less gym adherence at three-months. See Table 16.

A final model included the only significant predictor from the previous models, child race. The results of the overall model were not statistically significant, $F(1, 93) = 3.84$, $p = 0.053$; $R^2 = 0.04$. African American race was not a statistically significantly predictor of less gym adherence at three-months (= -0.20, $p = 0.053$). See Table 17.

Table 14.

Backward Elimination Regression Analysis Results for Gym Adherence at Three-Months and Psychosocial Predictors (N=77)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Gym Adherence 3-Months						0.017					0.011	-0.006	0.011
	CINSS	-0.000	0.047	0.000	-0.002								
	Parent BPNS	0.004	0.033	0.016	0.123								
	Child MAAS	-0.003	0.027	-0.014	-0.101								
	Parent MAAS	-0.018	0.026	-0.085	-0.672								
	Child Depression	0.003	0.004	0.094	0.629		0.003	0.003	0.103	0.898			

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. **p* < 0.05; ***p* < 0.01; ****p* < 0.001.

Table 15.

Backward Elimination Regression Analysis Results for Gym Adherence at Three-Months And Biological Predictors (N=83)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Gym Adherence 3-Months						0.030					0.028	-0.002	0.000
	Child BMI *z*-score	-0.028	0.076	-0.046	-0.366								
	Parent BMI	-0.004	0.003	-0.150	-1.241		-0.004	0.003	-0.168	-1.532			
	Child Metabolic Syndrome	0.000	0.046	-0.001	-0.010								

Note. BMI = Body Mass Index. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Table 16.

Backward Elimination Regression Analysis Results for Gym Adherence at Three-Months And Demographic Predictors (N=79)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Gym Adherence 3-Months						0.155					0.110	-0.045	0.123
	Child Age	-0.014	0.014	-0.108	-0.947								
	Child Gender	-0.025	0.050	-0.063	-0.498								
	Child Race	-0.110	0.046	-0.292	-2.383*		-0.125	0.041	-0.332	-3.084**			
	Parent Education	0.041	0.043	0.110	0.955								
	Parent Income	0.048	0.045	0.127	1.069								

Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 17.

Backward Elimination Regression Analysis Results for Gym Adherence at Three-Months with the Aggregated Significant Predictors (N=95)

Outcome	Predictor	Most Parsimonious Model *B*	*SE B*		*t*	R^2	f^2
Gym Adherence 3-Months						0.040	0.041
	Child Race	-0.080	0.041	-0.199	-1.960		

Note. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Gym adherence six-months. A backward elimination multiple regression examined the psychosocial predictors of gym adherence at six-months. The overall model including all of the predictors was not statistically significant, $F(5, 47) = 0.57$, $p = 0.72$; $R^2 = 0.06$. The most parsimonious model was not statistically significant, $F(1, 51) = 2.71$, $p = 0.11$; $R^2 = 0.05$. Thus, the psychosocial variables did not collectively or independently predict gym adherence at six-months. See Table 18.

Biological predictors of gym adherence at six-months were then examined with a backward elimination multiple regression. The overall model including all of the predictors was not statistically significant, $F(3, 55) = 0.199$, $p = 0.90$; $R^2 = 0.01$. At its most parsimonious the model was not statistically significant, $F(1\ 57) = 0.453$, $p = 0.50$; $R^2 = 0.01$, suggesting that the biological variables did not collectively or independently predict gym adherence at six-months. See Table 19.

Next, a backward elimination multiple regression examined the demographic predictors of gym adherence at six-months. The overall model including all of the predictors was statistically significant, $F(5, 52) = 3.21$, $p = 0.01$; $R^2 = 0.24$. The demographic variables together collectively accounted for 24% of the variance in gym adherence at six-months. At its most parsimonious, the model was statistically significant, $F(1, 56) = 11.36$, $p = 0.001$; $R^2 = 0.17$. Child race (= -0.41, $p = 0.001$) remained significant and the model accounted for 17% of the variance in gym adherence. Further, child African American identity was a statistically significant predictor of lower gym adherence at this time point. See Table 20.

A final backward elimination multiple regression examined the significant predictors from the previous models (e.g., child race) and the covariate protocol for gym adherence at six-months. Results of the overall model at its most parsimonious and statistically significant without eliminating any of the included variables, $F(2, 59) = 5.84$, $p = 0.005$; $R^2 = 0.17$. Both African American race (= -0.344, $p = 0.006$) and protocol (= -0.252, $p = 0.039$) significantly predicted gym adherence at six-months, and the model accounted for 17% of the variance in gym adherence at six-months. African American race and second protocol status (e.g., #13833) were independently associated with less gym adherence at this time point. See Table 21.

Table 18.

Backward Elimination Regression Analysis Results for Gym Adherence at Six-Months Among Psychosocial Predictors (N=53)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Gym Adherence 6-Months						0.057					0.050	0.007	0.053
	CINSS	-0.034	0.068	-0.102	-0.492								
	Parent BPNS	0.000	0.048	0.001	0.004								
	Child MAAS	-0.006	0.037	-0.029	-0.170								
	Parent MAAS	-0.050	0.033	-0.228	-1.497		-0.049	0.030	-0.225	-1.645			
	Child Depression	-0.003	0.008	-0.097	-0.420								

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 19.

Backward Elimination Regression Analysis Results for Gym Adherence at Six-Months Among Biological Predictors (N=59)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Gym Adherence 6-Months						0.011					0.008	0.003	0.008
	Child BMI *z*-score	-0.039	0.103	-0.055	-0.376								
	Parent BMI	-0.000	0.005	-0.001	-0.006								
	Child Metabolic Syndrome	0.050	0.068	0.103	0.740		0.043	0.064	0.089	0.673			

Note. BMI = Body Mass Index. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 20.

Backward Elimination Regression Analysis Results for Gym Adherence at Six-Months Among Demographic Predictors (N=58)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Gym Adherence 6-Months						0.236					0.169	0.067	0.203
	Child Age	-0.029	0.019	-0.201	-1.538								
	Child Gender	-0.059	0.066	-0.134	-0.899								
	Child Race	-0.133	0.065	-0.305	-2.035*		-0.179	0.053	-.411	-3.370**			
	Parent Education	0.051	0.056	0.116	0.899								
	Parent Income	0.057	0.059	0.129	0.969								

Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 21.

Backward Elimination Regression Analysis Results for Gym Adherence at Six-Months and the Aggregated Significant Predictors (N=62)

		Most Parsimonious Model					
Outcome	Predictor	*B*	*SE B*		*t*	R^2	f^2
Gym Adherence 6-Months						0.165	0.198
	Child Race	-0.165	0.057	-0.344	-2.879**		
	Protocol	-0.128	0.061	-0.252	-2.109*		

Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Nutrition adherence at three-months. A backward elimination multiple regression examined the psychosocial predictors of nutrition adherence at three-months. The overall model including all of the predictors was not statistically significant, $F(5, 69) = 1.67$, $p = 0.15$; $R^2 = 0.11$. The most parsimonious model was not statistically significant, $F(3, 71) = 2.70$, $p = 0.052$; $R^2 = 0.10$. Thus, the psychosocial variables assessed did not collectively or independently predict nutrition adherence at three-months. See Table 22.

Next, a backward elimination multiple regression examined the biological predictors of nutrition adherence at three-months. The overall model including all of the predictors was not statistically significant, $F(3, 71) = 0.604$, $p = 0.61$; $R^2 = 0.03$. The most parsimonious model was not statistically significant, $F(1, 73) = 1.05$, $p = 0.31$; $R^2 = 0.01$. Thus, the biological variables did not collectively or independently predict nutrition adherence at three-months. See Table 23.

Demographic predictors of nutrition adherence at three-months were then examined with a backward elimination multiple regression. The overall model including all of the predictors was not statistically significant, $F(5, 66) = 2.05$, $p = 0.08$; $R^2 = 0.14$. The most parsimonious model was statistically significant, $F(1, 70) = 6.67$, $p = 0.01$; $R^2 = 0.09$. In this model, African American race (= -0.30, $p = 0.01$) was a unique predictor and accounted for 9% of the variance in nutrition adherence at three-months. In this model, child African American identity was a statistically significant unique predictor of lower adherence. See Table 24.

A final backward elimination multiple regression examined the significant predictor from the previous models (e.g., child race) and covariates identified in the previous *t*-tests (e.g., protocol, MI Values) for nutrition adherence at three-months. Results of the overall model were statistically significant, $F(3, 88) = 12.20$, $p < 0.001$; $R^2 = 0.29$. The model at its most parsimonious was statistically significant, $F(2, 89) = 18.30$, $p < 0.001$; $R^2 = 0.29$. Child race (= -

0.256, $p = 0.006$) and protocol (= -0.512, $p < 0.001$) were unique, statistically significant predictors of nutrition adherence at three-months. Together, African American identity and engaging in the second protocol collectively accounted for 29% of the variance in nutrition adherence and were independently associated with lower adherence at three-months. See Table 25.

Table 22.

Backward Elimination Regression Analysis Results for Nutrition Adherence at Three-Months Among Psychosocial Predictors (N=75)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Nutrition Adherence 3-Months						0.108					0.102	0.006	0.114
	CINSS	-0.075	0.043	-0.270	-1.730		-0.056	0.032	-0.201	-1.742			
	Parent BPNS	0.056	0.030	0.233	1.861		0.057	0.029	0.240	1.966			
	Child MAAS	0.009	0.026	0.045	0.328								
	Parent MAAS	-0.053	0.024	-0.266	-2.193		-0.052	0.024	-0.263	-2.194			
	Child Depression	-0.002	0.004	-0.075	-0.497								

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 23.

Backward Elimination Regression Analysis Results for Nutrition Adherence at Three-Months Among Biological Predictors (N=75)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*T*	R^2	R^2	f^2
Nutrition Adherence 3-Months						0.025					0.014	0.011	0.014
	Child BMI *z*-score	0.051	0.080	0.086	0.637								
	Parent BMI	-0.004	0.003	-0.160	-1.243		-0.003	0.003	-0.119	-1.024			
	Child Metabolic Syndrome	0.020	0.049	0.050	0.404								

Note. BMI = Body Mass Index. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 24.

Backward Elimination Regression Analysis Results for Nutrition Adherence at Three-Months Among Demographic Predictors (N=72)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Nutrition Adherence 3-Months						0.135					0.087	0.048	0.095
	Child Age	0.007	0.015	0.061	0.501								
	Child Gender	-0.012	0.053	-0.032	-0.235								
	Child Race	-0.116	0.050	-0.311	-2.316*		-0.110	0.043	-0.295	-2.583*			
	Parent Education	-0.049	0.045	-0.132	-1.098								
	Parent Income	-0.063	0.047	-0.169	-1.351								

Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 25.

Backward Elimination Regression Analysis Results for Nutrition Adherence at Three-Months and the Aggregated Significant Predictors (N=92)

		Most Parsimonious Model					
Outcome	Predictor	*B*	*SE B*		*t*	R^2	f^2
Nutrition Adherence 3-Months						0.291	0.410
	Child Race	-0.095	0.034	-0.256	-2.844**		
	Protocol	-0.200	0.035	-0.512	-5.679***		

Note. $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Nutrition adherence six-months. A backward elimination multiple regression examined the psychosocial predictors of nutrition adherence at six-months. The overall model including all of the predictors was not statistically significant, $F(5, 43) = 1.01$, $p = 0.43$; $R^2 = 0.11$, nor was the most parsimonious model, $F(1, 47) = 0.926$, $p = 0.34$; $R^2 = 0.02$. Thus, the psychosocial variables did not collectively or independently predict nutrition adherence at six-months. See Table 26.

Biological predictors of nutrition adherence at six-months were then examined with a backward elimination multiple regression. The overall model including all of the predictors was not statistically significant, $F(3, 50) = 0.096$, $p = 0.96$; $R^2 = 0.01$, nor was the most parsimonious model, $F(1, 52) = 0.208$, $p = 0.65$; $R^2 = 0.00$. Thus, the biological variables did not collectively or independently predict nutrition adherence at six-months. See Table 27.

Thereafter, a backward elimination multiple regression examined the demographic predictors of nutrition adherence at six-months. The overall model including all of the predictors was not statistically significant, $F(5, 46) = 1.28$, $p = 0.29$; $R^2 = 0.12$. However, the most parsimonious model was statistically significant, $F(2, 49) = 3.23$, $p = 0.05$; $R^2 = 0.12$. Specifically, child gender (= -0.25, $p = 0.08$) and parent education (= 0.26, $p = 0.06$) remained significant in this model, indicating that female gender and parents with less education were associated with less nutrition adherence at six-months. Together, this model accounted for 12% of the variance in nutrition adherence at six-months, although none of the variables was a statistically significant unique predictor. See Table 28.

None of the previous models yielded statistically significant predictors, therefore a final backward elimination multiple regression was unable to be modeled. Together, none of the variables collectively or independently predicted nutrition adherence at six-months.

Table 26.

Backward Elimination Regression Analysis Results for Nutrition Adherence at Six-Months Among Psychosocial Predictors (N=49)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Nutrition Adherence 6-Months						0.105					0.019	0.086	0.019
	CINSS	-0.065	0.051	-0.269	-1.291								
	Parent BPNS	0.053	0.036	0.270	1.456		0.027	0.028	0.139	0.962			
	Child MAAS	0.019	0.028	0.114	0.684								
	Parent MAAS	-0.040	0.027	-0.236	-1.460								
	Child Depression	-0.001	0.006	-0.034	-0.148								

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 27.

Backward Elimination Regression Analysis Results for Nutrition Adherence at Six-Months Among Biological Predictors (N=54)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Nutrition Adherence 6-Months						0.006					0.004	0.002	0.004
	Child BMI *z*-score	0.022	0.079	0.044	0.282		0.032	0.070	0.063	0.456			
	Parent BMI	0.001	0.004	0.041	0.269								
	Child Metabolic Syndrome	0.005	0.050	0.014	0.095								

Note. BMI = Body Mass Index. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 28.

Backward Elimination Regression Analysis Results for Nutrition Adherence at Six-Months Among Demographic Predictors (N=52)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Nutrition Adherence 6-Months						0.122					0.117	0.005	0.133
	Child Age	0.005	0.016	0.045	0.294								
	Child Gender	-0.069	0.056	-0.212	-1.250		-0.081	0.044	-0.246	-1.822			
	Child Race	-0.024	0.055	-0.074	-0.442								
	Parent Education	-0.087	0.049	-0.267	-1.783		-0.084	0.044	-0.259	-1.925			
	Parent Income	-0.007	0.049	-0.023	-0.150								

Note. **p* < 0.05; ***p* < 0.01; ****p* < 0.001.

Behavior support adherence three-months. A backward elimination multiple regression examined psychosocial predictors of behavior support adherence at three-months. The overall model including all of the predictors was not statistically significant, $F(5, 72) = 2.29$, $p = 0.055$; $R^2 = 0.14$. The most parsimonious model was statistically significant, $F(2, 75) = 4.38$, $p = 0.02$; $R^2 = 0.11$. Child BPNS (= -0.29, $p = 0.01$) and parent BPNS (= 0.21, $p = 0.06$) were significant predictors, and the model accounted for 11% of the variance. Further, greater child BPNS was a statistically significant unique predictor of less adherence at this time point. See Table 29.

Next, a backward elimination multiple regression examined biological predictors of behavior support adherence at three-months. The overall model including all of the predictors was not statistically significant, $F(3, 77) = 0.815$, $p = 0.49$; $R^2 = 0.03$, nor was the most parsimonious model, $F(1, 79) = 2.30$, $p = 0.13$; $R^2 = 0.03$. Together, the biological variables did not collectively or independently predict behavior support adherence at three-months. See Table 30.

Demographic predictors of behavior support adherence at three-months were then examined with a backward elimination multiple regression. The overall model including all of the predictors was statistically significant, $F(5, 71) = 4.24$, $p = 0.002$; $R^2 = 0.23$. All of the demographic variables together collectively account for 23% of the variance in behavior support adherence at three-months. The most parsimonious model was statistically significant, $F(2, 74) = 8.36$, $p = 0.001$; $R^2 = 0.18$. Child age (= -0.27, $p = 0.02$) and parent income (= -0.28, $p = 0.01$) remained as predictors and the model accounted for 18% of the variance. Further, younger age and parent annual income of less than $50,000 were statistically significant unique predictors of greater behavior support adherence at this time point. See Table 31.

A final backward elimination multiple regression examined the significant predictors from the previous models (e.g., child basic psychological need fulfillment, child age, parent income) and covariates identified in the previous *t*-tests (e.g., protocol, MI Values) for behavior support adherence at three-months. Results of the overall model were statistically significant, $F(5, 85) = 5.42$, $p < 0.001$; $R^2 = 0.24$. The model at its most parsimonious was statistically significant, $F(2, 88) = 13.49$, $p < 0.001$; $R^2 = 0.24$. Child age ($= -0.243$, $p = 0.01$) and protocol ($= -0.418$, $p < 0.001$) were statistically significant predictors of behavior support adherence at three-months. Together, child age and protocol collectively account for 24% of the variance in behavior support adherence at three-months. Younger age was independently associated with greater behavior support adherence at three-months, while enrollment in the second protocol (e.g., #13833) was associated with less behavior support adherence at this time point. See Table 32.

Table 29.

Backward Elimination Regression Analysis Results for Behavior Support Adherence at Three-Months Among Psychosocial Predictors (N=78)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Behavior Support Adherence 3-Months						0.137					0.105	0.027	0.117
	CINSS	-0.103	0.043	-0.357	-2.413*		-0.084	0.032	-0.291	-2.610*			
	Parent BPNS	0.066	0.030	0.270	2.223*		0.052	0.027	0.212	1.897			
	Child MAAS	0.027	0.024	0.142	1.102								
	Parent MAAS	-0.029	0.024	-0.146	-1.241								
	Child Depression	0.001	0.004	0.032	0.222								

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 30.

Backward Elimination Regression Analysis Results for Behavior Support Adherence at Three-Months Among Biological Predictors (N=81)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Behavior Support Adherence 3-Months						0.031					0.028	0.003	0.029
	Child BMI *z*-score	-0.033	0.080	-0.052	-0.410								
	Parent BMI	0.005	0.003	0.184	1.508		0.004	0.003	0.168	1.516			
	Child Metabolic Syndrome	0.014	0.049	0.034	0.284								

Note. BMI = Body Mass Index. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Table 31.

Backward Elimination Regression Analysis Results for Behavior Support Adherence at Three-Months Among Demographic Predictors (N=77)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Behavior Support Adherence 3-Months						0.230					0.184	0.046	0.225
	Child Age	-0.028	0.013	-0.228	-2.093*		-0.033	0.013	-0.268	-2.487*			
	Child Gender	-0.073	0.049	-0.181	-1.488								
	Child Race	-0.008	0.046	-0.020	-0.164								
	Parent Education	-0.050	0.042	-0.133	-1.191								
	Parent Income	-0.113	0.044	-0.299	-2.587*		-0.107	0.041	-0.280	-2.601*			

Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 32.

Backward Elimination Regression Analysis Results for Behavior Support Adherence at Three-Months and the Aggregated Significant Predictors (N=91)

		Most Parsimonious Model					
Outcome	Predictor	*B*	*SE B*		*t*	R^2	f^2
Behavior Support Adherence 3-Months						0.235	0.307
	Child Age	-0.031	0.012	-0.243	-2.603*		
	Protocol	-0.175	0.039	-0.418	-4.483***		

Note. $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Behavior support adherence six-months. A backward elimination multiple regression examined the psychosocial predictors of behavior support adherence at six-months. The overall model including all of the predictors was not statistically significant, $F(5, 46) = 2.29$, $p = 0.061$; $R^2 = 0.20$. The most parsimonious model was statistically significant, $F(3, 48) = 2.97$, $p = 0.04$; $R^2 = 0.16$. Specifically, child BPNS (= -0.26, $p = 0.07$), parent BPNS (= 0.34, $p = 0.02$), and parent mindfulness (= -0.29, $p = 0.05$) were significant predictors. This model accounted for 16% of the variance. Further, greater parent BPNS and less parent mindfulness were statistically significant unique predictors of greater behavior support adherence at six-months. See Table 33.

Biological predictors of behavior support adherence at six-months were then examined by a backward elimination multiple regression. The overall model including all of the predictors was not statistically significant, $F(3, 53) = 0.538$, $p = 0.66$; $R^2 = 0.03$. The most parsimonious model was not statistically significant, $F(1, 55) = 1.37$, $p = 0.25$; $R^2 = 0.02$. Together, the biological variables did not collectively or independently predict behavior support adherence at six-months. See Table 34.

Next, a backward elimination multiple regression examined the demographic predictors of behavior support adherence at six-months. The model including all of the predictors was statistically significant, $F(5, 49) = 2.55$, $p = 0.04$; $R^2 = 0.21$, as was the most parsimonious model, $F(2, 52) = 4.93$, $p = 0.01$; $R^2 = 0.16$. Specifically, child age (= -0.31, $p = 0.02$) and child gender (= -0.23, $p = 0.07$) remained significant. The demographic variables collectively accounted for 21% of the variance, while the most parsimonious model accounted for 16% of the variance. Also, younger age was a statistically significant unique predictor of greater behavior support adherence at this time point. See Table 35.

A final backward elimination multiple regression examined the significant predictors from the previous models (e.g., parent basic psychological needs fulfillment, parent mindfulness, child age) and the covariate identified in the previous *t*-tests (e.g., protocol) for behavior support adherence at six-months. Results of the overall model were statistically significant, $F(4, 52) = 4.31$, $p = 0.004$; $R^2 = 0.25$, as was the model at its most parsimonious, $F(2, 54) = 7.14$, $p = 0.002$; $R^2 = 0.21$. Child age (= -0.30, $p = 0.02$) and protocol (= -0.32, $p = 0.01$) were statistically significant predictors of behavior support adherence at six-months. Together, child age and protocol collectively account for 21% of the variance. Younger age was independently associated with greater behavior support adherence at six-months, while enrollment in the second protocol (e.g., #13833) was associated with less behavior support adherence at this time point. See Table 36.

Table 33.

Backward Elimination Regression Analysis Results for Behavioral Support Adherence at Six-Months Among Psychosocial Predictors (N=52)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Behavior Support Adherence 6-Months						0.200					0.157	0.043	0.186
	CINSS	-0.078	0.045	-0.315	-1.718		-0.063	0.034	-0.256	-1.856			
	Parent BPNS	0.070	0.032	0.358	2.169*		0.067	0.028	0.343	2.360*			
	Child MAAS	0.039	0.025	0.241	1.570								
	Parent MAAS	-0.046	0.023	-0.287	-2.048*		-0.046	0.023	-0.285	-2.034*			
	Child Depression	0.002	0.006	0.088	0.425								

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 34.

Backward Elimination Regression Analysis Results for Behavior Support Adherence at Six-Months Among Biological Predictors (N=57)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Behavior Support Adherence 6-Months						0.030					0.024	0.006	0.025
	Child BMI *z*-score	-0.034	0.078	-0.064	-0.436								
	Parent BMI	0.004	0.004	0.170	0.184		0.004	0.003	0.156	1.171			
	Child Metabolic Syndrome	0.020	0.051	0.056	0.397								

Note. BMI = Body Mass Index. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 35.

Backward Elimination Regression Analysis Results for Behavior Support Adherence at Six-Months Among Demographic Predictors (N=55)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Gym Adherence 6-Months						0.206					0.159	0.047	0.189
	Child Age	-0.028	0.015	-0.252	-1.829		-0.034	0.014	-0.314	-2.464*			
	Child Gender	-0.109	0.052	-0.323	-2.096*		-0.078	0.043	-0.232	-1.823			
	Child Race	0.030	0.052	0.091	0.582								
	Parent Education	0.000	0.047	0.001	0.006								
	Parent Income	-0.069	0.048	-0.203	-1.449								

Note. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Table 36.

Backward Elimination Regression Analysis Results for Behavior Support Adherence at Six-Months and the Aggregated Significant Predictors (N=57)

		Most Parsimonious Model					
Outcome	Predictor	*B*	*SE B*		*T*	R^2	f^2
Behavior Support Adherence 6-Months						0.209	0.264
	Child Age	-0.035	0.014	-0.298	-2.447*		
	Protocol	-0.125	0.048	-0.320	-2.631*		

Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Total adherence three-months. A backward elimination multiple regression examined psychosocial predictors of total adherence at three-months. The overall model including all of the predictors was not statistically significant, $F(5, 74) = 1.46$, $p = 0.21$; $R^2 = 0.09$, nor was the most parsimonious model, $F(1, 78) = 2.46$, $p = 0.12$; $R^2 = 0.03$. Together, the psychosocial variables did not collectively or independently predict total adherence at three-months. See Table 37.

Following, the biological predictors of total adherence at three-months were examined with a backward elimination multiple regression. The overall model including all of the predictors was not statistically significant, $F(3, 80) = 0.137$, $p = 0.94$; $R^2 = 0.01$, nor was the most parsimonious model, $F(1, 82) = 0.191$, $p = 0.66$; $R^2 = 0.00$. Together, the biological variables did not collectively or independently predict total adherence at three-months. See Table 38.

Next, a backward elimination multiple regression examined the demographic predictors of total adherence at three-months. The overall model including all of the predictors was statistically significant, $F(5, 74) = 2.76$, $p = 0.02$; $R^2 = 0.16$, as was the most parsimonious model, $F(2, 77) = 5.54$, $p = 0.006$; $R^2 = 0.13$. Specifically, child age (= -0.19, $p = 0.08$) and child race (= -0.30, $p = 0.006$) remained as predictors. All of the demographic variables together collectively accounted for 16% of the variance, while the most parsimonious model accounted for 13% of the variance. African American race was a statistically significant unique predictors of less behavior support adherence at six-months. See Table 39.

A final backward elimination multiple regression examined the significant predictor identified from the previous models (e.g., child race) and the covariate identified in the previous *t*-tests (e.g., protocol) for total adherence at three-months. The results of the overall model were also at its most parsimonious and statistically significant without eliminating any of the included variables, $F(2, 99) = 9.95$, $p < 0.001$; $R^2 = 0.17$. Child race (= -0.226, $p = 0.02$) and protocol (= -0.369, $p < 0.001$) were statistically significant predictors of total adherence at three-months and accounted for 17% of the variance. African American race and engaging in the second protocol (e.g., #13833) were independently associated with less total adherence at this time point. See Table 40.

Table 37.

Backward Elimination Regression Analysis Results for Total Adherence at Three-Months Among Psychosocial Predictors (N=80)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Total Adherence 3-Months						0.090					0.031	0.059	0.032
	CINSS	-0.053	0.033	-0.236	-1.581		-0.039	0.025	-0.175	-1.568			
	Parent BPNS	0.038	0.023	0.201	1.621								
	Child MAAS	0.013	0.019	0.091	0.698								
	Parent MAAS	-0.034	0.019	-0.219	-1.830								
	Child Depression	0.001	0.003	0.048	0.328								

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 38.

Backward Elimination Regression Analysis Results for Total Adherence at Three-Months Among Biological Predictors (N=84)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Total Adherence 3-Months						0.005					0.002	0.003	0.002
	Child BMI *z*-score	-0.015	0.062	-0.030	-0.235								
	Parent BMI	-0.001	0.002	-0.042	-0.342		-0.001	0.002	-0.048	-0.437			
	Child Metabolic Syndrome	0.017	0.038	0.054	0.460								

Note. BMI = Body Mass Index. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 39.

Backward Elimination Regression Analysis Results for Total Adherence at Three-Months Among Demographic Predictors (N=80)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Total Adherence 3-Months						0.157					0.126	0.031	0.144
	Child Age	-0.013	0.011	-0.139	-1.244		-0.018	0.010	-0.190	-1.787			
	Child Gender	-0.045	0.039	-0.146	-1.174								
	Child Race	-0.076	0.036	-0.257	-2.115*		-0.089	0.031	-0.300	-2.816**			
	Parent Education	-0.015	0.033	-0.051	-0.448								
	Parent Income	-0.041	0.034	-0.139	-1.187								

Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 40.

Backward Elimination Regression Analysis Results for Total Adherence at Three-Months and the Aggregated Significant Predictors (N=102)

		Most Parsimonious Model					
Outcome	Predictor	*B*	*SE B*		*t*	R^2	f^2
Total Adherence 3-Months						0.167	0.200
	Child Race	-0.069	0.028	-0.226	-2.447*		
	Protocol	-0.117	0.029	-0.369	-3.997***		

Note. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Total adherence six-months. A backward elimination multiple regression examined psychosocial predictors of total adherence at six-months. The overall model including all of the predictors was not statistically significant, $F(5, 48) = 1.83$, $p = 0.13$; $R^2 = 0.16$, nor was the most parsimonious model, $F(3, 50) = 2.64$, $p = 0.06$; $R^2 = 0.14$. Together, the psychosocial variables did not collectively or independently predict total adherence at six-months. See Table 41.

Next, a backward elimination multiple regression examined the biological predictors of total adherence at six-months. Neither the overall model including all of the predictors, nor the most parsimonious model was statistically significant, p's > .05. Together, the biological variables did not collectively or independently predict total adherence at six-months. See Table 42.

Demographic predictors of total adherence at six-months were then examined with a backward elimination multiple regression. The overall model including all of the predictors was not statistically significant, $F(5, 51) = 1.98$, $p = 0.10$; $R^2 = 0.16$. However, the most parsimonious model was statistically significant, $F(2, 54) = 4.00$, $p = 0.02$; $R^2 = 0.13$. Gender ($= -0.27$, $p = 0.04$) and parent education ($= -0.23$, $p = 0.07$) remained as predictors and accounted for 13% of the variance. Male gender was a statistically significant unique predictors of greater total adherence at six-months. See Table 43.

A final backward elimination multiple regression examined the significant predictor from the previous models (e.g., child gender) and the covariates identified in the previous *t*-tests (e.g., protocol, MI Values) for total adherence at six-months. Results were statistically significant, $F(3, 59) = 5.84$, $p = 0.001$; $R^2 = 0.23$. The model at its most parsimonious was statistically significant, $F(2, 60) = 8.48$, $p = 0.001$; $R^2 = 0.22$. Child gender ($= -0.24$, $p = 0.04$) and protocol ($= -0.39$, $p = 0.001$) were statistically significant predictors of total adherence at six-months and the model accounted for 22% of the variance. Female gender and engaging in the second protocol (e.g., #13833) were independently associated with less total adherence at this time point. See Table 44.

Table 41.

Backward Elimination Regression Analysis Results for Total Adherence at Six-Months Among Psychosocial Predictors (N=54)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Total Adherence 6-Months						0.160					0.136	0.024	0.157
	CINSS	-0.066	0.041	-0.312	-1.639		-0.051	0.029	-0.241	-1.751			
	Parent BPNS	0.057	0.028	0.335	2.021*		0.058	0.025	0.341	2.350*			
	Child MAAS	0.025	0.022	0.176	1.144								
	Parent MAAS	-0.036	0.020	-0.262	-1.835		-0.037	0.019	-0.263	-1.879			
	Child Depression	0.000	0.005	0.017	0.081								

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 42.

Backward Elimination Regression Analysis Results for Total Adherence at Six-Months Among Biological Predictors (N=59)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Total Adherence 6-Months						0.019					0.017	0.002	0.017
	Child BMI *z*-score	0.014	0.063	0.031	0.214								
	Parent BMI	0.002	0.003	0.118	0.828		0.003	0.003	0.131	0.998			
	Child Metabolic Syndrome	0.005	0.041	0.018	0.132								

Note. BMI = Body Mass Index. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 43.

Backward Elimination Regression Analysis Results for Total Adherence at Six-Months Among Demographic Predictors (N=57)

		Full Model					Best Fitting Model						
Outcome	Predictor	*B*	*SE B*		*t*	R^2	*B*	*SE B*		*t*	R^2	R^2	f^2
Total Adherence 6-Months						0.162					0.129	0.033	0.148
	Child Age	-0.010	0.013	-0.110	-0.795								
	Child Gender	-0.075	0.044	-0.268	-1.716		-0.076	0.036	-0.271	-2.131*			
	Child Race	-0.010	0.044	-0.038	-0.240								
	Parent Education	-0.047	0.038	-0.169	-1.241		-0.065	0.035	-0.234	-1.840			
	Parent Income	-0.038	0.039	-0.135	-0.963								

Note. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Table 44.

Backward Elimination Regression Analysis Results for Total Adherence at Six-Months and the Aggregated Significant Predictors (N=63)

		Most Parsimonious Model					
Outcome	Predictor	*B*	*SE B*		*t*	R^2	f^2
Total Adherence 3-Months						0.220	0.282
	Child Gender	-0.073	0.036	-0.235	-2.045*		
	Protocol	-0.127	0.037	-0.389	-3.402**		

Note. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Logistic Regressions: Attrition

A series of backward elimination logistic regression analyses were conducted to assess whether psychosocial (e.g., motivation, mindfulness, depression), biological (e.g., child BMI *z*-score, parent BMI, presence of child metabolic syndrome), and demographic (e.g., child age, child gender, child race, parent education, parent income) variables were statistically significant predictors of attrition. A likelihood ratio backward selection process was used to construct the models (Vittinghoff, Glidden, Shiboski, & McCulloch, 2005). In accordance with the recommended ten events per variable (Perduzzi, Concato, Kemper, Holford, & Feinstein, 1996), each group of factors was modeled independently with the goal of aggregating the statistically significant predictors together in a parsimonious final model.

Attrition at three-months. A backward elimination logistic regression examined psychosocial predictors of attrition at three-months. When all five predictor variables were considered together, they did not significantly predict attrition, $X^2 = 1.94$, $df = 5$, $N = 104$, $p = 0.86$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.02$ and Nagelkerke $R^2 = 0.03$. With all predictors included in the model, 81.7% of the cases were correctly predicted. At its most parsimonious, the model did not significantly predict attrition, $X^2 = 0.98$, $df = 1$, $N = 104$, $p = 0.32$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.01$ and Nagelkerke $R^2 = 0.02$. With only one predictor (e.g., child mindfulness) included in the model, 81.7% of the cases were correctly predicted. See Table 45.

Next, a backward elimination logistic regression examined biological predictors of attrition at three-months. When all three predictor variables were considered together, they did not significantly predict attrition, $X^2 = 3.33$, $df = 3$, $N = 117$, $p = 0.34$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.03$ and Nagelkerke $R^2 = 0.04$. With all predictors included in the model, 76.1% of the cases were correctly predicted. At its most parsimonious, the model did not significantly predict attrition, $X^2 = 2.16$, $df = 1$, $N = 117$, $p = 0.14$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.02$ and Nagelkerke $R^2 = 0.03$. With only one predictor (e.g., child mindfulness) included in the model, 76.1% of the cases were correctly predicted. See Table 46.

Demographic predictors of attrition at three-months were then examined with a backward elimination logistic regression. When all five predictor variables were considered together, they did not significantly predict attrition, $X^2 = 5.66$, $df = 5$, $N = 107$, $p = 0.34$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.05$ and Nagelkerke $R^2 = 0.08$. With all predictors included in the model, 79.4% of the cases were correctly predicted. At its most parsimonious, a model including parent income significantly predicted attrition, $X^2 = 4.32$, $df = 1$, $N = 107$, $p = 0.04$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.04$ and Nagelkerke $R^2 = 0.06$. With this one predictor included in the model, 79.4% of the cases were correctly predicted. According to the Wald criterion, parent income was a significant predictor of attrition at three-months, Wald = 4.06, $df = 1$, $p = 0.04$. The change in odds associated with a one-unit change in parent income was 2.78 (*CI* 1.03-7.51), indicating that for every one-unit change attrition was 2.78 times more likely. See Table 47.

A final backward elimination logistic regression examined the significant predictor from the previous models (e.g., parent income) and the covariate identified in the previous chi-square tests (e.g., MI Values) for attrition at three-months. The results of the overall model resulted in its most parsimonious form and was statistically significant when the two predictor variables were considered together, $X^2 = 23.30$, $df = 2$, $N = 143$, $p < 0.001$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.15$ and Nagelkerke $R^2 = 0.23$. With all predictors included in the model, 76.2% of the cases were correctly predicted. According to the Wald criterion neither parent income (Wald = 3.04, $df = 1$, $p = 0.08$), or MI Values (Wald = 0.00, $df = 1$, $p = 0.99$), were independent significant predictors of attrition at three-months. See Table 48.

Table 45.

Backward Elimination Logistic Regression Analysis Results for Attrition at Three-Months Among Psychosocial Predictors (N=104)

		Full Model						Best Fitting Model					
Outcome	*Predictor*	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likeli-hood*	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likeli-hood*
Attrition 3-Months						1.936	96.958					0.975	98.894
	CINSS	0.062	0.508	0.015	1.064								
	Parent BPNS	0.226	0.377	0.360	1.254								
	Child MAAS	0.350	0.335	1.088	1.419			0.263	0.271	0.943	1.301		
	Parent MAAS	-0.209	0.289	0.521	0.811								
	Child Depression	0.026	0.048	0.295	1.027								

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 46.

Backward Elimination Logistic Regression Analysis Results for Attrition at Three-Months Among Biological Predictors (N=117)

		Full Model						Best Fitting Model					
Outcome	Predictor	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likelihood*	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likelihood*
Attrition 3-Months						3.329	125.439					2.161	128.768
	Child BMI *z*-score	-0.473	0.748	0.400	0.632								
	Parent BMI	0.026	0.025	1.056	1.026								
	Child Metabolic Syndrome	-0.676	0.534	1.600	0.509			-0.722	0.511	1.998	0.486		

Note. BMI = Body Mass Index. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 47.

Backward Elimination Logistic Regression Analysis Results for Attrition Three-Months Among Demographic Predictors (N=107)

		Full Model						Best Fitting Model					
Outcome	Predictor	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likelihood*	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likelihood*
Attrition 3-Months						5.664	103.064					4.320	104.409
	Child Age	-0.005	0.163	0.001	0.995								
	Child Gender	-0.555	0.655	0.717	0.574								
	Child Race	0.079	0.554	0.020	0.924								
	Parent Education	0.252	0.541	0.217	1.287								
	Parent Income	0.862	0.540	2.546	2.369			1.022	0.507	4.061*	2.780		

Note. $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table 48.

Backward Elimination Logistic Regression Analysis Results for Attrition at Three-Months Among the Aggregated Significant Predictors (N=143)

		Most Parsimonious Model					
Outcome	Predictor	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likeli-hood*
Attrition 3-Months						23.301	133.567
	Parent Income	0.787	0.451	3.038	2.196		
	MI Values	-20.196	7026.775	0.000	0.998		

Note. MI = Motivational Interviewing. $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Attrition at six-months. A backward elimination logistic regression examined the psychosocial predictors of attrition at six-months. When all five predictor variables were considered together, they significantly predicted attrition, $X^2 = 15.33$, $df = 5$, $N = 97$, $p = 0.01$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.15$ and Nagelkerke $R^2 = 0.20$. With all predictors included in the model, 68.0% of the cases were correctly predicted. At its most parsimonious, a model including parent BPNS and child depression significantly predicted attrition, $X^2 = 12.55$, $df = 2$, $N = 97$, $p = 0.002$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.12$ and Nagelkerke $R^2 = 0.16$. With these two predictors included in the model, 62.9% of the cases were correctly predicted. According to the Wald criterion, parent BPNS was a significant predictor of attrition at six-months, Wald = 7.69, $df = 1$, $p = 0.006$. The change in odds associated with a one-unit change in parent BPNS was 2.34 (*CI* 1.28-4.26), indicating that for every one-unit change attrition was 2.34 times more likely. According to the Wald criterion, child depression was a significant predictor of attrition at six-months, Wald = 6.06, $df = 1$, $p = 0.01$. The change in odds associated with a one-unit change in child depression was 1.09 (*CI* 1.02-1.17), indicating that for every one-unit change attrition was 1.09 times more likely. See Table 49.

Biological predictors of attrition at six-months were then examined with a backward elimination logistic regression. When all three predictor variables were considered together they did not significantly predict attrition, $X^2 = 5.17$, $df = 3$, $N = 117$, $p = 0.16$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.04$ and Nagelkerke $R^2 = 0.06$. With all predictors included in the model, 59.8% of the cases were correctly predicted. At its most parsimonious, a model including parent BMI significantly predicted attrition, $X^2 = 4.91$, $df = 1$, $N = 117$, $p = 0.03$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.04$ and Nagelkerke $R^2 = 0.06$. With this one predictor included in the model, 59.0% of the cases were correctly predicted.

According to the Wald criterion, parent BMI was a significant predictor of attrition at six-months, Wald = 4.55, $df = 1$, $p = 0.03$. The change in odds associated with a one-unit change in parent BPNS was 1.05 (*CI* 1.00-1.10), indicating that for every one-unit change attrition was 1.05 times more likely. See Table 50.

Next, a backward elimination logistic regression examined the demographic predictors of attrition at six-months. When all five predictor variables were considered together they significantly predicted attrition, $X^2 = 12.29$, $df = 5$, $N = 107$, $p = 0.03$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.11$ and Nagelkerke $R^2 = 0.15$. With all predictors included in the model, 68.2% of the cases were correctly predicted. At its most parsimonious, a model including parent education significantly predicted attrition, $X^2 = 6.17$, $df = 1$, $N = 107$, $p = 0.01$. The effect size of the predictors was small, with Cox and Snell $R^2 = 0.06$ and Nagelkerke $R^2 = 0.08$. With this one predictor included in the model, 61.7% of the cases were correctly predicted. According to the Wald criterion, parent education was a significant predictor of attrition at six-months, Wald = 5.97, $df = 1$, $p = 0.02$. The change in odds associated with a one-unit change in parent education was 2.67 (*CI* 1.21-5.86), indicating that for every one-unit change attrition was 2.67 times more likely. See Table 51.

A final backward elimination logistic regression examined the significant predictors from the previous models (e.g., parent BPNS, child depression, parent BMI, parent education) and the covariates identified in the previous chi-square tests (e.g., protocol, MI Values) for attrition at six-months. When all six predictor variables were considered together they significantly predicted attrition, $X^2 = 31.54$, $df = 6$, $N = 87$, $p < 0.001$. A medium effect size was found, with Cox and Snell $R^2 = 0.30$ and Nagelkerke $R^2 = 0.41$. With all predictors included in the model, 77.0% of the cases were correctly predicted. At its most parsimonious, a model including parent BPNS, child depression, and MI Values treatment significantly predicted attrition, $X^2 = 26.83$, *df*

= 3, $N = 87$, $p < 0.001$. The effect size of the predictors was small to medium, with Cox and Snell $R^2 = 0.27$ and Nagelkerke $R^2 = 0.36$. With these three predictors included in the model, 75.9% of the cases were correctly predicted. According to the Wald criterion parent BPNS (Wald = 7.48, $df = 1$, $p = 0.006$), and MI Values (Wald = 8.46 $df = 1$, $p = 0.004$), were significant predictors of attrition at six-months. See Table 52.

Table 49.

Backward Elimination Logistic Regression Analysis Results for Attrition at Six-Months Among Psychosocial Predictors (N=97)

		Full Model						Best Fitting Model					
Outcome	Predictor	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likeli-hood*	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likeli-hood*
Attrition 6-Months						15.332	117.391					12.545	120.178
	CINSS	-0.012	0.440	0.001	0.988								
	Parent BPNS	0.994	0.342	8.453**	2.703			0.849	0.306	7.655**	2.338		
	Child MAAS	0.294	0.270	1.184	1.342								
	Parent MAAS	-0.317	0.247	1.649	0.729								
	Child Depression	0.104	0.045	5.339*	1.109			0.086	0.035	6.058*	1.090		

Note. CINSS = Child Intrinsic Need Satisfaction Scale. BPNS = Basic Psychological Need Scale. MAAS = Mindful Attention Awareness Scale. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 50.

Backward Elimination Logistic Regression Analysis Results for Attrition at Six-Months Among Biological Predictors (N=117)

		Full Model						Best Fitting Model					
Outcome	Predictor	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likelihood*	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likelihood*
Attrition 6-Months						5.168	156.952					4.909	157.211
	Child BMI *z*-score	-0.209	0.672	0.097	0.811								
	Parent BMI	0.051	0.024	4.603*	1.053			0.048	0.023	4.552*	1.050		
	Child Metabolic Syndrome	-0.124	0.424	0.085	0.883								

Note. BMI = Body Mass Index. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Table 51.

Backward Elimination Logistic Regression Analysis Results for Attrition Six-Months Among Demographic Predictors (N=107)

		Full Model						Best Fitting Model					
Outcome	Predictor	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likeli-hood*	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likelihood*
Attrition 6-Months						12.289	135.286					6.165	141.410
	Child Age	0.215	0.141	2.325	1.240								
	Child Gender	-0.477	0.504	0.897	0.621								
	Child Race	-0.044	0.459	0.009	0.957								
	Parent Education	0.856	0.444	3.709	2.353			0.981	0.401	5.970*	2.667		
	Parent Income	0.621	0.440	1.991	1.861								

Note. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$.

Table 52.

Backward Elimination Logistic Regression Analysis Results for Attrition Six-Months Among the Aggregated Significant Predictors (N=87)

		Full Model						Best Fitting Model					
Outcome	Predictor	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likelihood*	*B*	*SE B*	*Wald*	*Odds*	χ^2	*-2 Log likelihood*
Attrition 3-Months						31.539	85.725					26.834	90.431
	Parent BPNS	1.007	0.386	6.806**	2.738			1.006	0.368	7.476**	2.735		
	Child Depression	0.070	0.047	2.259	1.073			0.069	0.043	2.530	1.071		
	Parent BMI	0.031	0.029	1.173	1.032								
	Parent Education	0.520	0.549	0.896	1.682								
	Protocol	0.613	0.570	1.154	1.845								
	MI Values	2.846	1.143	6.198*	17.212			3.152	1.084	8.459**	23.377		

Note. BPNS = Basic Psychological Need Fulfillment. BMI = Body Mass Index. MI = Motivational Interviewing. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Discussion

Behavioral weight management is the most commonly approach for the treatment of pediatric obesity (McGovern et al., 2008). Although a number of these programs have demonstrated encouraging results, treatment efficacy is often hampered by non-adherence and high attrition (Skelton & Beech, 2011). There are several factors associated with low participation in weight management programs (Barlow & Ohlemeyer, 2006; de Niet, Timman, Jongejan, Passchier, & van den Akker, 2011; Kitscha, Brunet, Farmer, & Mager, 2009; Zeller et al., 2004), yet gaps remain in the literature.

The current study had two exploratory aims. The first aim examined adolescent and parent psychosocial (e.g., motivation, mindfulness, depression), biological (e.g., anthropometric, biochemical), and demographic variables associated with adherence to a pediatric weight loss program. The second aim examined adolescent and parent psychosocial (e.g., motivation, mindfulness, depression), biological (e.g., anthropometric, biochemical), and demographic variables as related to attrition from a pediatric weight loss program. The sample included participants who completed the T.E.E.N.S. pediatric weight management program through three- and six-month time points (Bean et al., 2011; Evans, et al., 2009; Stern et al., 2006; 2007; Wickham et al., 2009). Results are expected to increase our understanding of the factors related to participation in weight management programs and inform the refinements of interventions, such as T.E.E.N.S.

Psychosocial Factors

Basic psychological needs. Guided by Self-Determination Theory's explanation of human motivation (Ryan & Deci, 2000a), it was hypothesized that the child participants' basic psychological need fulfillment would be associated with greater adherence and lower attrition. Unexpectedly, no significant relations were found between child basic psychological need fulfillment and adherence or attrition. This was surprising, as previous research has highlighted the association between greater basic psychological need fulfillment and intrinsic motivation in health behaviors (Deci & Ryan, 2000b; Sheldon & Niemiec, 2006; Ryan, 2006). A potential explanation for this null finding might be attributed to the critical role of parent involvement. Because parent involvement is important to the completion of pediatric treatments, child variables, such as their level of basic psychological need fulfillment might not be as important as parental participation factors (e.g., adherence, attrition). There is mounting evidence in the pediatric weight management literature indicating that targeting parental factors might be more effective than targeting child factors (Golan & Crow, 2004b; Janicke, 2013; Janicke et al., 2008; Mazzeo et al., 2014). In as much, it could be most valuable to tailor interventions to the parent when examining child participation in pediatric weight management.

Another possible explanation for the null results might be related to issues with instrumentation. The basic psychological needs scale used to in the current study was normed on samples comprised predominantly of White (74%) children from Montreal (Veronneau et al., 2005). Although the psychometric properties of the scale were reported to be adequate, the sample from which the scale was normed is notably different from the current sample. There is the potential for cultural influence to bias results when notable cultural differences exist between a study sample and the sample from which a scale was normed (Geisinger, 1994). In this case, the current study benefits from a notably diverse sample, and it is plausible that this group might respond differently than the sample used in the scale construction study. A lack of associations might be due to group differences and therefore explain the unexpected null findings. Future studies examining the psychometric properties of the scale on other diverse groups would be valuable.

In addition to examining potential relations between basic psychological need fulfillment in children and participation variables (e.g., adherence, attrition), need fulfillment in parents was also examined. Specifically, it was hypothesized that greater levels of parent basic psychological need fulfillment would be associated with greater adherence and lower attrition. Although most analyses yielded non-significant associations with the participation outcomes, a statistically significant relation between parent basic psychological need fulfillment and attrition at six-months was identified. This association indicated that greater parent need fulfillment was predictive of greater attrition at six-months. This evidence runs contrary to the current study's hypotheses. A possible explanation for the puzzling directionality of this finding might stem from the nature of the participants' goals. According to goals research framed under Self-Determination Theory, an individual's method of framing a goal with either intrinsic or extrinsic qualities will influence the associated motivated behaviors (Vansteenkiste, Lens, & Deci, 2006). Specifically, high motivation support will increase motivated behaviors, but perceptions that the goal is based on external forces could be associated with behaviors contrary to treatment goals. In this instance, if a parent considered her or his goal to participate in treatment as bound to external reasons - while experiencing high levels of need fulfillment - he or she might have the motivational supports to resist against the extrinsically framed goal. It was assumed that the participants' goals were intrinsically-framed and not based on external force, yet this might not be the case. Parent participants might have felt compelled by social messages, family, or the referring medical staff. Unfortunately, no measures assessing the qualities of the participants' goals related to participation were administered. Future research in this area would benefit from examining the participants' specific goals and whether they are framed by intrinsic or extrinsic characteristics.

Mindfulness. Considering the associations between dispositional mindfulness and autonomous behavioral regulation (Brown & Ryan, 2004), it was hypothesized that greater levels of parent and child dispositional mindfulness would be associated with greater adherence and lower attrition. Surprisingly, no statistically significant relations were found in the current study. A unique association between mindfulness and motivation, but not between mindfulness and participation might explain these null findings. Mindfulness was included in the current study because of its relation to the motivational process (Levesque & Brown, 2007) with the expectation that would relate to adherence and attrition. Theoretically, the association between mindfulness and motivation is considered to increase the opportunity for self-determined choices and relation between dispositional mindfulness and basic psychological need fulfillment is considered to play a fundamental role in that process (Deci & Ryan, 1980; Goodman et al, under review; Levesque & Brown, 2007). The relations between mindfulness and basic psychological need fulfillment were identified in the correlations of the current study. However, when the associations between mindfulness and the participation variables were tested, no significant relations were found. Together, these findings affirm that mindfulness is associated with motivation, but the data also indicate that it is not related to adherence and attrition.

The lack of associations between mindfulness and the participation variables might relate to the number of criticisms regarding the state of the art in operationalizing mindfulness, such as issues with construct validity and the scales used to measure mindfulness (Grossman, 2008; Grossman, 2011; Thompson & Waltz, 2007; Van Dam, Earleywine, & Danoff-Burg, 2009; Quickel, Johnson, & David, 2014). Specifically, the MAAS has received criticism due to inconsistencies regarding construct validity as well as issues with content and convergent validity (Grossman, 2011). These concerns arise from a number of arguments. A primary concern with the MAAS and mindfulness research in general, is the lack of a gold-standard referent from which to define mindfulness. Without a prototype from which a measure can be devised, it is unclear whether the scales are actually measuring an accurate and universally definable construct. It is also argued that there are no coherent qualities being measured among the current mindfulness measures. Specifically, a number of interrelated items are assessed, but not one distinct construct. Further, the prominent mindfulness scales demonstrate poor convergent validity, indicating low theoretical association among the operationalization of mindfulness. Additionally, there are arguments concerning the accuracy of self-report regarding perceived mindfulness, such as imprecise self-evaluation and personal values that might bias self-report.

Arguments related to the MAAS also highlighted the potentially construct-inconsistent nature of the item wording. The items are negatively worded and therefore might assess characteristics not associated with mindfulness, such as inattentiveness (Van Dam, Earleywine, & Borders, 2010). Further, there is concern that the scale is related to a number of other constructs, such as meta-awareness or attention (Grossman, 2008; Grossman, 2011). Considering these arguments, it is possible that the null results were related to validity issues in which a number of different constructs were actually being measured and therefore no clear pattern in the data emerged.

Depression. Multiple studies have identified associations between obesity and depression in children and adolescents (Anderson, Cohen, Naumova, Jacques, & Must, 2007; Mustillo, Worthman, Keeler, Angold, & Costello, 2003). Additionally, there is evidence for the relation between depression and low adherence to health behavior goals in adults (DiMatteo, Lepper, & Croghan, 2000; Wing, Phelan, & Tate, 2002) and emerging evidence for children with chronic health conditions (Bender, 2006). In research pertaining to pediatric weight management programs, there is evidence for greater depressive symptoms in child participants as predictors of non-adherence (White et al., 2004) and attrition (Zeller et al., 2004). Considering these trends in the literature, it was hypothesized that participants who reported more symptoms of depression would manifest lower adherence and higher attrition. Surprisingly, no relation was found among these variables. A possible explanation for the null findings might relate to the role of parental mood states, rather than child mood states. One study found that depression in mothers was associated with children's adherence to health management (Bartlett, Krishman, Riekert, Butz, Malveaux & Rand, 2004). Although these findings were from a sample of parents with asthmatic children, the results highlight the important role of parents in pediatric health behavior adherence. Future studies of pediatric obesity and adherence would benefit from assessing parent depression instead of child depression.

Biological Factors

The current study tested a number of hypotheses examining the potential relations between biological variables and adherence and attrition. Specifically, parent BMI, child BMI, and child metabolic syndrome were expected to be associated with lower adherence and greater attrition. These hypotheses were guided by the Negative Feedback Regulation of Food Intake model (NFRFI; Morton, Cummings, Baskin, Barsh, & Schwartz, 2006), which describes the interaction between metabolic factors and psychological responses associated with food intake behavior. None of the regression models demonstrated any significant relations among the biological factors and the participation variables (e.g., adherence, attrition). However, correlational analyses identified two statistically significant associations between parent BMI and participation. Specifically, greater parent BMI was related to less gym adherence at three-months and greater attrition at six-months. These results are consistent with evidence demonstrating that changes in parent weight predict changes in child weight (Boutelle, Cafri, & Crow, 2012; Epstein, Wing, Keoske, Andrasik, & Ossip, 1981; Kitzman et al., 2010). These findings are in line with the body of literature demonstrating the relation between parent weight-related behaviors and the respective child behaviors (Benton, 2004; Brown & Ogden, 2004; Golan & Crow, 2004; Oliveria, Ellison, Moore, Gillman, Garrahie, & Singer, 1992;). It is plausible that these behaviors might be extrapolated into other health behavior domains, such as active participation in treatment. Nevertheless, these two associations were not found in other correlations or regressions involving different domains of adherence (e.g., nutrition, behavior support, total adherence) or time points for adherence and attrition. In light of the many null findings among the correlations and lack of findings in the regressions, cautious interpretation of these two associations is recommended. There is a chance that these two correlations were spurious in nature and potentially due to coincidence or unobserved factors (Pearson, 1896).

Due to the exploratory nature of the hypotheses related to the biological factors, the lack of statistically significant relations among the variables is not entirely unexpected. The biological factors in the current study were included to explore whether the NFRFI (Morton, Cummings, Baskin, Barsh, & Schwartz, 2006), which demonstrates the influence of metabolic factors on food intake, might also explain motivated behavior associated with participation in a weight management program. It is likely that the NFRFI is able to explain food behaviors due to the relatively short period of time between the impulse to eat and the consumption of food. However, behaviors associated with overall adherence to or attrition from a weight management program require more time between impulse and outcome and include a number of complex demands that might mediate the decision to drop out from or adhere to the program. It is recommended that future studies guided by the NFRFI model examine the influence of metabolic factors on food intake behaviors exclusively, rather than weight-related health behaviors at large.

Demographic Factors

A number of demographic features are associated with pediatric obesity. Specifically, female gender, low-income status, and racial minority status are often associated with higher estimated rates of obesity and overweight among children (Gordon-Larsen, Adair, & Popkin, 2003; Hoelscher et al., 2015; Ogden et al., 2014; Miech, Kumanyika, Stettler, Link, Phelan, & Chang, 2006; Ng et al., 2014). A study examining attrition in a pediatric weight management program also identified older age, African American racial identity, and Medicaid usage as correlates of attrition (Zeller et al., 2004). Based on these data, it was hypothesized that that female child gender, African American racial identity, older child age, lower parent income, and lower parent education would predict lower adherence and higher attrition in the current study. A number of associations between demographic characteristics and participation were found, yet no consistent patterns were identified across the adherence domains (e.g., gym, nutrition, behavior support, total adherence) or at systematic time-points for adherence and attrition (e.g., 3-month, 6-month). However, African American racial identity, female gender, and older age were significantly associated with lower adherence in a range of domains. Current results are largely in line with the previous research (Zeller et al., 2004; Ogden et al., 2014; Miech et al., 2006). These results indicate that focusing on adherence behaviors among these groups might increase the efficacy of the associated pediatric weight management program.

Strengths, Limitations, and Future Directions

The present research has a range of strengths and limitations. Despite the number of null findings, the results are believed to add to the understanding of adherence and attrition in weight management programs. Specifically, the current study enhances our understanding by exploring a wide range of psychosocial, biological, and demographic covariates. Delineated below are sections on the limitations and strengths of the current research. Each section includes recommendations for future research in light of these methodological qualities.

Limitations. The current study was hampered by the number of tests conducted, challenges with the participation variables, and sample issues. First, the exploratory nature of the study prompted a range of tests to be conducted. These tests often overlapped thematically, in which participation in one domain (e.g., gym, nutrition, behavior, total) was tested with a similar set of variables (e.g., psychosocial, biological, demographic) and at specific time points (e.g., three-months, six-months). Associated with the numerous tests conducted, the high number of null results calls for cautious interpretation. Second, there is no 'gold' standard for measuring health behavior participation constructs (Vitolins, Rand, Rapp, Ribisl, & Sevick, 2000), and the current study was hindered by a number of limitations related to operationalizing the participation variables. Specifically, two main issues are of note: the measurement of adherence and the fundamental link between the adherence and attrition variables. Third, there were limitations associated with the sample drawn for the current study. These limitations are delineated below.

In light of the many null findings among the correlations and lack of findings in the regressions, cautious interpretation of the significant associations found is recommended. Considering the chance for Type I errors, there is a possibility that these significant correlations were spurious in nature and potentially due to coincidence or unobserved factors (Pearson, 1896). It is recommended that future studies account for Type I errors (i.e., lowering the significance levels alpha, Bonferroni corrections, alternative statistical tests), and focus the research questions to decrease the number hypotheses and lower the chance of identifying rare events.

Defining adherence is a nuanced task due to the number of ways it can be operationalized. The current study quantified adherence by dividing the number of visits attended by the total number of possible visits in a range of study domains (gym, nutrition support, behavior support, total). This was not considered a major methodological flaw because a proportion of attendance to intervention activities is a commonly used measure (Brewer, 1999; Brewer et al., 2000). However, the study might have yielded greater information about participant adherence by operationalizing this construct in a number of alternative ways. For example, measures pertinent to weight management often include dietary self-report as a measure of nutrition adherence (Kirkpatrick et al., 2013; Thompson & Byers, 1994) and energy expenditure as a measure of physical activity adherence (Seale & Rumbler, 1997; Shephard & Aoyagi, 2012). Adherence is also defined by the patient's ability and volition to participate in treatment (Franca, Sahade, Nunes, & Ardan, 2013). This patient-centered definition implies that motivation and personal interest are important factors related to treatment adherence. Considering these alternative methods for measuring adherence, a future study could take a multifaceted approach to enhance understanding of the motivational qualities of adherence. For example, querying for perceptions of adherence (e.g., interest, ability, and values related to participation) would provide an understanding of why people participate, rather than simply to what degree. Further, qualitative examinations of participant adherence, such as including open-ended interviews at the beginning and end of treatment, might provide valuable phenomenological data about patient adherence throughout treatment.

Another limitation is the fundamental link between the date of attrition and adherence. By selecting the parameters of three- and six-month time points, the adherence variables essentially became a subset measure of attrition at these junctures and might not reflect the construct of adherence more generally. These two time points were chosen because there was a greater chance that participants from both protocols had complete data at these junctures. However, inferences from the results might only shed light on individuals who adhered to the program within these time points and might not generalize to adherence behaviors at large. Future studies could account for dropout date and analyze time to event data without selecting predetermined group end points in order to prevent undue influence by attrition date.

In addition to the limitations related to the measurement of adherence, the sample characteristics offered a range of challenges in the current study. First, there was a restricted scope among a number of the participant demographics. For example, there were notably high percentages among many of the demographic variables (e.g., 93.5% female parent, 71.1% female child, 61.2% African American child race, 60.4% African American parent race, 52.9% parent income greater than or equal to $50,000). Because of the restricted scope, the generalizability of the results and the ability to examine differences among demographic characteristics was limited. Although the demographic associations with the participation variables appear similar to other demographic relations with obesity status and participation in pediatric weight management (Zeller et al., 2004), cautious interpretation of these findings is suggested.

Another limitation was the relatively small variability among the scores of the anthropometric and biochemical variables. The sample was purposefully comprised of adolescents with a BMI percentile $\geq 85^{th}$ for their gender and age, therefore it was not surprising that a number biological variables with limited variance was detected. With limited variance, there was a reduced chance of identifying statistically significant relations among the variables (Crocker & Algina, 1986). Although this study deliberately focused on a relatively homogenous group, future studies examining constructs such as adherence and attrition could benefit from a wider range of participant characteristics.

Another limitation included characteristics of the sample composition. Specifically, the sample was comprised of participants from two versions of the T.E.E.N.S. research protocol (e.g., #904, #13833) and contained a subset of parent participants who engaged in a motivational interviewing treatment. To account for differences, a series of independent samples *t*-tests and chi-square analyses were conducted on the adherence and attrition variables to identify significant differences in the sample. When significant differences were detected, these variables were entered into the regression models. Despite controlling for these covariates, unaccounted differences might exist among the participants. For example, the participants' dedication to the program might differ due to the time commitments associated with their protocol status (e.g., one-year, two-years). Although this was accounted for at three-month and six-month time points, analyzing time to event data might uncover patterns in the data outside of the two time point parameters.

In addition to effects associated with sampling from the different protocols, there might be effects related to the motivational interviewing treatment that were unaccounted for by the current study. Although this was also controlled for statistically, there might be important treatment-related differences associated with values and readiness for change that were not accounted for in the current study. Considering the proposed links between Self Determination Theory and Motivational Interviewing (Vansteenkiste & Sheldon, 2006), the current study might have benefitted from a more in depth assessment of how the qualities of the MI Values study influenced the current results. Future studies should examine a sample comprised of only one protocol and without concurrent interventions.

Strengths. The current study benefitted greatly from being part of a large, multidisciplinary protocol. The T.E.E.N.S. study is unique in the demographic representativeness of underserved groups. Specifically, a hallmark of T.E.E.N.S. is the representativeness of

African American participants, and namely African American girls. As compared to their peers, African American girls are at a higher risk for deleterious health problems associated with obesity, yet there remains a dearth of research examining this group (Eaton et al., 2008; Ogden & Carroll, 2010). Further, there is evidence that this group is associated with higher attrition in pediatric weight loss programs (Zeller, et al., 2004). Considering the limited research on this group, the risk of negative health consequences, and the evidence for the likelihood of poor participation in weight management treatment, the current study benefits from the inclusion of these participants and adds to the current body of knowledge of this underserved group.

The present findings also highlight the importance of parents in pediatric weight management. Considering the null findings related to child motivational support and the negative relation between parent motivational support and attrition, future research could examine why parent factors were related to low participation. Although the directionality of this finding is concerning, it indicates that parents play a critical role in child health behaviors. There is mounting evidence to support the importance of parents in pediatric health and that focusing on parents might be more effective than only targeting the child in pediatric weight management (Golan & Crow, 2004b; Janicke, 2013; Janicke et al., 2008; Mazzeo et al., 2014). This approach is logical considering how instrumental parents are in treatment success, such as managing the child’s time and providing transportation to the treatment. Future studies should tailor interventions to the parent when examining child participation in pediatric weight management.

Along these lines, targeting African American families continues to be an important direction in pediatric weight management. Considering the relation between African American race and low child adherence, targeting parents in this group might be critical to enhance treatment participation. There is evidence to demonstrate that parents play an important cultural role in weight-related health behaviors among African American families (Hooper et al., 2009).

Having a greater understanding of parental factors among African American families in the context of pediatric weight management will offer new directions in effectively increasing participation in for this group.

Conclusion. Due to the paucity of research on the roles of motivation and mindfulness on attrition from and adherence to pediatric weight management programs, the exploratory focus of the current study addressed a notable gap in the literature (Hampl, Paves, Laubscher, & Eneli, 2011; Saelens & McGrath, 2003; Skelton & Beech, 2011; Wrotniak, Epstein, Paluch, & Roemmich, 2005). Although there were a number of null results, the results inform researchers about the importance of examining other factors related to participation in the context of pediatric weight management. The results also highlight the importance of parents in child participation and that demographic factors (e.g., child age, child race, and child gender) continue to be associated with negative health behaviors. Together, the findings of the current study provide future directions for weight management research, namely for studies exploring adherence and attrition.

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Appendix A

Adolescent Basic Psychological Needs Scale

<u>Instructions</u>: We are interested in how you feel about yourself and how you think other people see you. For each statement, choose the number from the scale that best describes your feelings and ideas in the **past week**. Circle the number that corresponds to your answer.

Not at all true	**Slightly true**	**Moderately true**	**Mostly true**	**Completely true**
1	**2**	**3**	**4**	**5**

1. I feel I do things well at school.	1 2 3 4 5
2. My teachers like me and care about me.	1 2 3 4 5
3. I feel free to express myself at home.	1 2 3 4 5
4. I feel my teachers think that I am good at things.	1 2 3 4 5
5. I like to spend time with my parents.	1 2 3 4 5
6. I feel free to express myself with my friends.	1 2 3 4 5
7. I feel I do things well at home.	1 2 3 4 5
8. My parents like me and care about me.	1 2 3 4 5
9. I feel I have a choice about when and how to do my school work.	1 2 3 4 5
10. I feel my parents think that I am good at things.	1 2 3 4 5
11. I like to be with my teachers.	1 2 3 4 5
12. I feel I have a choice about which activities to do with my friends.	1 2 3 4 5
13. I feel I do things well when I am with my friends.	1 2 3 4 5
14. My friends like me and care about me.	1 2 3 4 5
15. I feel free to express myself at school.	1 2 3 4 5
16. I feel my friends think that I am good at things.	1 2 3 4 5
17. I like to spend time with my friends.	1 2 3 4 5
18. I feel I have a choice about when and how to do my household chores.	1 2 3 4 5

Appendix B

Adolescent Mindful Attention Awareness Scale

Day-to-Day Experiences

<u>Instructions:</u> Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what <u>really reflects</u> your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

1. I could be experiencing some emotion and not be	1	2	3	4	5	6

conscious of it until some time later.						
2. I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
3. I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
5. I tend to not notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
6. I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
7. It seems I am "running on automatic" without much awareness of what I'm doing.	1	2	3	4	5	6
8. I rush through activities without being really attentive to them.	1	2	3	4	5	6

9. I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1	2	3	4	5	6
10. I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
11. I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6
12. I find myself preoccupied with the future or the past.	1	2	3	4	5	6
13. I find myself doing things without paying attention.	1	2	3	4	5	6
14. I snack without being aware that I'm eating.	1	2	3	4	5	6

Appendix C

Patient Demographics

Personal and Family Information

Subject Name: ______________________________ Date:

Parent of Legal Guardian Name: ___________________________________

Subject: Check the box for the racial or ethnic group which with you identify:

_ White

_ Black (includes Jamaican, Bahamanians and other Carribeans of African descent)

_ Hispanic (includes persons of Mexican Puerto Rican, Central or South/American or other Spanish origin or culture)

_ Asian (includes Pakistanis & Indians)

_ Native American (includes Alaskans)

_ Middle Eastern

_ Pacific Islander

_ Other (specify) ___________________

Parent/Guardian: Check the box for the racial or ethnic group which with you identify:

_ White

_ Black (includes Jamaican, Bahamanians and other Carribeans of African descent)

_ Hispanic (includes persons of Mexican Puerto Rican, Central or South

/American or other Spanish origin or culture)

_ Asian (includes Pakistanis & Indians)

_ Native American (includes Alaskans)

_ Middle Eastern

_ Pacific Islander

_ Other (specify) ___________________

Parents' Highest level of completed education:

_ Less than high school diploma

_ High School diploma

_ Some college

_ College degree

_ Some graduate school

_ Graduate degree

Family Income Level:

_ Less than $10,000 per year _ $30,000 - $40.000 per year

_ $10,000 - $20,000 per year _ $40,000 - $50,000 per year

_ $20,000 - $30,000 per year _ More than $50,000 per year

Appendix D

Parent Basic Psychological Need Satisfaction Scale

Please read each of the following items carefully, thinking about how it relates to your life, and then indicate how true it is for you. Use the following scale to respond:

1	2	3	4	5	6	7
not at all true			somewhat true			very true

1. I feel like I am free to decide for myself how to live my life.

1	2	3	4	5	6	7
not at all true			somewhat true			very true

2. I really like the people I interact with.

1 2 3 4 5 6 7

not at all true | somewhat true | very true

3. Often, I do not feel very competent.

1 2 3 4 5 6 7

not at all true | somewhat true | very true

4. I feel pressured in my life.

1 2 3 4 5 6 7

not at all true | somewhat true | very true

5. People I know tell me I am good at what I do.

1 2 3 4 5 6 7

not at all true | somewhat true | very true

6. I get along with people I come into contact with.

1 2 3 4 5 6 7

not at all true | somewhat true | very true

PLEASE CONTINUE

7. I pretty much keep to myself and don't have a lot of social contacts.

1 2 3 4 5 6 7

not at all true | somewhat true | very true

8. I generally feel free to express my ideas and opinions.

1 2 3 4 5 6 7

not at all true | somewhat true | very true

9. I consider the people I regularly interact with to be my friends.

1	2	3	4	5	6	7
not at all true			somewhat true			very true

10. I have been able to learn interesting new skills recently.

1	2	3	4	5	6	7
not at all true			somewhat true			very true

11. In my daily life, I frequently have to do what I am told.

1	2	3	4	5	6	7
not at all true			somewhat true			very true

12. People in my life care about me.

1	2	3	4	5	6	7
not at all true			somewhat true			very true

13. Most days I feel a sense of accomplishment from what I do.

1	2	3	4	5	6	7
not at all true			somewhat true			very true

PLEASE CONTINUE

14. People I interact with on a daily basis tend to take my feelings into consideration.

1	2	3	4	5	6	7
not at all true			somewhat true			very true

15. In my life I do not get much of a chance to show how capable I am.

1 2 3 4 5 6 7

not at all somewhat very

true true true

16. There are not many people that I am close to.

1 2 3 4 5 6 7

not at all somewhat very

true true true

17. I feel like I can pretty much be myself in my daily situations.

1 2 3 4 5 6 7

not at all somewhat very

true true true

18. The people I interact with regularly do not seem to like me much.

1 2 3 4 5 6 7

not at all somewhat very

true true true

19. I often do not feel very capable.

1 2 3 4 5 6 7

not at all somewhat very

true true true

20. There is not much opportunity for me to decide for myself how to do things in my daily life.

1 2 3 4 5 6 7

not at all somewhat very

true true true

PLEASE CONTINUE

21. People are generally pretty friendly towards me.

1 2 3 4 5 6 7

not at all somewhat very

true true true

Appendix E

Parent Mindful Attention Awareness Scale

Day-to-Day Experiences

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

I could be experiencing some emotion and not be conscious of it until some time later.	1 2 3 4 5 6
I break or spill things because of carelessness, not paying attention, or thinking of something else.	1 2 3 4 5 6

I find it difficult to stay focused on what's happening in the present.	1 2 3 4 5 6
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1 2 3 4 5 6
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1 2 3 4 5 6
I forget a person's name almost as soon as I've been told it for the first time.	1 2 3 4 5 6
It seems I am "running on automatic," without much awareness of what I'm doing.	1 2 3 4 5 6
I rush through activities without being really attentive to them.	1 2 3 4 5 6
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1 2 3 4 5 6
I do jobs or tasks automatically, without being aware of what I'm doing.	1 2 3 4 5 6
I find myself listening to someone with one ear, doing something else at the same time.	1 2 3 4 5 6
I drive places on 'automatic pilot' and then wonder why I went	

there.	1 2 3 4 5 6
I find myself preoccupied with the future or the past.	1 2 3 4 5 6
I find myself doing things without paying attention.	1 2 3 4 5 6
I snack without being aware that I'm eating.	1 2 3 4 5 6

Vitae

Stephen K. Trapp was born April 28, 1982 in Cincinnati, Ohio. Stephen is a doctoral student in the Counseling Psychology program at Virginia Commonwealth University. He received his Bachelor's degree in Literature and Communications from American University in 2004, a Master's degree in Human Development Counseling from Vanderbilt University in 2008. Stephen will be completing his doctoral internship at the Salt Lake City Veterans Affairs Medical Center in July 2015.

Biographical Information

Date of Birth:	April 28, 1982
Place of Birth:	Cincinnati, OH
Citizenship:	United States of America

Academic Training

Undergraduate:	American University B.A., May 2004 Major: Literature and Visual Communication
Masters:	Vanderbilt University M.Ed., May 2008 Major: Human Development Counseling
Thesis Topic:	*A qualitative study of male participation of a cancer-related social support group*
Thesis Advisor:	Andrew Finch, Ph.D.
Doctoral:	Virginia Commonwealth University Ph.D. Expected August 2015 Major: Counseling Psychology
Dissertation Topic:	*Motivation, mindfulness, and metabolic factors predicting attrition and adherence in a multidisciplinary weight management program*

Doctoral Advisor: Marilyn Stern, Ph.D.

Awards and Honors

Outstanding Counseling Graduate Student, Scientist-Practitioner-Leader Award (2014), Virginia Commonwealth University Psychology Department

Outstanding Leader in Counseling Psychology Award (2014), Virginia Commonwealth University Psychology Department

Virginia Commonwealth University, Department of Psychology Travel Award (2010, 2012, 2014)

Society for the Advancement of Psychology Travel Award (2009, 2011)

Vanderbilt University, Peabody College Dean's Scholarship recipient (2006-2008)

Chi Sigma Iota Counseling Honors Society

Publications

Journal:
Trapp, S.K., Perrin, P.B., Aggarwal, R., Peralta, S.V., Stolfi, M.E., Morelli, E., Pena, A., & Arango-Lasprilla, J.C. (in press, *Behavioural Neurology*). Personal strengths and health related quality of life in dementia caregivers from Latin America.

Trapp, S. K., Leibach, G. G., Perrin, P. B., Morlett, A., Olivera, S. L., Perdomo, J. L., Arango, J. A., & Arango-Lasprilla, J. C. (in press, *Revista Psicología desde el Caribe*). Spinal cord injury impairments and caregiver mental health in a Colombian sample: An exploratory study.

Trapp, S.K., Goodman, R.J., & Davis, J. (in press, *International Journal of University Teaching and Faculty Development*). Publishable graduate course projects: Bridging classwork with scholarship in a graduate student teaching course.

Leibach, G. G, **Trapp, S. K.**, Perrin, P. B., Everhart, R. S., Villaseñor, T., Jimenez-Maldonado, M., & Arango-Lasprilla, J. C. (2014). Family needs and TBI caregiver mental health in Guadalajara, Mexico. *NeuroRehabilitation. 34,* 167-175. doi: 10.3233/NRE-131013

Trapp, S.K., Lumpkin, J.M., & Ellwood, M.S. (2014). Neuropsychological assessment and treatment following a spinal cord injury and alcohol withdrawal. *Clinical Case Studies, 13*(2), 167-180. doi: 10.1177/1534650113504293

Lamanna, J., **Trapp, S.K.,** Russell, C., & Stern, M. (2014). Preparing for the Future: An Examination of Health Care Provider and Patient Communication regarding Childhood Cancer Survivorship. *Child: Care, Health, & Development*.

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Trapp, S. K., Woods, J. D., Grove, A., & Stern, M. (2013). Male coping processes as demonstrated in the context of a cancer related social support group. *Journal of Supportive Care in Cancer, 21*(2), 619-627. doi: 10.1007/s00520-012-1565-x

Stern, M., Lamanna, J., Russell, C., Ewing, L., Thompson, A., **Trapp, S.K.**, Bitsko, M., & Mazzeo, S. (2013). Adaptation of an obesity intervention program for pediatric cancer cancer survivors (NOURISH-T). *Clinical Practice in Pediatric Psychology, 1*(3), 264-275. doi: 10.1037/cpp0000023

Berenz, E. C., **Trapp, S. K**., Acierno, R., Richardson, L., Kilpatrick, D. G., Tran, T. L., Trung, L. T., Tam, N. T., Tuan, T., Buoi, L. T., Ha, T. T., Thach, T. D., Gaboury, M., & Amstadter, A. B. (2013). Pre-typhoon panic attack history moderates the relationship between degree of typhoon exposure and post-typhoon PTSD and depression in a Vietnamese sample. *Depression and Anxiety, 30* (5), 461-468. doi: 10.1002/da.22096

Brown, R. C., **Trapp, S. K.,** Berenz, E. C., Bigdeli, T. B., Acierno, R., Tran, T. L., Trung, L. T., Tam, N. T., Tuan, T., Buoi, L. T., Ha, T. T., Thach, T. D., & Amstadter, A. B. (2013). Pre-typhoon socioeconomic status factors predict post-typhoon psychiatric symptoms in a Vietnamese sample. *Social Psychiatry and Psychiatric Epidemiology*. doi: 10.1007/s00127-013-0684-0

Trapp, S. K., & Stern, M. (2013). Review of the Patient Practitioner Orientation Scale. *Association of American Medical Colleges MedEdPORTAL Directory and Repository of Educational Assessment Measures*: https://www.mededportal.org/publication/9501

Book Chapters:
Woods, J., **Trapp, S.K.,** & Stern, M. (2014). Cross-cultural perspectives on childhood obesity: A framework for health professionals. In Regan Gurung (Ed.), *Multicultural Approaches to Health and Wellness in America.* ABC-CLIO, Santa Barbara, CA.

Trapp, S.K., Slosky, L., Lamanna, J., Leibach, G., Durrette, M., & Stern, M. (2012). Posttraumatic growth in the cancer experience. In *The Psychology of Cancer.* NOVA Science Publishers, Hauppauge, NY.

Clinical Activities

Summer 2014 – on going
Veteran Affairs Salt Lake City Health Care System, Salt Lake City, UT

Predoctoral Clinical Internship
- Physical Medicine and Rehabilitation (3 months)
- Substance Abuse Treatment Program (3 months)
- Inpatient Psychiatry Unit (3 months)
- Veteran Integration to Academic Leadership Program (3 months
- Outpatient Psychotherapy (6 months)
- Neuropsychological Assessment Clinic (6 months)
- Geriatric Primary Care Clinic (2 month intensive)

Fall 2011 – Spring 2014
Hunter Holmes McGuire Veterans Affairs Medical Center, Richmond VA
Predoctoral Practicum Placements
- Primary Care Psychology Rotation
- Spinal Cord Injury Rotation
- Posttraumatic Stress Disorder Rotation
- Substance Abuse Rotation
- Clinical-Research in Rehabilitation, PTSD, and Hepatology

Fall 2010 – Fall 2011
Virginia Commonwealth University Health Systems, Richmond VA
Predoctoral Practicum Placements
- Primary Care Clinic Rotation
- Endocrinology Clinic Rotation

Summer, 2010 – Spring 2011
Virginia Commonwealth University Center for Psychological Services and Development, Richmond, VA
Predoctoral Practicum Placement

Winter, 2009 – Spring 2014
Virginia Commonwealth University Health Systems TEENS Program, Richmond VA
Predoctoral Practicum Placement

Fall, 2007 – Spring, 2008
Vanderbilt University Medical Center, Nashville, Tennessee
Masters Practicum Placements
- Endocrinology Clinic
- Center for Integrative Health

Spring, 2007 – Spring, 2008
Gilda's Club, Nashville, Tennessee
Masters Practicum Placements

Spring, 2007
Mercy Children's Clinic, Nashville, Tennessee

Masters Practicum Placements