STAGES OF CHANGE, PARENTING, ATYPICAL ANTIPSYCHOTIC MEDICATION, AND ADOLESCENT BODY MASS INDEX: AN EXPLORATORY STUDY

A Dissertation Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Philosophy

by

Sonia Dutt

August 2013

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Abstract

Objective This retrospective longitudinal study investigated the relationship between readiness to change (The Transtheoretical Model of Stages of Change), parenting (e.g., parenting style, practices, and stress), and the use of atypical antipsychotic medication on body mass index (BMI) in adolescents with obesity, most of whom were Hispanic. **Methods** Data were obtained from an existing clinical database of 41 adolescents between 12-18 years of age (Mean age 14.35 years, 39% male, 4.9% White, 19.5% Black, 63.4% Hispanic, 12.2% Other) who participated in outpatient behavioral weight management group therapy, that included motivational interviewing, once a week for a period of seven weeks. Multilevel Regression Modeling analysis was employed to examine within and between participant differences in BMI. Readiness to change was measured with the use of baseline self-report ratings on the University of Rhode Island Change Assessment (URICA). Parent ratings on the Parenting Relationship Questionnaire-Child and Adolescent (PRQ-CA) were obtained as a measure of parenting style, practices, and stress. Medication status (e.g., the use of atypical antipsychotic medication) was collected for each individual. **Results** Although used by only two subjects atypical antipsychotic medication was significantly related to higher BMI at baseline. Parenting confidence was significantly related to lower BMI at baseline. From week to week, there was not a significant fixed effect for rate of change in BMI within or between individuals; however, random effects for rate of change between individuals were present. Mean baseline BMI was lower for individuals who presented in the action

stage of change than those who presented in the precontempation/contemplation stages. **Conclusion** Understanding the influence of individual readiness to change, parenting confidence, and the use of atypical antipsychotic medication on adolescent weight status, may improve comprehensive assessment and interventions in the clinical treatment for adolescent obesity. Implications for professionals are discussed and directions for future research are highlighted. Furthermore, given the diverse demographic of the sample used in this study (63.4% Hispanic, 19.5% Black); multicultural considerations for adolescents with obesity are discussed.

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Chapter I

Introduction

The last thirty years have revealed a global epidemic of increasing childhood obesity rates (Flegal, Carroll, Ogden, & Curtin, 2010; World Health Organization [WHO], 2011). Although research to address the increasing rates of global childhood obesity is expanding, the rate at which new studies emerge is not as rapid as the looming obesity epidemic, and gaps in the current literature base remain. After reviewing the prevalence rates of the global obesity epidemic, this paper summarizes risk factors and treatments for childhood obesity. Furthermore, comorbid health conditions will be discussed, as will implications for school psychologists and other professionals. To inform understanding of the gaps in the current literature examining childhood obesity, a literature review discusses past studies that examined weight status in adults and youth. To contribute to the existing research, the current study specifically examined individual readiness to change, parenting relationship, parenting stress, and the use of atypical antipsychotic medication, as they relate to body mass index (BMI) in adolescents with obesity, most of whom were Hispanic.

Global Childhood Obesity Epidemic

The prevalence of global childhood obesity has almost tripled over the last thirty years (Flegal et al., 2010). In 2010, 42 million children under the age of five years, worldwide, were overweight (WHO, 2011). In the United States alone, obesity rates have almost doubled in the last decade in children and adolescents and affect 17% (12.5 million) of youth ages 2-19 (Centers for Disease Control and Prevention [CDC], 2010; Ogden, Carroll, Kit, & Flegal, 2010). By 2030, it is estimated that with this increasing

trend, a majority of the world's adult population will be overweight or obese (Kelly, Yang, Chen, Reynolds, & He, 2008; Ogden et al., 2010).

Obesity status can be measured using the body mass index (BMI), which is determined by dividing a child's weight (in kilograms) divided by the square of height (in meters). Then, using an age and sex specific percentile for BMI determined by growth charts specific to childhood developmental periods (CDC, 2000) obesity status is determined. Overweight is defined as a BMI at or above the 85th percentile and lower than the 95th percentile for children of the same age and sex (CDC, 2000). Obesity is defined as a BMI at or above the 95th percentile for children of the same age and sex (CDC, 2000; Kuczmarski, Ogden, Guo, Grummer-Strawn, Flegal, Mei, et al, 2002).

Quality of Life and Health Complications Associated with Childhood Obesity

Childhood obesity is associated with higher rates of premature death and future morbidities in adulthood (WHO, 2011). Obesity can affect all body systems including but not limited to, respiratory and cardiovascular systems, the central nervous system, and mental health (Acosta, Manubay, & Levin, 2008; Freedman, Khan Dietz, Srinivasan, & Berenson, 2001; Ford, 2005). These problems can significantly affect quality of life by placing children/adolescents at higher risk for medical complications throughout life and higher mortality as adults (Acosta et al., 2008). For example, in childhood, obesity can lead to obstructive sleep apnea caused by stress on the heart and lungs due to insufficient blood flow from the heart to the lungs (Bixler, Vgontzas, Lin, Liao, D., Calhoun, Vela-Bueno, & Graff, 2009). Sleep is significantly disturbed in an individual who experiences sleep apnea. For a child, sleep apnea may result in secondary complications such as, poor attention span at school and academic performance due to

daytime somnolence. Furthermore, sleep apnea can also lead to nocturnal enuresis in children of all ages (Bascom, Penney, Metcalfe, Knox, Witmans, Uweira, & Metcalfe, 2011). Particularly, for an adolescent, bedwetting may be an implication for mental health, as it can be a source of embarrassment and distress (Prynn, 2012). Overall, medical complications related to obesity can hinder day-to-day quality of life in youth. Knowledge of possible sleep apnea and enuresis combordities for children and adolescents with obesity can assist professionals and school psychologists involved in monitoring the mental health of the school-age population by providing a framework from which to intervene if necessary.

Biomedical sequelae of obesity and implications for school psychologists.

Respiratory, gastrointestinal, and endocrine problems may occur more frequently among obese children (American Diabetes Association [ADA], 2000; Davis, 2003; Ford 2005). Asthma may be difficult to detect in children with obesity if proper attention is not given to shortness of breath and intolerance to exercise (Barlow, 2007). For adolescents, difficulties with physical activity primarily due to obesity or secondary to asthma may result in the inability to participate in school activities such as physical education, recess, and team sports. School psychologists and medical professionals could engage in consultation to develop programs that reinforce healthy levels of physical activities in the school setting to mitigate isolation and promote potential weight loss amongst adolescents with obesity (Pyle, 2006). Furthermore, school psychologists can play a consultative role in educating physical education teachers and caregivers about shortness of breath and intolerance to exercise common in youth with obesity (Pyle, 2006). Consultation may help coordinate systems of care for adolescents, and link

caregivers, school personnel, and medical professionals to promote positive educational and health outcomes for children and adolescents (Lear, 2002; Power, Shapiro, & DuPaul, 2003; Spear, 2007). To promote positive health outcomes for children and adolescents with obesity through consultation, it is important that school psychologists and other professionals have a clear understanding of the specific comorbid medical conditions associated with obesity. A brief overview of the biomedical sequelae of obesity and implications concerning quality of life for youth are outlined next.

Numerous bodily systems can be medically affected by obesity. First, gastrointestinal problems, such as, nonalcoholic fatty liver disease (NAFLD) creates fatty liver that can ultimately result in cirrhosis in obese children (Lavine, Schwimmer, Molleston, Scheimann, Murray, Abrams, & Tonascia, 2010). For obese youth, cirrhosis can result in frequent hospital or doctor office visits, thus causing excess absences from school and potential difficulty with school readjustment and social skills. Moreover, cirrhosis has the potential to result in premature death. Other gastrointestinal problems such as gastroesophageal reflux disease and constipation are further exacerbated by obesity (Fishman, Lenders, Fortunato, Noonan, & Nurko, 2004; Hampel, Abraham, & El-Serag, 2005) possibly resulting in a negative impact on academic performance due to frequent school absences or reduced instruction time that can result from visits to the nurse because of abdominal discomfort. School psychologists monitoring school performance of students may be able to contribute to the development of appropriate academic and behavioral accommodations for symptoms of gastrointestinal problems related to obesity in the school setting to potentially alleviate the stress associated with frequent absences, school readjustment issues, and social difficulties. In addition to

gastrointestinal health complications, collaborating professionals should be aware of potential endocrine problems in children/adolescents with obesity.

A serious endocrine/metabolic disorder among overweight children is type 2 diabetes mellitus, with a prevalence rate of up to 6% in this population (Cruz, Shaibi, Weigensberg, Spruijt-Metz, Ball, & Goran, 2005). If two or more risk factors such as family history of diabetes, being of Black, Hispanic, or Native American background; having polycystic ovary syndrome; and acanthosis nigricans (skin discoloration usually around the back and neck area that commonly occurs as a result of insulin resistance) are present, the American Diabetes Association recommends screening when a child is overweight beginning at puberty or ten years of age that should be performed every two years (ADA, 2000). For a ten-year-old child, medical visits and disease screening may raise stress and anxiety levels and result in less time available to experience a typical childhood (Pervanidou & Chrousos, 2011). According to Pervanidou and Chrousos (2011), increased stress and anxiety levels could also lead to academic and social difficulties. School psychologists play an important role in monitoring potential mental health concerns for all children in the school setting including those presenting with obesity problems.

Other health problems related to obesity that have the potential to negatively affect the daily functioning of young people include pseudotumor cerebri, a rare condition that can lead to vision loss (Dietz, 1998). Moreover, obesity is a risk factor for cardiovascular problems such as elevated systolic and diastolic blood pressure and abnormal triglyceride levels (Sorof & Daniels, 2002). Overweight children and adolescents have up to 3.7 more times likelihood of developing hypertension then their

non-obese peers (Sorof & Daniels, 2002). It is apparent that childhood obesity can have damaging effects on day to day life and school functioning for children and adolescents (Al-Akour, Khader, Khassawneh, & Bawadi, 2012; Nadeau, Kolotkin, Boex, R., Witten, T., McFann, K. K., Zeitler, P., & Walders-Abramson, 2011). The health problems related to childhood obesity discussed in this paper are examples of the medical ailments associated with obesity that can negatively affect quality of life. Next, examples of psychological difficulties that are associated with childhood obesity and quality of life are discussed.

Psychological sequelae of obesity and implications for school psychologists.

Psychological outcomes such as psychiatric and eating disorders have the potential to negatively affect quality of life in children and adolescents with obesity. In fact, the degree to which quality of life is lowered in obese children is reported to be as negatively impacted as those diagnosed with cancer (Schwimmer, Burwinkle, & Varni, 2003). Psychiatric disorders are a prevalent comorbidity of obesity. Specifically, 13 and 14 year old adolescents with obesity report more sadness, loneliness, and anxiety than their peers who do not have obesity (Strauss, 1999; Zametkin, Zoon, Klein, & Munson, 2004). Furthermore, childhood obesity is related to oppositional defiant disorder in females and depression in males (Acosta et al., 2008; Mustillo Worthman, Erkanli, Keeler, Angold, & Costello, 2003; Nammi, Koka, Chinnala, Boini, 2004; Steinsbekk, 2009). Symptoms of depression in obese adolescents can manifest as flat affect, anhedonia, body dissatisfaction, fatigue, and/or suicidality. Depressive symptoms such as anhedonia and fatigue have the potential to interfere with an adolescent's psychosocial functioning due to lack of interest in or lack of energy to engage in peer activities, thus

contributing to the isolation and loneliness that obese adolescents report (Zametkin et al., 2004). Lastly, in terms of depression, suicidality is a serious concern that may lead to premature death. In addition to psychiatric conditions like anxiety and depression, eating disorders are related to decreased quality of life in obese children and adolescents (Acosta et al., 2008).

Body dissatisfaction and overvaluation of body shape and weight may be correlated with lower perceived self-worth and attractiveness, lack of athletic ability, and with the development of an eating disorder (Acosta et al., 2008; Banis, Varni, Wallander, Korsch, Jay, et al., 1998; Goldschmidt, Wilfley, Eddy, Boutelle, Zucker, Peterson, & Le Grange, 2011; Matsunaga, Kiriike, Matsui, Oya, Okino, et al., 2005). If binge eating or purging behaviors are present, individuals may be affected by an eating disorder such as bulimia nervosa. Binge eating is six times more common among children and adolescents with obesity (Zametkin et al., 2004) and prevalence of binge eating in children and adolescents with obesity has been estimated between 9-33% (Dietz, 2010; Morgan, Yanovski, Nguyen, McDuffie, Sebring, Jorge, et al., 2002; Tanofsky-Kraff, Faden, Yanovski, Wilfley, & Yanovski, 2005). Binge eating may decrease the short-term effectiveness of family-based behavioral weight control treatment for children (Wildes, Marcus, Kalarchian, Levine, Houck, & Cheng (2010). Furthermore, the presence of an eating disorder is typically associated with impulsivity and obsessive-compulsive tendencies (Acosta et al., 2008; Matsunaga et al., 2005) that can lead to secondary complications related to poor nutrition, concentration levels, academic performance, and psychosocial difficulties (Steingsbekk, 2009).

Psychological difficulties can be comorbid with childhood and adolescent obesity and exacerbate physical and cognitive functioning, psychological well-being, and social interactions (Steingsbekk, 2009). Psychiatric problems such as depression and eating disorders further differentiate obese children and adolescents from their peers, thus providing a role for school psychologists to become actively involved in consultation with school personnel and caregivers about students who present with weight problems.

Childhood obesity is a complicated public health concern and unfortunately, negative consequences of obesity have a far-reaching effect influencing all aspects of a child's development. Negative consequences of obesity create a medical, mental health, and academic burden for the individual, his or her caregivers, and the professionals (medical, school, and community) involved in the child or adolescent's care. Thus, treatment efforts that are multidisciplinary and consistent across settings should be considered and are discussed next.

Treatment of Childhood Obesity

Current treatments for pediatric obesity include psychological/behavioral, medical, and dietary treatment strategies. These strategies are guided by the 2007 expert committee recommendations of the Maternal and Child Health Bureau (MCHB), Health Resources and Services Administration, and the Department of Health and Human Services (Barlow, 2007).

Behavioral and Psychotherapeutic Intervention

The MCHB guidelines (Barlow, 2007) recommend that the first line of treatment for pediatric obesity should target reduction in caloric intake and an increase in physical activity. According to the MCHB guidelines, treatment should begin with behavior

modification, inclusion of parents/family as active treatment participants, skills training for parents, and a focus on child/adolescent motivation and readiness to make behavior/dietary changes. Environmental factors linked to obesity are important to consider as well. According to the Analysis Grid for Environments linked to Obesity ([ANGELO], Swinburn, Egger, & Raza, 1999), weight-related behaviors depend on micro-environmental systems/settings. The microsystems for children typically include schools, home, and neighborhoods (Swinburn, et.al., 1999). The ANGELO framework posits that characteristics of these settings such as policy (e.g., school curriculum aimed at reducing sedentary behaviors), physical aspects (e.g., physical education resources), and socio-cultural aspects (e.g., nutrition knowledge among caregivers or teachers) constitute an obesogenic or leanness-promoting environment. The ANGELO framework for understanding obesity in children and adolescents is consistent with the MCHB guidelines that recommend multicomponent treatments be used for children/adolescents with obesity. Multicomponent treatments are those that target multiple microsystems of the individual (the family system through family therapy, and the obese child's parents through parent training), and the affected individual through behavioral weight management therapy (Jelalian & Saelens, 1999). Research suggests some strong evidence for the short-term and long-term efficacy of multicomponent treatments for children ages 8-12 (Jelalian & Saelens, 1999). A more recent meta-analysis of pediatric obesity treatment studies further supported efficacy of multicomponent treatments and concluded that optimal prevention and treatment strategies are characterized by broad reach and are matched to the economic and structural demands of the target group (Safron, Cislak, Gaspar, & Luszczynska, 2011). In addition, research supports that

transferability and sustainability of treatment gains across settings are characteristics of effective interventions that target childhood obesity and in terms of implications for school psychologists; many school-based interventions meet these criteria and are effective among children and adolescents (Brown & Summerbell, 2008; Safron et al., 2011). Overall, treatments that include family treatment, parent education, behavioral modification, physical activity, and dietary interventions can be efficacious for youth affected with obesity (Lissau, 2006; ZenZen & Kridli, 2009).

For example, Kitzman-Ulrich Hampson, Wilson, Presnell, Brown, and O'Boyle (2008) conducted a study in which 42 overweight (BMI $\geq 95^{th}$ percentile) female adolescent participants and parents completed a 16-week randomized controlled trial comparing three groups; multifamily therapy plus psychoeducation (n=15), psychoeducation-only (n=16), or wait list control (n=11). Results indicated that adolescents in a psychoeducational program that integrated family variables reduced energy intake (i.e., eating) in overweight adolescent girls and improved nurturance within the family. No significant effects were found for body mass index. Family variables such as cohesion and nurturance have been associated with adolescent weight-related behaviors and integrating family variables into multicomponent weight loss-programs for adolescents can provide health related benefits (Kitzman- Ulrich, et al., 2008).

Consistent with extant evidence, the majority of behavioral interventions currently used in the treatment of adolescent obesity include those that target dietary changes, increasing physical activity and reducing sedentary behaviors (Cunningham, Ellis, & Naar-King, 2010; Jelalian, Lloyd-Richardson, Mehlenbeck, Hart, Flynn-O'Brien, Kaplan, &Wing, 2010). Psychotherapeutic strategies commonly used involve cognitive

behavioral therapy, motivational interviewing techniques, and family systems therapy (Cunningham et al., 2010; Jelalian et al., 2010; Jelalian & Saelens, 1999, Kitzman- Ulrich et al., 2008; Limbers, Safron, et al., 2011; Turner, & Varni, 2008; Vos, Wit, Pijl, Kruyff, & Houdijk, 2011; ZenZen & Kridli, 2009). Specifically, including problem-solving strategies in family-based multicomponent interventions have been found to increase long-term efficacy of parent-child behavioral counseling for obese children ages 8-12 years (Epstein, Valoski, Wing, & McCurley, 1994).

For adolescents, targeting the individual independent of the family may be developmentally appropriate in terms of preserving autonomy and methods such as motivational interviewing may be effective. In adult studies, motivational interviewing has been found to be an effective treatment for reducing cigarette smoking (Colby, Nargiso, Tevyaw, Barnett, Metrik, et al., 2012) alcohol abuse (Stein, Colby, Barnett, Monti, Golembeske, et al., 2006), and cannabis use (McCambridge, Day, Thomas, & Strang, 2011) and may be effective in obesity treatment for youth, given that adolescents are difficult to engage in treatment (Acosta, et al., 2008). Motivational interviewing has been found to be effective in improving health outcomes for adolescents with chronic health conditions (Naar-King, Parsons, Murphy, Chen, Harris, & Belzer, 2009). In a multisite, randomized, controlled, trial, a four session motivational interviewing intervention with individualized feedback, improved health outcomes in young people ages 16-24 years old (Naar-King et al., 2009). Furthermore, Channon, Huws-Thomas, Rollnick, Hood, Cannings-John, et al., (2007) found that adolescents with type 1 diabetes (ages 14-17) receiving an average of four motivational interviewing sessions over the course of 12 months showed significantly improved average blood glucose levels than

adolescents who received supportive counseling. In adolescents with eating disorders, specifically bulimia nervosa and anorexia, motivational interviewing when combined with cognitive behavioral therapy has been found to be more cost effective than traditional family therapy for bulimia and standard treatments for anorexia (Gowers, Clark, Roberts, et al., 2007; Schmidt, Lee, Beecham,et al., 2007). Given that motivational interviewing can provide a framework for promoting collaboration and support autonomy for adolescents, it may be a developmentally appropriate approach to improve mental and physical health of adolescents with chronic conditions (Nar-King, 2011). In cases when psychotherapeutic interventions prove ineffective for some adolescents with obesity, professionals and caregivers may turn to medical treatments, and these are described next.

Medical Interventions

Medical treatments include pharmacological and surgical interventions. Like psychotherapeutic interventions, research on medical treatments that focus primarily on the adolescent population is limited (Acosta et al., 2008). Furthermore, no weight loss medications (e.g., Orlistat) have been approved by the Food and Drug Administration (FDA) for use in children under the age of 16 years old (Berkowitz, Wadden, Tershakovec, Cronquist, 2003) limiting our understanding of the efficacy and safety of pharmacological treatments for obesity in the adolescent population. On the other hand, surgical interventions, such as gastric bypass surgery have been studied in the adolescent population and evidence for the efficacy and safety of surgical interventions is stronger than for pharmacological treatments.

Gastric bypass surgery is the most commonly used surgical intervention for morbid obesity and can be an effective treatment option for some adolescents. Evidence suggests similar outcomes in child/adolescent populations to adults who undergo gastric bypass surgery. Post surgery, both age demographics showed an average of a 36% reduction in BMI (Sugarman, Wolfe, Sica, & Clore, 2003). Furthermore, adolescent bypass procedures show a better outcome in reversal or improvement of glucose metabolism when diabetes mellitus is comorbid with obesity (Brandt, Harmon, Helmrath, Inge, McKay, & Michalsky, 2010). However, experts recommend surgery to be the last resort option for children/adolescents who have unsuccessfully completed behavioral/psychological or medication treatment modalities due to perioperative risks, post procedure risks, and lifelong commitment to specific eating behaviors (Barlow, 2007;Strauss, Bradley, & Brolin, 2001; Sugarman et al, 2003).

Chronic care model for pediatric obesity treatment. The MCHB prevention and treatment recommendations for pediatric obesity (Barlow, 2007) were guided by biological and ecological risk/maintaining factors for obesity. Ecological and biological factors, such as learned lifestyle patterns, readily available energy dense food choices, increasing popularity of sedentary behaviors (e.g., watching television and playing video games) the presence of certain medications (e.g., atypical antipsychotics), parenting relationship, and motivation/opportunity to engage in physical activity (Acosta et al, 2008; Barlow, 2007; Ratzoni, Gothelf, Brand-Gothelf, Reidman, Kikinzon, Gal,et al., 2002; Nasrallah, 2003; Rhee, 2008), reciprocally influence each other as children develop across different ecological settings (i.e., school, family, social, community, etc.). To maximize gains across settings, the MCHB guidelines for the treatment of pediatric

obesity recommend the use of the chronic care model (Bodenheimer, Wagner, & Grumbach, 2002), which accounts for the complexity of treating pediatric obesity. The chronic care model asserts for example, that for acute conditions such as a joint injury, a medical office visit would suffice in its simplicity. However, for the treatment of a chronic problem like obesity, treatment is multilayered and requires an integration of community resources, health care, patient self-management, and family involvement (Bodenheimer et al., 2002). Figure 1 illustrates the contextual considerations of the chronic care model important for treating a patient and his/her family system. In addition to considering environmental and medical systems that influence treatment of an adolescent with obesity, it is important to consider interactions among settings, individual readiness, cultural diversity, access to resources, parenting, biological, and societal influences that may inform effective treatment for pediatric obesity (Barlow, 2007; Bronfenbrenner, 1979; Jelalian & Saelens, 1999).

Effective implementation of pediatric obesity interventions across individual, family, and biological systems may occur when the multiple influences on child/adolescent functioning of each system are understood. Consistent with Jelalian and Saelens (1999), the American Dietetic Association (ADA; 2006) conducted a systematic review of child/adolescent weight loss intervention studies and concluded that the research showed a positive effect for multi-component (e.g., incorporating behavioral and dietary/nutrition counseling, physical activity, and parent training) family-based programs in children ages 5-12 and a positive effect for multi-component, school-based programs for adolescents. The conclusions of the ADA (2006) review suggest that systemic variables may influence change in BMI in the pediatric obese population. The

ADA (2006) conclusions provide support for previously discussed MCHB guidelines that recommend a systemic approach to pediatric obesity treatment.

Given that evidence suggests adolescent readiness/intent to change and multicomponent treatment with family involvement are correlated with better outcomes for adolescents with obesity (Kitzman-Ulrich et al., 2008; Naar-King et al, 2009, Safron et al., 2011), the systemic and individual variables discussed next include individual adolescent readiness to change and parenting relationship. In addition, atypical antipsychotic medication use in the pediatric population will be discussed. Part of the MCHB guidelines recommendations is consideration of biological influences, such as medication, on child weight status. Because consideration of adolescent motivation to change, parental involvement, and biological influences are part of the MCHB recommendations for the multi-component treatment of pediatric obesity, these variables are important for professionals and caregivers to understand.

Individual Readiness to Change

Although the MCHB 2007 pediatric obesity treatment guidelines suggest that individual motivation to change should be addressed in obesity intervention, research in this area is scant. Adolescent motivation or readiness to change in terms of weight loss and utilizing motivational interviewing as a treatment for obesity is an area that requires further research (Acosta et al., 2008; Kelly & Melnyck, 2008; Resnicow, Davis, Rollnick, 2006; Small, Anderson, & Melnyck, 2007). Motivation to change may be especially important in psychotherapeutic interventions for adolescents, as previous studies suggest that motivation (a desire to change) may be lacking in adolescents that receive psychotherapeutic care (Bullock, Hosie, Little, & Milham, 1990; Sommers-Flanagan,

Richardson, & Sommers-Flanagan, 2011). Most available readiness for change research includes populations other than adolescents and/or other problems such as smoking cessation, dietary behavior, and addictions. Several studies examine the use of Prochaska and DiClemente's (1983) transtheoretical model (TTM), a stages of change model, to qualitatively measure individual readiness and intention to change across different populations and problems. The TTM model will be utilized for the purposes of this research.

Transtheoretical Model: Stages of Change

The TTM provides a theoretical framework of readiness/intention for behavior change. It assumes that behavior change is a nonlinear process and consists of five stages (Norcross, Kreb, & Prochaska, 2011; Prochaska, DiClemente, & Norcross, 1992). The first three stages are motivational in that they consider intention to initiate change, and the remaining two stages are action based which individuals can pass through as they develop behavioral skills towards change. According to the TTM (Norcross et al., 2011; Prochaska et al., 1992), the first of the stages is *Precontemplation,* when an individual has no intention of change in the future and there is no acknowledgement or awareness of a problem. However, family and friends are aware of the problem, and often individuals in precontemplation are pressured into treatment by family and friends despite no intention to change. *Contemplation* is the stage where individuals are aware that a problem exists and are seriously thinking about taking action, yet remain ambivalent about change. Individuals can remain in this stage for a considerable length of time before making a commitment to take any action. *Preparation* is the stage in which individuals are intending to take action in the next month (and have been unsuccessful in

previous attempts to change over the past year) and may exhibit slight behavioral changes. For example, an individual who wishes to lose weight may start to skip a snack between meals and resolve to start their new diet "tomorrow". Most measures of readiness that use the TTM are continuous and on such a measure, individuals in the preparation stage would score high on both contemplation and action (Norcross et al., 2011; Prochaska et al., 1992).

Individuals in the *action* stage modify their behaviors, experiences, or environment in an effort to overcome their problem. The most overt behavioral changes occur in the action stage and successful modification of the target behavior occurs. For example, an individual engaging in behavioral weight management may actively reduce caloric intake, engage in routine exercise, and participate in regular individual and/or family therapy. *Maintenance* is the stage in which individuals work to prevent relapse and is considered a continuation, not a static stage. According to the TTM, all of the stages of change are continuous and non-static in nature (Prochaska et al., 1992). This implies that an individual can move through the stages in any given order and are not required to pass through all of the stages for change to occur.

Treatment Outcomes and TTM

The TTM has been employed in studies examining prediction of treatment outcomes for individuals. Stages of change have been studied in outpatient and inpatient individuals and in self-changers (DiClemente & Hughes, 1990; Norcross et al., 2011) with self-report methods. Continuous measures of change represent a temporal dimension to change that result from changes in individual attitudes, intentions, and behaviors (Prochaska et al., 1992). Nonetheless, it has been found that treatment

outcomes in terms of patient/client progress are a function of pretreatment stage of change (Norcross et al., 2011; Prochaska & DiClemente, 1992; Prochaska, Norcross, Folwer, Follick, & Abrams, 1992).

Evidence suggests that stages of change can predict successful weight control/health behaviors in adult populations (Prochaska et al., 1992). For example, Prochaska and colleagues (1992) conducted a longitudinal study of a behavior therapy program for weight control in an adult sample. The participants entering treatment were characterized as prepared for action. During the first half of treatment, participants who were prepared for action progressed into action early in therapy and as expected, were more successful in losing weight by the end of treatment than those participants who were not in an action stage prior to therapy. The researchers concluded that the stages of change scores were the second best predictors of outcome, the first being the process or specific intervention of change (i.e., stimulus control, reinforcement management, self-reevaluation, etc.) that the participants used early in treatment. The results of this study illustrate that a person's pretreatment stage of change can provide prescriptive information on treatments of choice to maximize treatment outcome. A common method for determining an individual's stage of change prior to and during treatment is through self-report measures.

Measures of Change

A continuous measure of stages of change called the Rhode Island Change Assessment (URICA; DiClemente & Hughes, 1990) yields subscale scores that correspond to the stages of the TTM. Pantalon, Nich, Franckforter, and Carroll (2002) set out to evaluate the psychometric properties of the URICA among individuals with

concurrent alcohol and cocaine problems and to evaluate a new composite (*Committed Action*, which is computed by subtracting the Contemplation score from Action score) of the URICA within the same sample. The sample consisted of 106 individuals who met criteria for cocaine dependence and alcohol dependence or abuse according to the revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-III-R*, American Psychiatric Association, 1987). The participants were part of a randomized controlled trial investigating the efficacy of a pharmacotherapy (disulfiram) and behavioral treatments for comorbid cocaine and alcohol dependence. As expected, results indicated that participants categorized as having high committed action had a significantly greater percentage of abstinence from both alcohol and cocaine following treatment, than participants categorized as low committed action. Furthermore, an interaction was found, suggesting that participants in the low committed action stage who were treated with disulfiram had better outcomes than those with high committed action when assigned to medication, whereas, high committed action individuals had equal outcomes with or without medication treatment. The researchers concluded that the URICA's psychometric properties were acceptable and the committed action composite showed evidence of predictive validity, suggesting that identification of pretreatment level of intent to change can inform the relationship between readiness and treatment of addictive behaviors such as alcohol and drug dependence. Similarly, research shows stages of change may have implications for treatment outcomes related to weight control and dietary behaviors.

Stages of Change and Adult Weight Control and Dietary Behaviors

In terms of research related to weight control, Jeffery, French, and Rothman (1999) examined stages of change as a predictor of success in weight control in adult women. In a randomized controlled trial, weight change over three years was examined in 719 (baseline), 660 (year one), 627 (year two), and 645 (year three) adult women (20-45 years old). Participants were assigned to a no-treatment control group or one of two interventions designed to reduce the rate of weight gain with age. The interventions included either monthly newsletters advocating appropriate diet and exercise behaviors or periodic offerings of supplemental weight control activities (e.g. nutrition/exercises classes). The participants were given follow up exams every year for three years with body weight as the primary outcome variable. Stages of change for weight control were determined by combined measures of current dieting, weight control efforts in the last year, and intention of diet using an algorithm based on a TTM algorithm suggested by Prochaska, DiClemente, and Norcross (1992).

Results of the Jeffery et al. (1999) investigation indicated that the majority of women in their study were categorized in the Precontemplation, Preparation, and Action stages. Few (4%) met the criteria for Contemplation. On average, the participants gained 0.5kg/year over the three years. This observed relationship was not significant, however, it was opposite of what was expected in that individuals in the Action stage gained more weight than those in the Precontemplation stage at each time point that data were collected. The researchers concluded the staging algorithm suggested by the TTM has little predictive value for weight control over time (maintenance) and the predicted relationship between stage of change and weight change in the short term was not

observed. The researchers suggest that unlike long-term smoking cessation for which the staging algorithm of the TTM has been found useful in predicting smoking behavior, maintenance of weight loss is different than intent to initiate weight loss. The staging algorithm of the TTM focuses on readiness to initiate behavior change. With weight loss, initiation is typically not the problem. It is typically after six months that behavioral maintenance of weight loss deteriorates and weight is regained (Jeffery, Drewnoski, Epstein, Stunkard, Wilson, Wing, & Hill, 2000; Jeffery, Wing, & Mayer, 1998). The key to successful long-term weight control is consistent application of behavior changes and skills acquired over time (Jeffery et al., 2000; Wing, Papandonatos, Fava, Gorin, Phelan, McCaffery, & Tate, 2008; Wing & Phelan, 2005). Jeffery and colleagues (1999) argue that the TTM does not capture the long-term maintenance component of weight loss and therefore explains its inability to predict long-term maintenance of weight loss. Although, Jeffrey and colleagues (1999) concluded the TTM lacks long-term predictive validity for the maintenance of weight loss, other research has suggested the TTM can be used to predict participation in dietary behavior management for adults.

Short-term readiness to participate in dietary behavior management (e.g., healthy eating and reducing fat intake) can be predicted by stages of change in adult primary care patients (Wee, Davis, & Phillips, 2005). Wee and colleagues (2005) surveyed primary care patients (365 adult patients, 60% of the sample was overweight/obese) about their health, health habits, and readiness to engage in weight behavior management. The survey results indicated that of 199 respondents at the preparation, action, or maintenance stage of losing weight, 61% were also at an advanced stage for improving diet and exercise. Those perceiving weight as a health risk were more likely to be at advanced

stages of readiness to concurrently lose weight, improve diet, and increase exercise. The results of the investigation suggest that stages of change can predict readiness for behavioral weight management in the short-term in obese/overweight adults.

Adolescent Weight Control and Readiness to Change

Existing adolescent obesity research is scant in the area of readiness to change in relation to improving health and lifestyle. An understanding of an individual's place in the change process can help inform intervention (Armitage, Sheeran, Conner, & Arden, 2004; Norcross et al., 2011) and has been found to be a useful framework through which tailored health promotion interventions may be designed for adolescents (Buchanan & Coulson, 2006; Castro-Fornieles, Bigorra, Martinez-Mallen, Gonzalez, Moreno, Font, & Toro, 2011).

Frenn and Malin (2003) examined low-fat diet and physical activity constructs in 221 middle school students (127 males, 51% African American, 27% Caucasian, 4% Hispanic, 2% Laotian, and 14% other) from low-income, culturally diverse, urban backgrounds using the Health Promotion Model (HPM) and the TTM. The HPM is a framework used for identifying antecedents in an individual's environments that promote and maintain healthy behavior. Results indicated that the TTM stages of change measure employed in the study accurately predicted percentage of fat in diet and total number of exercise and physical activity strategies used to accomplish a low fat diet across the stages of change. Specifically, the authors reported that percentage of fat in food was significantly greater in precontemplation than in contemplation and in preparation than for action. Access to low fat foods (an HPM construct) was significantly less in the contemplation stage of change than the preparation stage. The researchers suggest that

middle-school aged youth are highly dependent on their caregivers for the food they have access to at home and school. They conclude that taken together, the HPM and TTM frameworks provide a greater understanding of environmental antecedents (e.g., low-fat diet, physical activity) and their intercorrelations with an adolescent's readiness to change in terms of engaging in healthy weight behaviors (low fat diet and physical activity). Consumption of carbonated sugary drinks is another aspect of healthy weight behavior that has been investigated in the adolescent population and is discussed next.

Buchanan and Coulson (2006) measured the association between stage of change, decisional balance, and self-efficacy in relation to carbonated drink consumption and attitudes to health (i.e., weight gain, obesity, tooth erosion) in a UK sample of 399 adolescents (mean age 12.5 years, SD =1.54). Decisional balance referred to comparing adolescents' perceptions of pros and cons related to reducing carbonated beverage consumption. Of note, the decisional balance technique that the authors employed in their study can be considered a motivational interviewing approach, which, as discussed earlier can be a developmentally appropriate technique for working with adolescents and for addressing readiness to change (Acosta et al., 2008; Miller & Rollnick, 2002). Self-efficacy was examined as a measure of person's belief in his/her ability to change his/her behavior and has been found in previous studies to be predictive of stage of change (Buchanan & Coulson, 2006). Results indicated that over half of the adolescents in the sample were classified into one of the pre-action stages (i.e., precontemplation or contemplation) and males were more likely to be represented in the precontemplation stage then females. A significant association with stage of change, decisional balance, and self-efficacy was found but there was no association with attitudes to general or oral

health. The authors suggest that TTM is useful for targeting health behaviors in the adolescent population and suggest that developmental, social, and psychological considerations be included in this framework.

Because adolescence is a time of transition and increased autonomy, in addition to stages of change, there may be other influences that affect an adolescent's successful weight management. Several influences in an adolescent's life (e.g., peer pressure, parental relationship) may promote or hinder the actual behavioral change. Both initiation and maintenance of weight loss behaviors may be challenging due to social, psychological, and developmental variables. These variables may interact with the successful application of consistent behavioral changes and skills to initiate and maintain weight loss efforts in adolescents.

Concluding that multiple systemic variables likely influence weight loss outcomes for adolescents, Buchanan and Coulson (2006), suggest it is important to investigate not only the role of stages of change, but also the role of parental influence on promoting positive outcomes for adolescents in the action stages of change. Parental influence occurs through the quality of the parenting relationship, which may influence treatment outcomes related to implementing behavioral skills for reducing body weight and BMI in obese adolescents. Parenting relationship is a systemic variable that may have implications for successful reduction in BMI in the adolescent population and will be discussed next.

Parenting Variables

Although limited in its focus on the adolescent population, the existing research illustrates that researchers and clinicians recognize the influence that parents have on the

development and treatment of childhood obesity (Kitzman-Ulrich, Wilson, St. George, Lawman, Segal, & Fairchild, 2010; Rhee, 2008; Barlow & Chang, 2007). Through the parenting relationship, parents can have a pervasive influence around the development of dietary habits in young children and adolescents (Rhee, 2008). However, there is a consensus among researchers and treatment providers that there is a paucity of research regarding the relationship between parenting relationship and adolescent overweight status, and that further research is needed to inform treatment programs for adolescent overweight/obesity (Acosta et al., 2008; Kelly & Melnyck, 2008; Rhee, 2008; Small, Anderson, & Melnyck, 2007). In the current study, parenting relationship and parenting stress will be examined as two independent variables in relation to adolescent obesity. *Parenting stress* will be examined as a separate independent variable from *parenting relationship*. Furthermore, *parenting relationship* will represent the impact of two parenting domains, which are parenting practices and parenting style.

Parenting Relationship Variable

Parenting Practices. The first domain of the *parenting relationship variable* in the current study is parenting practices, which is represented as the set of parental behaviors that shape the daily life with and for children/adolescents. With regard to adolescent weight status, positive parenting practices have been found to be associated with lower BMI and lower likelihood of being or becoming overweight (Avula et al., 2011). Some parenting practices include, but are not limited to, the use of modeling eating behaviors (e.g., choosing healthy or unhealthy foods), prompting children to eat with the use of rewards (e.g., increasing reliance on external cues that dictate how much a child eats), use of consistent discipline practices, and feeding practices such as

controlling child portion size, or requiring a child to finish everything on his or her plate (Avula et al., 2011; Rhee, 2008). An aspect of parenting practices is parental involvement, which refers to the extent that parents and children participate together in a variety of common activities that contribute to a structured routine for daily life. Involvement in common activities may increase child engagement in cognitively stimulating activities, thus reducing time for sedentary activities and boredom induced eating The experience of a predictable home environment is related to positive emotional, cognitive, and physical development, including healthy weight (Avula et al., 2011). Specifically for adolescents, evidence suggests that there is a positive association between parent involvement (Kitzman-Ulrich, et al., 2010; Rhee, 2008, Sen, 2006) and adolescent weight status.

For example, Sen (2006) estimated odds of change in overweight status using a multinomial logistic regression in a sample of 5,014 respondents between the ages of 12 and 15 years of age from the 1997 wave of the National Longitudinal Survey of Youth. Results indicated that Caucasian youth who eat at least three meals per week with their family have decreased odds of becoming overweight, and those who are overweight who eat seven meals per week with their family, have increased odds of losing weight. Increased frequency of family dinners may provide increased opportunity for positive parenting practices such as modeling healthy food choices, employing consistent use of portion size control, and encouraging the adolescent to recognize their own hunger and satiety responses to influence the odds of weight loss demonstrated in this study with an adolescent sample.

Parenting Style. The second domain of the parenting relationship variable in the current study is parenting style, which refers to the degree of parental warmth/ sensitivity towards the child, involvement with the child, and use of clear parenting boundaries (Rhee, 2008). Parenting style is related to the use of structure and the development of a secure parent-child relationship that can contribute to adaptive coping styles in children and adolescents, thus decreasing the likelihood of using food as a coping mechanism for difficult emotions (Avula et al., 2011). The parenting style model employed in many studies is that of Baumrind (1971) who developed four models of parenting: authoritarian, authoritative, permissive, and rejecting-neglecting. Maccoby and Martin (1983) operationalized these parenting styles into two dimensions-demandingness and responsiveness. Demandingness refers to parent expectations for displays of maturity by their children, parental control, and discipline. Responsiveness refers to parental displays of warmth, sensitivity, affection, and involvement with their children. According to Maccoby and Martin (1983), an authoritarian parenting style is one that gives priority to obedience and is characterized by high demandingness and low responsiveness. Authoritative parenting style is characterized by both high demandingness and high responsiveness. Parents who employ an authoritative parenting style typically are warm and involved yet set firm and consistent age-appropriate limits for their children. A permissive parenting style is considered more responsive than demanding, is indulgent without discipline, and reflects parental inattention and indifference. Lastly, a rejecting-neglecting parenting style refers to a parenting style that is generally uninvolved and where no rules are set for children. Parenting styles are important to understand in adolescent obesity because they influence child weight status (van der Horst, Kremers,

Ferreira, Singh, Oenema, & Brug, 2007). Evidence suggests that parenting style (the degree of warmth/sensitivity and involvement parents show towards their children) modifies the relationship between parenting practices and child outcomes (Rhee, 2008). Parenting style influences child perceptions of overall parental support, therefore, providing an environmental and emotional context for which specific parenting patterns are being interpreted by the child (Van der Horst et al., 2007).

Van der Horst and colleagues (2007) investigated whether perceived parenting practices and parenting styles were associated with adolescent's consumption of sugar-sweetened beverages. The consumption of sugar-sweetened beverages has been found to be positively associated with adolescent obesity (Mrdjenovic & Levitsky, 2003) and in recent years the consumption of sugary beverages has increased from five fluid ounces to 12 fluid ounces a day in school age children/adolescents ages 6-17 (Van der Horst et al., 2007). The increase in sugary beverages amongst adolescents has contributed to 8% of total daily energy intake and up to 10.3% for overweight adolescents (Van der Horst et al., 2007). In a cross-sectional design, high school students (n= 383, mean age = 13.5 years) completed self-report questionnaires about consumption of sugary beverages, parenting practices (behavior management techniques), parenting styles (degree of warmth and involvement) attitude, and habit strength. A multiple linear regression analysis yielded an interaction effect between adolescent perceived parenting style and consumption of sugary beverages.

Those adolescents who perceived their parents as being moderately strict and highly involved—characteristics of an authoritative parenting style—consumed less sugary beverages. Furthermore, parenting practices related to consumption of fruits and

vegetables were more pronounced in families that exhibited moderately strict and highly involved parenting styles. These results suggest that an authoritative parenting style is an important factor in promoting healthy dietary behaviors for adolescents, an outcome consistent with successful weight management for adolescents.

Rhee, Lumeng, Appugliese, Kaciroti, & Bradley (2006) demonstrated that authoritative parenting style was associated with lower risk for childhood overweight. They analyzed data from the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development to determine the relationship between the four parenting styles (authoritative, authoritarian, permissive, and neglectful) and overweight status in children by first grade. A total of 872 children, [11.1% overweight (BMI of $\geq 95^{th}$ percentile) 82.8% white, 49% male, mean age 7 years old], were included in the analysis. Results indicated that children of authoritarian mothers (n = 298) had an increased risk of being overweight (almost a fivefold increase), compared with children of authoritative mothers (n = 179). Furthermore, children of permissive (n = 132) and neglectful (n = 263) mothers were twice as likely to be overweight, compared with children of authoritative mothers. The authors conclude that high levels of maternal sensitivity and expectations for self-control are correlated with lower prevalence rates of overweight in children.

These findings are further substantiated by those of Berge, Wall, Bauer, and Neumark-Sztainer (2009) who studied the relationship between congruent parenting styles and adolescents' weight status. Berge and colleagues (2009) conducted a regression analyses on data from an existing database (Project EAT) for 4,746 diverse adolescents. Findings indicated that incongruent parenting styles between mothers and

fathers were associated with higher adolescent weight status. Using the same database (Project EAT) Berge, Wall, Loth, and Neumark-Sztainer (2010) examined five-year longitudinal associations between parenting style and adolescent weight and weight-related behaviors. Multiple linear regression models were used to predict adolescent overweight, healthy dietary intake, and physical activity for a sample that included 2,516 adolescents (16-21 years old). Data were collected at two time points. Results indicated maternal authoritative parenting style at time one predicted lower BMI in adolescent sons and daughters at time two (five years follow-up). Paternal permissive parenting style predicted higher intake of fruits and vegetables at five year follow up among females suggesting that for a daughter, fruit and vegetable intake are related to the warmth and caring she feels from her father. The authors conclude that it is important for healthcare providers to promote authoritative parenting styles in relation to adolescent weight. Despite limitations to these studies, such as a lack of ethnic minority and low social economic status representation in the study samples, taken together these studies suggest that parents can help mold specific behaviors, attitudes, and beliefs about eating practices for children/adolescents. Furthermore, parenting style can have an important impact on child outcomes. These studies demonstrate that an understanding of how parenting styles affect child eating and activity behavioral patterns independently and in conjunction with ecological factors (i.e., cultural norms, individual motivation, biological factors, etc) is important in guiding the development of obesity prevention and treatment programs for children and adolescents.

Evidence suggests treatment programs with parent training that promotes authoritative parenting, consistent monitoring, delivery of consequences, and

encouraging positive behaviors have a positive effect on youth weight loss (Kitzman-Ulrich, et al., 2010). Furthermore, previous studies suggest that positive parenting relationship influences the adoption and maintenance of health behaviors through role-modeling, provision of healthy food, providing support for engaging in healthy behaviors, and creating a supportive climate for health behavior change (Benton 2004; Ward-Begnoche, 2006).

The relationship between positive parenting practices and child weight management is evident in ethnic minority samples as well. For example, Olvera and Power (2010) conducted a longitudinal study examining the relationship between the four parenting styles and child weight status in Mexican American families. The four-year study included 69 low-income Mexican American mothers and their 4-to-8-year-old children. At baseline, 35% were either overweight or obese. Results indicated that children of indulgent mothers were more likely to gain weight three years later and become overweight than children of authoritative or authoritarian mothers. The authors suggest that in Mexican American populations, children of indulgent mothers may be at highest risk for the development of obesity, for several reasons. First, indulgent mothers display low levels of control over feeding practices and may negatively affect their child's development of self-regulation in eating domains. Furthermore, indulgent mothers may be more lenient about regulating their child's unhealthy food preferences and provide less encouragement for physical activity (Olvera & Power, 2010). Taken together, these research studies demonstrate that child eating and weight related behavioral patterns are influenced by parenting style.

Parenting Stress Variable

The second independent variable related to parenting that will be examined in this study is *parenting stress,* which is characterized by the parents' level of stress in relating to their child. For the purposes of this study, the term *relational frustration* will be used interchangeably with *parenting stress.* Specifically, the Parenting Relationship Questionnaire-Child and Adolescent (PRQ-CA; Kamphaus and Reynolds, 2006) is the measure that was used to capture parenting stress/relational frustration in this study. The PRQ-CA contains a subscale named "relational frustration." Thus, the results from the "relational frustration" subscale on the PRQ-CA will be used a proxy for parenting stress. The PRQ-CA and the use of the data obtained from the measure are further explained in the measures section. To date, evidence suggests that parenting stress is not predictive of adolescent BMI (Barlow & Chang, 2007; Guilfoyle, Zeller, & Modi, 2010) and the current study seeks to explore this relationship in the current sample. Although parenting stress has not been found to significantly predict youth BMI, it is an important variable to consider because of its relationship with health related quality of life for children with obesity. Health related quality of life is the extent to which difficulties are present in domains such as emotional physical, social, and school functioning related to obesity (Guilfoyle et al., 2010). For adolescents, the influence of health related quality of life might reach further into domains such as body esteem, social life, and family relations (Guilfoyle et al., 2010). Guilfoyle and colleagues (2010) conducted a study with 120 caregivers and their children (ages 5-18 years) and found that parenting stress significantly predicted obesity-specific parent proxy health related quality of life in school aged children, 5-10 years old, but did not find any significant correlations between

BMI, health related quality of life, and parenting stress in the adolescent population. Parents are an important component of pediatric weight management and addressing their elevated stress levels may be important for pediatric obesity treatment. Specifically, for adolescents, given that they experience a unique set of developmental changes, demands on caregivers may become increasingly difficult for parents of obese adolescents and further research including adolescents with obesity is warranted. Further exploring the extent of stress in parents with adolescents who are obese may be beneficial to inform treatment.

Examining the parenting variables in this study (which include parenting practices, parenting style and parenting stress) may lead to a better understanding of factors affecting obesity in the adolescent population. However, it is important to recognize that parenting practices, style, and stress do not influence child weight status in isolation but in conjunction with child traits (e.g., readiness to change) (Rhee, 2008) and the impact of weight related side effects associated with atypical antipsychotic medication. Reasons for considering the use of atypical antipsychotic medication in adolescents with obesity are discussed next.

Atypical Antipsychotics

In recent years, there has been a six to tenfold increase in the prescription of atypical antipsychotics to the pediatric population between the ages of five to nineteen (Patel, et al., 2005). This is primarily due to dramatic increases in the off-label prescription of atypical antipsychotics. Off-label prescribing is the prescription of a medication for patients in an age range or diagnostic category for which it has not been approved by the U. S. Food and Drug Administration (FDA). Off-label prescribing of

atypical antipsychotics in the pediatric population is more common than their use for FDA indicated populations and disorders (Crystal, Olfson, Huang, Pincus, & Gerhard, 2009). Typically, off-label prescriptions of atypical antipsychotics are written for reasons other than psychosis, which include addressing aggressive behaviors, irritability associated with autism spectrum disorders, Attention Deficit Hyperactivity Disorder, and treatment-resistant depression (Correll, Manu, Olshanskiv, Napolitano, Kane, & Malhotra, 2009; Olfson, Crystal, Huang, & Gerhard, 2010).

Atypical Antipsychotics and Weight

Atypical antipsychotics have been found to be associated with an increase in body weight and BMI, and long-term complications associated with overweight/obese status such as metabolic syndrome, insulin resistance, diabetes and cardiometabolic complications) in both the adult and adolescent populations (Correll et al., 2009; Klein, Cottingham, Sorter, Barton, & Morrison, 2006; Melkersson, Dahl, & Hulting, 2004; Poulin, Chaput, Simard, Vincent, Bernier, Gauthier, et al., 2007; Shirzadi, & Ghaemi, 2006). Weight gain as a side effect associated with atypical antipsychotic use in the adolescent population has been documented in several studies (Jerrell & McIntyre, 2008; Kelly, Conley, Love, Horn, & Ushchak, 1998; Ratzoni et al., 2002; Varley & McClellan, 2009). The FDA and several other organizations recognize weight gain as a serious adverse event associated with atypical antipsychotic use and long term implications such as diabetes. The FDA issued a public health advisory that warned of increased risk of hyperglycemia and diabetes mellitus associated with all atypical antipsychotics (http://www.fda.gov/CDER/warn/2004/12195Risperdal.pdf). This FDA advisory paralleled a consensus statement issued in November 2003 by the American Diabetes

Association, the American Psychiatric Association, the American Association of Clinical Endocrinologists, and the North American Association for the Study of Obesity. These professional associations concluded that a relationship exists between the use of atypical antipsychotics and the increased risk of diabetes (Diabetes Care, 2004). These national groups acknowledged that weight gain was a common side effect of atypical antipsychotics in all age groups. Weight gain associated with adolescent use of atypical antipsychotics is a serious issue because changes in body fat composition may be major contributors to metabolic complications associated with atypical antipsychotics, such as insulin resistance, pre-diabetes, diabetes, and cardiometabolic complications that can eventually result in premature death (Correll, 2008).

Despite safety concerns associated with side effects of atypical antipsychotic medication, the FDA has approved four atypical antipsychotics for use in the pediatric population. They are aripiprazole or Abilify, risperidone or Risperdal, olanzapine or Zyprexa, and quetiapine fumarate or Seroquel. Risperidone and aripiprazole have FDA indications for the treatment of schizophrenia in young people aged 13 to 17 years, for Bipolar I Disorder in 10 to 17 year olds, and irritability associated with Autistic Disorder in children (ages 5-16 for risperidone and ages 6-17 for aripiprazole). Quetiapine fumarate is FDA-indicated for the treatment of Schizophrenia in 13-17 year olds and Bipolar I Disorder in 10-17 year old children and adolescents. Olanzapine has an FDA indication for the treatment of Schizophrenia and Bipolar I Disorder in 13-17 year olds. For the current study, the impact on BMI was studied for any subject taking an atypical antipsychotic with or without an FDA approved indication in the pediatric population, as well as in conjunction with other psychotropic medications (e.g. polypharmacy). The

specific name and indication of each atypical antipsychotic included in the analysis is further discussed in the methods section of the current study.

When considering adolescent BMI, it is important to understand the impact of multiple environmental and intraindividual factors that have the potential to reciprocally influence change in BMI. As previously discussed, current research has established the influence of individual motivation to change on adult outcomes (DiClemente & Hughes, 1990; Norcross et al., 2011). In addition, positive parenting relationship and its impact on obesity has been investigated in the child population (Kitzman-Ulrich, Wilson, St. George, Lawman, Segal, & Fairchild, 2010; Rhee, 2008; Barlow & Chang, 2007). Furthermore, research has established that atypical antipsychotics contribute to weight gain and increases in BMI over time in the children (Correll et al., 2009; Klein, Cottingham, Sorter, Barton, & Morrison, 2006; Melkersson, Dahl, & Hulting, 2004; Poulin, Chaput, Simard, Vincent, Bernier, Gauthier, et al., 2007; Shirzadi, & Ghaemi, 2006). Taken together, individual motivation to change, the parenting relationship, parenting stress, and the presence of atypical antipsychotic medication are some of the intraindividual and environmental factors that may affect adolescent BMI; however, the literature base has yet to examine these variables in the adolescent population. The purpose of this study is to address the gap in the literature and examine multiple systemic and intraindividual factors as they affect adolescent BMI.

Chapter II

Method

Current Study

There are multiple environmental and intraindividual reciprocal influences on the adaptive and maladaptive functioning of adolescents, including those that foster healthy BMI. This study sought to examine the impact of four factors that could affect BMI in adolescents and contributes to the current literature base by addressing the emerging need for research that has resulted from the current obesity epidemic facing young people. The factors included in the current study are two intraindividual factors (i.e., readiness to change, use of atypical antipsychotic medication) and two environmental/contextual factors (i.e., parenting relationship and parenting stress).

Independent Variables

Individual readiness to change. Adolescent readiness to change was operationalized through the use of the TTM stages of change measured by the University of Rhode Island Change Assessment (URICA; DiClemente & Hughes, 1990). The URICA is discussed further in the measures section.

Atypical antipsychotics. The use of atypical antipsychotic medication was examined for effects on adolescent BMI. Medication status was determined from patient chart information and is further discussed in the measures section.

Parenting variables. Six parenting relationship scales were examined and operationalized according to the Parenting Relationship Questionnaire-Child and Adolescent (PRQ-CA; further explained in the measures section) developed by Kamphaus and Reynolds (2006). Table 1 in Appendix A includes the six parenting

relationship scales (and their definitions) from the PRQ-CA that were utilized in this study. Five of the scales were used to serve as a proxy for parenting practices and parenting style; the two domains of the *parenting relationship* variable examined in this study. The fives of the PRQ-CA scales were assigned to each parenting domain for the purposes of the current study and have not been previously validated for use in this manner. Additionally, Table 1 includes the definition of relational frustration, the scale from the PRQ-CA that was used as a measure for *parenting stress* in this study.

In addition to the definition of each PRQ-CA scale that was utilized in this study, Table 1 includes columns to represent each component of the parenting variables. The third and fourth column of Table 1 contains the two domains of the parenting relationship variable. They are titled "parenting style" and "parenting practices." The fifth column of Table 1 contains the heading "parenting stress". An "X" in those columns designates the PRQ-CA scale to its corresponding component. The first five scales from the parenting relationship questionnaire were used to represent aspects of the two domains (parenting style and parenting practices) of the *parenting relationship* variable examined in this study. Parenting practices can be captured by the communication scale (a measure for the quality of information exchange), the parenting confidence scale (a proxy for behavior management decisions), and the involvement scale (a measure for the extent that parents and children participate together in a variety of common activities). Parenting style is represented by the discipline practices scale (a proxy for demandingness) and the attachment scale (a proxy for responsiveness). The last scale from the PRQ-CA listed in the table is relational frustration and was used as a measure of the *parenting stress* variable in this study.

Research Questions

Individual growth trajectories/within participant differences. One research question (RQ1) was explored to study individual growth trajectories of adolescents in the sample. Due to the small sample size individual growth trajectories were examined linearly by asking the following question.

RQ1. Does an adolescent's BMI change over time?

Between participant differences. Five research questions were explored to understand how initial BMI and rates of change in BMI across individuals vary by the predictor variables (stages of change, parenting relationship, parenting stress, and the use of atypical antipsychotic medication). The five research questions are as follows.

RQ2. Can stages of change, parenting relationship, parenting stress, and/or the use of atypical antipsychotic medication account for initial BMI differences in adolescents at the beginning of a behavior weight management intervention?

RQ3. How do rates of change in BMI vary by stages of change? Consistent with the adult literature (Norcross et al., 2011; Prochaska & DiClemente, 1992; Prochaska et al., 1992) it was hypothesized that the action or maintenance stage of the TTM would predict greater decrease in adolescent BMI than the precontemplation and contemplation stages.

RQ4. Can parenting relationship predict change in BMI in adolescents with obesity? Consistent with existing literature (Kitzman-Ulrich et al., 2010; Rhee, 2008), it was hypothesized that positive parenting relationship would predict greater decrease in adolescent BMI than a negative parenting relationship.

RQ5. How does parenting stress affect change in BMI in adolescents with obesity? This study aimed to explore parenting stress associated with obesity in the adolescent population.

RQ6. Does the use of atypical antipsychotic medication influence change in BMI in adolescents with obesity? This study aimed to explore the relationship between the use of atypical antipsychotic medications and change in adolescent BMI.

Supplemental Analysis

Supplemental analyses were conducted to examine potential confounding variables and differences in outcome variables. First, supplemental analysis was conducted to examine participants' attendance at weekly group sessions as a potential confounding variable affecting changes in BMI. In addition, body fat percentage was examined as an outcome variable to compare it to the use of BMI as the outcome variable in this study.

At the outset of this study it was recommended that differences in individual sexual maturation (e.g., Tanner Scales), be analyzed to rule out potential confounding affects, however, these data were not available in patient charts and implications for these missing data will be discussed further in the limitations section.

Participants

Deidentified data were obtained from an existing database maintained at the Adolescent Medicine & Sports section of Texas Children's Hospital in Houston, Texas. The database contained data from treatment measures that were administered to adolescents who participated in an adolescent weight management group therapy intervention study funded by a grant from the Harris County Hospital District

Foundation. The purpose of the weight management group was to increase adolescent motivation to implement behavioral weight management strategies that promoted change in BMI. There was not a parent component to the treatment; however, the database contained parent ratings of the adolescents that participated in the treatment. The study was conducted between October 2010 and October 2011.

The database contained data for 41 adolescents, (39% male, 53.7% female, mean age 14.35 years old). The mean weight for the adolescents in the sample was 105.43 kg with a standard deviation of $\pm$ 24.08. The majority of the participants identified as part of an ethnic minority group, (63.4% Hispanic, 19.5% Black, 12.2% Other), with only 4.9% White, and 63.5% of participants reported an annual family income of between less than $10,000 to $29,999. Other demographic information for the sample including BMI range is presented in Table 2 in Appendix A.

Research Design

Information in the database was collected from baseline and post treatment measures of parental ratings of child social/emotional/behavioral functioning and parenting relationship. The database contained adolescent self-reports of emotional/behavioral/psychosocial functioning, self-perception, stages of change, and nutrition knowledge. Height was collected at baseline and post treatment. Weekly weight measurements were collected for BMI calculations. Participants were included in the intervention study if they were between the ages of 12 and 18 years old with BMI at or above the 85th percentile specific to participants' age and sex.

Seven cohorts of adolescents participated in the study. Each group consisted of two to six participants and the treatment program was delivered to each group on a

weekly basis for seven consecutive weeks. Informed consent was obtained from participants' parents/guardians and the participants themselves if they were 18 years old. The treatment targeted adolescent motivation to change and focused on generalizing the implementation of behavioral weight management strategies across settings (e.g. home and school) and nutrition education. The treatment manual was created by the Adolescent Medicine psychologist and the topics covered over the seven-week group treatment are outlined in Table 3 in Appendix A. Baseline and post treatment measures were administered by psychology supervisors and advanced psychology predoctoral practicum students. These service providers also monitored treatment fidelity and integrity/reliability of administration of pre and post treatment measures. Baseline data were utilized for purposes of this study.

Measures

The independent variables utilized in this study included scores from the URICA, a measure of stages of change, the PRQ-CA a measure of parenting relationship and parenting stress, and information about the use of atypical antipsychotic medication obtained from patient charts. The dependent variable utilized in this study was the body mass index (BMI) of participants. A supplemental analysis was completed to determine the effect of group member attendance at therapy sessions as a covariate on participant BMI. In addition, body fat percentage was entered into the analysis as an outcome variable to compare its use to that of BMI.

University of Rhode Island Change Assessment. The University of Rhode Island Change Assessment (URICA; DiClemente & Hughes, 1990) is based on the transtheoretical stages of change model. It is a continuous measure that yields

information about an individual's readiness to change. It contains 32 items answered on a Likert Scale ranging from strongly disagree (1) to strongly agree (5), and has four subscales with eight items for each. The URICA yields four subscales (preparation is not included) despite the five that are included in the transtheoretical model based on evidence from a number of studies, across diverse samples, that have suggested a four-factor structure parsimoniously accounts for participant responses on the URICA (Carney & Kivlahan, 1995; DiClemente & Hughes, 1990; McConnaughy, Prochaska, & Velicer, 1983; McConnaughy., DiClemente, Prochaska, & Velicer, 1989). Construct validity evidence has been obtained through factor analysis (Dozois, Westra, Collins, Fung, & Garry, 2004; McConnaughy et al., 1983; McConnaughy, et al., 1989) and cluster analysis (McConnaughy et al., 1983; Nigg, Burbank, Padula, Dufresne, Rossi, Velicer, LaForge & Prochaska, 1999) that have indicated the stages of the TTM are associated with different behavioral profiles. Furthermore, construct validity evidence was obtained in an adolescent inpatient psychiatric sample. Greenstein, Franklin, & McGuffin (1999) found the correlation between the subscales on the URICA revealed a simplex pattern similar to that reported in adult studies. They found that adjacent stages tended to be more correlated than nonadjacent stages. For example, the largest negative correlation coefficient ($r = -0.57$) was between Contemplation and Precontemplation. The largest positive correlation coefficient ($r = 0.70$) was between Contemplation and Action. Also consistent with the TTM, it was found that in an adolescent sample, Precontemplation was negatively correlated with all other stages, whereas correlations among the Contemplation, Action, and Maintenance stages were all positive (Greenstein et al., 1999).

The internal consistency of the URICA is good with coefficient alphas from 0.79 to 0.89 for the four subscales (Dozois et al., 2004; McConnaughy et al., 1983; McConnaughy et al., 1989) for adult samples. Similar to adult populations, studies that have examined the use of the URICA in adolescent subclinical samples (e.g., inpatient hospital psychiatric unit) have found internal reliability coefficient alphas from 0.77 to 0.88 for the four subscales (Greenstein et al., 1999). Numerous studies have yielded internal consistency results for the URICA in adolescent populations that support its use to measure stage-of-change in adolescents with emotional, behavioral, and/or psychiatric problems. However, existing adult and adolescent research has not examined other estimates of reliability such as test-retest reliability of the URICA. In addition, although there is a growing body of literature suggesting that stage of change is predictive of treatment outcome in adults (Dozois et al., 2004; Stephens, Cellucci, Gregory, 2004) the predictive validity of the URICA with adolescent samples has not yet been established.

Although predictive validity of the URICA in adolescent clinical samples has not yet been established, readiness to change may be especially important to understand prior to the provision of health related and psychotherapeutic interventions because evidence suggests that motivation may be lacking in adolescents receiving psychotherapeutic care (Greenstein et al., 1999). Because the URICA was originally developed for use with clinical adult substance abuse/addiction populations, it was adapted for the adolescent obese sample in this study in accordance with recommendations by Rossi, Rossi, Velicer, and Prochaska (1995). The adaptations that were made to the URICA for this study based on the recommendations from Rossi and colleagues (1995) are described next.

The standard directions and certain items were revised to make the URICA relevant and reader friendly for the present sample. For example, the item "As far as I'm concerned, I don't have any problems that need changing" was changed to "As far as I'm concerned, I don't have any weight/health problems that need changing". The item "I am actively working on my problem" was changed to "I am actively working on my weight/health problem". The item "Maybe this place will be able to help me" was changed to "Maybe this group will be able to help me". Twenty-six of the original 32 URICA items were adapted for use with the adolescent obese population that was included in this study. Moreover, the instructions for completing the scale indicated that respondents should complete the scale in reference to their weight/health problem.

In this study, baseline URICA scores were utilized for the sample. For purposes of analysis, the stages of change were treated categorically rather than continuously. Three categories were created for the analysis and are as follows; Precontemplation, Contemplation, and Action/Maintenance. The Action and Maintenance scales were collapsed into one category because only one individual in the sample was in the Maintenance stage at the time that baseline data were collected. The implications of the way that the URICA was analyzed in this study are further discussed in the limitations section. The descriptive statistics and missing data information for the current sample in terms of stages of change can be found in Table 4 in Appendix A.

Parenting Relationship Questionnaire-Child and Adolescent. The Parenting Relationship Questionnaire-Child and Adolescent (PRQ-CA; Kamphaus & Reynolds, 2006) is a norm-referenced, 71-item measure completed by parents/caregivers of children and adolescents aged 6-18 years of age. The items of the PRQ-CA are endorsed based on

a four-point scale (e.g., never, sometimes, often, and almost always) and yield information about the nature of a parent/caregiver-child relationship and parenting stress in the form of seven-scaled scores. The authors of the PRQ-CA conducted a confirmatory analysis of a pool of items to determine scale structure and confirm construct validity. Items with low standardized loadings (less than .30) were dropped, leaving approximately four to six items with the highest standardized loadings (median factor loading = .64) to serve as the core set of items for the PRQ-CA (Kamphaus & Reynolds, 2006). Although these results have not been replicated, the authors of the PRQ-CA assert that the scaled scores reflect aspects of the parent/caregiver-child relationship and parenting stress based on empirically established dimensions of; Attachment, Communication, Discipline Practices, Involvement, Parenting Confidence, Satisfaction with School, and Relational Frustration (Kamphaus & Reynolds, 2006).

The PRQ-CA has evidence of internal reliability and convergent validity. Internal consistency is high for males and females across the age range of 6-18 years. Coefficient alpha reliabilities ranged from 0.78-0.93, with median values for each norm group (male or female and ages 6-9 years, 10-12 years, 13-15 years, and 16-18 years) ranging from 0.82-0.87. Given that the present study includes children ages 12-18 years of age, it is notable that reliability coefficients for the PRQ-CA are slightly higher for parental relationship with older children compared to younger children. Furthermore, median test-retest reliability for the seven subscales of the PRQ-CA is high ($r = 0.79$). Overall, the PRQ-CA demonstrates adequate internal consistency reliability evidence.

Intercorrelations amongst the PRQ-CA subscales for female rater and male rater norm groups are moderate and in the expected direction. For example, for both female

and male raters Relational Frustration was negatively correlated with Attachment, Communication, Involvement, and Parent Confidence, indicating that higher levels of parental frustration were associated with problematic parenting/caregiver and child relationships. When correlated with three instruments that measure similar constructs (e.g., Parent-Child Relationship Inventory, PCRI; Gerard, 1994; Parenting Stress Index; PSI, Abidin, 1995; Stress Index for Parents of Adolescents; SIPA, Sheras, Abidien, & Konold, 1998), the PRQ-CA demonstrated moderate to good convergent validity adjusted correlation values ranging from 0.41 to 0.76. Predictive validity for the PRQ-CA has not been established, and although the normative basis for the PRQ-CA is a national sample representative of all regions of the U.S, cultural validity may be limited due to differences in childcare practices that vary by culture, thus results should be interpreted carefully (Kamphaus & Reynolds, 2006). For the purposes of this study, only six of the seven PRQ-CA scales were utilized, as the Satisfaction with School scale was not included in the analysis. The Satisfaction with School scale was left out of the analysis because it is not encompassed within the parenting relationship and parenting stress variables of interest for the research questions of the current study. For this study, the PRQ-CA was scored based on female rater norms because in every case, the participants' mother completed the measure. The descriptive statistics and missing data information for the PRQ-CA in this study can be found in Table 5 in Appendix A.

Atypical Antipsychotics. The use of atypical antipsychotic medication was determined by examining patient charts. Thirty-nine of the 41 individuals in the sample had patient charts that could be examined for this information. Table 6 in Appendix A indicates that of the 39 individuals, two were taking an atypical antipsychotic medication

in conjunction with another psychotropic medication at the time of this study. A different atypical antipsychotic medication was used by each of the two subjects. The antipsychotics used were aripiprazole (Abilify), which is indicated in the pediatric population as discussed earlier and ziprasidone (Geodon), which has an FDA indication for use only in adult populations with schizophrenia and bipolar I disorder. Safety and effectiveness for pediatric patients has not been established for ziprasidone. In both cases, the individuals were taking an atypical antipsychotic medication in conjunction with an additional psychotropic medication (i.e., polypharmacy). The individual that was taking aripiprazole was also prescribed methylphenidate hydrochloride (Metadate CD), a medication commonly prescribed to treat ADHD. The individual who was prescribed ziprasidone was also prescribed fluoxetine (Prozac), a medication commonly used for the treatment of depression and anxiety. Of the remaining 37 participants with medical chart information available, 16.2% (n=6) were taking one or more psychotropic medications that were not atypical antipsychotics (e.g. stimulant medication, antiepileptic, benzodiazepine) and the remaining participants were not taking any psychotropic medications.

Body mass index. Body mass index (BMI) is calculated by dividing a child's weight (in kilograms) by the square of height (in meters). Participants' weights were collected weekly for the duration of treatment (7 weeks) and their heights were collected in the first and last week of treatment. For this study, baseline height was used in the calculation of weekly BMI due to some missing post treatment height data and measurement error in post treatment height (i.e., some adolescents were recorded as

decreasing in height by more than 3 centimeters). Descriptive statistics of BMI by week can be found in Table 7 in Appendix A.

Attendance. Attendance was examined in a supplemental analyses to determine its impact on BMI as a covariate. Attendance was recorded each week for the duration of the seven week program. Participant attendance ranged from 1-7 sessions, with mean attendance of four sessions.

Body Fat Percentage. As part of the supplemental analyses**,** body fat percentage was calculated using a formula based on current BMI, age, and gender developed by Deurenberg, Weststrate, Seidell (1991). It was examined as an outcome variable to compare it to the use of BMI as the outcome variable in this study.

Chapter III

Procedures

An application to conduct archival research was submitted to and approved by the University of Houston's Committee for the Protection of Human Subjects (CPHS). Furthermore, an application to analyze the data available in the existing clinical database at the Baylor College of Medicine/Texas Children's Hospital for the purpose of this dissertation study was approved by the Internal Review Board (IRB) at the Baylor College of Medicine/Texas Children's Hospital.

Methodology: Multilevel Regression Model Analysis

Multilevel Regression Model Analysis, also known as Hierarchical Linear Modeling (HLM) was used to analyze data in this study. Multilevel regression model analysis has become an increasingly popular method used in social, developmental, and educational research (Graves & Frohwerk, 2009; O'Connell & McCoach, 2008; Peugh & Enders, 2005). Multilevel analysis can be used to analyze nested data at the individual and group level.

Nested data. Individuals are commonly nested within groups (e.g., students nested within a classroom, employees nested within a business) and as a result, data can be nested within organizations, or communities. When studies have a longitudinal design, repeated measures occur over time, therefore, data are nested within persons (Peugh, 2010, Raudenbush & Bryk 2002). Multilevel modeling is a statistical method that enables examination of effects occurring at the individual level and across levels of a hierarchy of nested data (Raudenbush & Bryk 2002). For example, a researcher may be investigating the effects of classroom environment on student aggression and academic

achievement (Barth, Dunlap, Dane, Lochman, & Wells, 2004). Such a study would be examining nested data within an organization (e.g., school). Multilevel modeling is well suited for this kind of study due to the nested nature of the data with the students in the classrooms of the schools. Because data nesting occurs in multilevel models, so does correlation between individual units (students of the classrooms) and the larger unit in which data are nested (i.e., classrooms in a school). Multilevel modeling is an appropriate analysis for treating the correlations that can be present in nested data (Graves & Frohwerk, 2009; Shek & Ma, 2011). Multilevel modeling has the ability to convey relationships among variables at a given level and indicate how variables at one level influence interactions occurring at another level in a hierarchy (Raudenbush & Bryk, 2002).

Multilevel modeling and longitudinal studies. In longitudinal designs, data are nested within the individual, due to repeated observations over time (Peugh, 2010; Raudenbush & Bryk 2002). The use of multilevel modeling to examine longitudinal data enables the generation of individual growth curves for analysis at the individual level. In multilevel modeling, the differences at the individual level serve as an impetus to examine differences between individuals.

Individual growth curve modeling is advantageous because it is more powerful than other methods (e.g., ANOVA) in examining the effects associated with repeated measures, and is more flexible because of its ability to treat missing data (Shek & Ma, 2011; Willett & Singer, 2003). Furthermore, multilevel analysis can identify temporal patterns in longitudinal data such as increases, decreases, or stability in outcomes over time. Moreover, multilevel analysis can include time variable predictors (e.g., those

whose values vary over time such as family composition, employment, stress, and self-esteem). Multilevel modeling enables estimates of individual slope or growth over time and models within and between persons variability with relationship to covariates (Willett & Singer, 2003).

The present study is retrospective and longitudinal in nature; therefore, data used in this study were nested within the individual, due to repeated observations over time. Multilevel analysis was used because of its capabilities to generate a two-level hierarchical model that nests time within individual (Bryk & Raudenbush, 1992). In this study, the data were analyzed using a mixed effect model analysis that employed maximum likelihood (ML) estimation enabling treatment of missing values (Peugh, 2010). Using a mixed effect model analysis enabled modeling of individual change over time and systematic differences in change between participants. It also enabled examination of random and fixed effects of variables in the study. (Shek & Ma, 2011). The distinction between random and fixed effects in multilevel analysis of longitudinal data is important and will be discussed next.

Longitudinal studies are designed to measure changes over time in individuals. In longitudinal studies, measurements of characteristics (i.e., blood pressure, parent ratings of child behavior, self-ratings of stress, etc) are obtained for each individual at different times and possibly under changing experimental conditions. For example, in this study, data collection occurred over one year and measurements were taken from seven different cohorts of individuals. Thus, the individuals in the study received therapeutic intervention at different times during the year and from different group facilitators. The variation that occurs in longitudinal studies when experimental conditions may change

over time can be studied with multilevel methods, where the probability distribution for the measurements has the same form for each individual, but the parameters of that distribution vary over individuals (Laird & Ware, 1982). The variability in the distribution of individual parameters is considered the random effects in the population. Specifically for this study, for differences at the individual level, individual growth curve models were generated to model individual parameters. The individual parameters for this study were initial BMI (intercept), and within person change in BMI over time (slope, RQ1). The individual changes in BMI trajectories that were modeled over seven weeks are considered Level 1 (within-person) of data analysis.

For Level 2 (between persons) of data analysis interindividual differences in change trajectories were modeled across participants as a function of the covariates (stages of change, parenting relationship,, parenting stress, and the use of atypical antipsychotic medications) that were measured once for each participant. The covariates or predictors in this study are assumed to be fixed at level-1 and level-2 as they do not vary randomly across groups. Differences in initial BMI (intercept) at baseline as a function of the covariates or fixed effects were examined (RQ2). Furthermore, multilevel analysis enabled examination of the effects of stages of change (RQ3), parenting relationship, (RQ4) parenting stress (RQ5), and the use of atypical antipsychotic medication (RQ6) on rate of change in BMI (slope) between participants over the seven-week period of treatment.

Multilevel Model Building

Two models were estimated prior to building the final model for each test. The models include the unconditional means model (Model 1) and the Unconditional Linear

Growth Model (Model 2). Model 1 examines the grand mean (the mean across initial BMI, or intercept observations) and indicates whether there are differences across individuals (level 1) and across observations (level 2). Model 1 indicates within person (level 1) deviation from the grand mean and between person differences in initial BMI (intercept) and does not include any covariates. The determination of between participant variance in BMI is called the *intra-class correlation coefficient* (ICC). The ICC describes the amount of variance in BMI due to differences between individuals (Shek & Ma, 2011). Model 2 is the estimation of a within-participants (level-1) model that indicates whether there was change over time (slope) within-subjects with the repeated outcome measure of BMI. It includes the addition of the variable "week" representing time at level 1 and no predictors at level 2. Model 2 enables examination of RQ1, (does an adolescent's BMI change over time?). The full model (Model 3) was estimated in which the stages of change, parenting relationship, parenting stress, and the use of atypical antipsychotic medication were added at level 2 (between subjects) to analyze their effects on initial BMI status at baseline (RQ2) and rates of change (slope) in BMI differences between participants (RQ3, RQ4, RQ5, and RQ6).

Unconditional Means Model (Model 1)

An unconditional means model is a one-way ANOVA model with a random effect, where no predictor is included (Shek & Ma, 2011) and the equation to express this is: $Y_{ti} = \beta_{0i} + r_{ti}$, where:

- Y_{ti} is BMI at time *t* for individual *i;*
- β_{0i} is the overall status (i.e., time variable has not yet been entered into the model) of BMI observations for individual *i;*

- $r_{ti,}$ is the residual error in the outcome variable for individual *i* at Time *t*

It serves as a baseline model to examine individual variation related to interindividual differences (interclass correlation coefficient) in initial BMI or the differences between the observed mean for each individual and the true mean from the population (Shek & Ma., 2011).

Unconditional Linear Growth Model (Model 2)

To capture individual trajectories over time, an unconditional linear growth curve model (Model 2) examined individual changes over time. No predictors were included at level 2 in this model and it was fitted to determine individual parametric (intercept or initial status and slope) models of BMI over time (RQ1). The basic linear growth model equation for level 1 analysis that expresses individual change over time is: $Y_{ti} = \beta_{0i} + \beta_{1i}$ *(Week)* + $r_{ti,}$ where:

- Y_{ti} is BMI at time *t* for individual *i;*
- β_{0i} is the initial status (i.e., wave 0 or week 0) of BMI for individual *i*
- β_{1i} is the linear rate of change for individual *i*
- $r_{ti,}$ is the residual error in the outcome variable for individual *i* at Week *t*

For this study, the heterogeneity in initial BMI (intercept differences) and rate of change (slope) between individuals provided the impetus to further investigate whether the individual differences were related to explanatory variables (stages of change, parenting relationship, parenting stress, and the use of atypical antipsychotic medication) analyzed in level 2, (between-subjects) of analysis in the full model (Model 3) (Shek & Ma, 2011).

The Full Model (Model 3)

To test the effect of predictors (stages of change, parenting relationship, parenting stress, and the use of atypical antipsychotic medication) to model group level differences on the individual growth parameters (intercept and slope), each predictor was entered into the full model (Model 3) at level 2 of analysis. This model enabled examination of research questions 2-6. The growth parameters of level 1 are the outcome variables to be predicted by the between-subjects variables at Level 2. In multilevel analysis, the errors are assumed independent and normally distributed, and the variance is equal across individuals (Shek & Ma, 2011). The level 2 equation is as follows:

$Y_{ti} = \gamma_{0i} + \gamma_{1i} (W_{t)} + r_{ti,}$ where:

- Y_{ti} is the grand mean for BMI for the whole sample at Time t
- γ_{0i} is the initial status of BMI for the whole sample at Time t
- γ_{1i} is used to test whether the predictor is associated with the growth parameters
- W_t is the explanatory variable to analyze the predictor's effect on interindividual variation on outcome variable
- $r_{ti,}$ refers to random effects (amount of variance) that are unexplained by the predictors

In this study, to determine the best model, Bozdogan's Criterion (CAIC) and the Bayesian Information Criterion (BIC) were utilized to inform fit of these models (Bozdogan, 2000; Vrieze, 2012).

Chapter IV

Results

Analysis Assumptions and Sample Demographics

Prior to building the multilevel model, descriptive statistics were examined for test assumptions. Furthermore, demographic information about participants was compiled and is presented in Table 2 and Tables 4-6 in Appendix A. Of note, the sample used in this study was primarily composed of individuals from ethnic minority groups. Specifically, 63.4% of individuals identified as Hispanic, 19.5% identified as Black, and 12.2% identified as Other. Less than 5% of individuals in the sample indentified as White. Thus, the sample used in this study over represents ethnic minority groups when compared to the proportion of individuals in the United States population. However, given that there are no *well-established* treatments for ethnic minority youth with clinical problems (Huey & Polo, 2008), results from the current study may contribute to the development of evidence-based culturally tailored frameworks for treating ethnic minority youth and families affected by obesity. Further implications for this unique sample will be addressed in the discussion section.

Normality. Inspection of histograms revealed approximately normal distributions for parenting relationship, parenting stress, and BMI variables and the shape of the histograms approximated the bell-shaped curve of a normal distribution (Field, 2009). Furthermore, the skewness and kurtosis values for these variables were within acceptable ranges (between +3 and -3). Because atypical antipsychotic use and stages of change were utilized as categorical variables, the assumption of normality of residuals does not apply to these variables (Field, 2009).

Linearity and Homogeneity of Variance. Inspection of residual scatter plots revealed a shapeless pattern where the points appeared randomly and evenly distributed throughout the plot, thereby confirming that the assumptions of linearity and homogeneity of variance have been met (Field, 2009; Kinnear and Grey, 2011).

Multicollinearity. Multicollinearity (highly correlated variables) was examined with diagnostic statistics (e.g., tolerance and variance inflation factors [VIF]). Tolerance statistics below 0.10 and VIF statistics greater than 10 indicate a violation of multicollinearity assumptions (Bowerman & O'Connell, 1990). For each analysis, regressions of all predictor variables (stages of change, parenting relationship, parenting stress, and the use of atypical antipsychotic medication) yielded tolerance statistics greater than 0.10 and VIF statistics of less than 10 indicating assumptions of multicollinearity were not violated.

Multilevel Model

Unconditional means model (Model 1). An unconditional means model (Model 1) yielded significant heterogeneity in BMI means between individuals ($\beta = 39.5$, $SE = 1.30$, $p < .05$). The variance associated with the level-1 error is the estimated within-person variance (σ^2) and was 0.093. The interclass correlation coefficient (ICC; ρ) was 0.99, suggesting that about 99% of the total variation in individual initial BMI was due to interindividual differences, thus informing the subsequent models for this analysis. The large variability amongst intercepts is likely a reflection of the large range of BMI scores (range of BMI in the sample = 27.99-58.91). On the other hand, large variability does not exist for slope, which may be function of the short duration of the study (slope was represented from week 1 to week 7).

Unconditional linear growth model (Model 2). Two fixed effects were estimated for this model. "Week" was added to represent time at level 1 and no predictor variables at level 2 were added. For this model, the intercept was centered around the participant's first visit (e.g., "week 0"). For this study, the individual linear growth model yielded significant intercept parameters ($p < .05$), again indicating that individual differences in initial BMI were significant ($\beta = 39.49$, $SE = 1.332$, $p < .05$). The level-1 error decreased from 0.093 in Model 1 to 0.063 in Model 2 after adding "Week". Pseudo-R^2 ($\check{R}^2$) represents the amount of variation in BMI that is explained by the predictors in the model (McCoach & Black, 2008). It compares the variance between Model 2 (unconditional growth model) and Model 1 (unconditional means model) to quantify how much variation in BMI was accounted for by the addition of "week". Pseudo-R^2 is calculated with the following equation:

$$\check{R}^2 = \frac{\sigma\epsilon^2 \text{ (Model 1)} - \sigma_\epsilon^2\text{(Model 2)}}{\sigma_\epsilon^2 \text{ (Model 1)}}$$

$$= 0.093\text{-}0.063/0.093 = .32$$

The $\check{R}^2$ value indicated that "Week" accounted for approximately 32% of the variance within individuals.

Does an adolescent's BMI change over time (RQ1)? The individual linear growth model did not yield significant slope parameters indicating that there was not a fixed effect for week, and on average, there was no significant change in slope across the seven weeks ($\beta = 0.02$, $SE = 0.02$, $p = .30$). The random effects of week ($\beta/SE = .007/.003$) indicated the potential for slight variability in slopes providing the impetus to

go forward with the full model to determine if variability could be explained by between individual predictors.

The full model (Model 3). The final model estimated was the full model in which the stages of change, parenting relationship, parenting stress, and the use of atypical antipsychotic medication were added to the previous model (Model 2). This model enabled exploration of the remaining research questions and results of the full model (Model 3) are discussed next and presented in Table 8 in Appendix A.

Can Stages of change, parenting relationship, parenting stress,, and/or the use of atypical antipsychotic medication explain initial BMI differences in adolescents at the beginning of a behavioral weight management intervention (RQ2)? Of all the predictors tested, two were significant predictors of baseline BMI status (intercept). First, although only applicable for two subjects, the use of an atypical antipsychotic was a significant predictor of higher initial BMI status (β = -13.45, *SE* = 4.11, *p*=.003*)*. Second, higher parenting confidence was a significant predictor of lower initial BMI status (β = -0.25, *SE* = 0.098, *p*= .016*)*. The level 1 variance (σ^2) was 0.061. The $\check{R}^2$ was 0.032. The use of atypical antipsychotic and parenting confidence accounted for 3.2% of the variation in BMI between individuals. Furthermore, for this model with parenting confidence and the use of atypical antipsychotic medication as the predictor variables, the Bozdogan's Criterion (CAIC) was 310.49 and the Bayesian Information Criterion (BIC) was 300.49 indicating that this model improved model fit compared to model 2 with CAIC =382.00 and BIC = 376.00, because generally, smaller numbers in the information criterion indicate a better model fit. The use of atypical antipsychotic medication and

parenting confidence were variables that were found to be significant predictors of initial BMI status. Full results can be found in Table 8 of Appendix A.

How do rates of change in BMI vary by stages of change (RQ3)? Stages of change were not found to be a significant predictor of rate of change in BMI between participants. Specifically when analyzed against the action/maintenance stage, the results are as follows: *Precontemplation:* $\beta = 1.44$, $SE = 4.19$, $p=.733$), *Contemplation:* $\beta = 0.378$, $SE = 3.50$, $p=.915$). Results for this analysis can be found in Table 8 in Appendix A.

Can parenting relationship predict change in BMI in adolescents with obesity (RQ4)? The parenting relationship scales from the PRQ-CA (attachment, communication, discipline practices, involvement, and parenting confidence) were not found to be significant predictors of rate of change in BMI between participants. For each predictor the results are presented as an interaction with the variable week to represent change over time and are as follows: attachment x week: ($\beta = -0.002$, $SE = 0.002$, $p=.327$), communication x week: ($\beta = -0.000$, $SE = 0.002$, $p> .923$), discipline practices x week: ($\beta = -0.002$, $SE = 0.002$, $p=.382$), involvement x week ($\beta = 0.000$, $SE = 0.002$, $p> .890$), and parenting confidence x week: ($\beta = -0.001$, $SE = 0.002$, $p=.546$). Results for this analysis can be found in Table 8 in Appendix A.

How does parenting stress affect change in BMI in adolescents with obesity (RQ5)? Parenting stress as measured by the relational frustration scale on the PRQ-CA was not found to be a significant predictor of rate of change in BMI between adolescent participants ($\beta = 0.001$, $SE = 0.002$, $p=.576$). Results for this analysis can be found in Table 8 in Appendix A.

Does the use of atypical antipsychotic medication influence change in BMI in adolescents with obesity (RQ6)? The use of atypical antipsychotic medication was not found to be a significant predictor of rate of change in BMI between participants (β = 0.012, *SE* = 0.071, *p=.865).* Results for this analysis can be found in Table 8 in Appendix A.

Supplemental Analysis

To examine the effect of potential confounding variables and other possible outcome variables, investigation into attendance at weekly group sessions, and body fat percentage was conducted. Results indicated that attendance was not a significant predictor of initial BMI (β = -0.48, *SE* = .60, *p* = .419) or slope trajectories (β = .00, *SE*= .01, *p* = .859). To explore potential differences in outcomes, body fat percentages were calculated for all participants (using a body fat percentage formula based on current BMI, age, and gender developed by Deurenberg, Weststrate, Seidell [1991]). Body fat percentages were entered into the analysis as the dependent variable, and similar to the original model, intercept was significantly different amongst adolescents, minimal change in slope was observed, and parenting confidence was a significant predictor of initial body fat percentage (β = -0.57, *SE* = 0.15, *p* =.002). Contrary to the original model, the use of atypical antipsychotic medication (β = -9.24, *SE* = 6.98, *p* =.206) was not significant when body fat percentage was entered as the outcome variable. This finding presents a paradox because when BMI was used as the outcome variable, atypical antipsychotic medication was found to be a significant predictor of BMI, however, when the outcome variable was changed to body fat percentage atypical antipsychotic medication was no longer significant. Given that only two individuals in the sample were

taking atypical antipsychotic medication and the results changed when outcome variables were changed, these results need to be interpreted with caution because of the small number of subjects (n=2) involved and because of the contradictory findings. These and other limitations of the study will be considered further in the Discussion section.

Chapter V

Discussion

Current Findings

This retrospective longitudinal study examined the predictive relationships of stages of change, parenting relationship, parenting stress, and the use of atypical antipsychotic medication on BMI in a diverse, low SES, clinical sample composed primarily of obese Hispanic (63.4%) and African American (19.5%) treatment seeking adolescents. Multilevel Regression Model Analysis was used to explore within and between participant differences in initial BMI and rate of change in BMI over time. All results of this study need to be interpreted in light of the unique characteristics of the sample, given that it was largely made up of individuals who identified as part of ethnic minority groups (e.g., 63.4% Hispanic and 19.5% African American adolescents). However, given that minority and low SES groups are disproportionately affected by obesity across all ages in the United States (Wang & Beydoun, 2007), the results of this study may contribute to a multicultural understanding of obesity in ethnic minority adolescents.

The first aim of the study was to examine if an adolescent's BMI changes over time and at what rate. It was found that random effects of time (e.g. week) contributed to variability in rates of change between individuals. Significant random effects for the heterogeneity in rate of change (slope) between individuals provided the impetus to further investigate whether the individual differences were related to other explanatory variables (stages of change, parenting relationship, parenting stress, and medication status) or fixed effects over time (e.g. week).

The second aim of the study was to examine between participant differences in initial BMI (intercept) and rate of change in BMI over time (slope) as a function of the predictor variables (stages of change, parenting relationship, parenting stress, and the use of atypical antipsychotic medication). Two significant relationships were found to explain differences in initial BMI (intercept) between participants. First, although only two subjects used them, the use of atypical antipsychotic medication was significantly related to higher BMI at baseline. Secondly, higher parenting confidence, a parenting relationship variable related to parent decision making, was found to be significantly related to lower BMI at baseline. In terms, of change in BMI over time however, no significant predictors emerged. The research questions of this study and the findings for each predictor variable are discussed next.

Does an adolescent's BMI change over time (RQ1)?

Interindividual differences in initial BMI status were found to be significant. However, from week to week, results indicated there was not a significant fixed effect for rate of change in adolescent BMI over time for this sample. Interestingly, the adolescents in the sample presented with initial BMI values in a large range (Min. = 27.99, Max. = 58.79) however all met the overweight/obese percentile cutoff (e.g., BMI $\geq 85^{th}$ percentile), for their individual age and sex. Individuals in this study that met the minimum cutoff to be classified as obese showed the same result (e.g., no change over time) as those individuals that met a higher cutoff to be classified as obese. This indicates that for this sample higher vs. lower BMI at baseline is not predictive of more or less change over time. However, the results indicate that the participants were able to maintain stable weight throughout the seven week intervention. Researchers assert that

the key to successful long-term weight control is consistent application of behavior changes and skills acquired over time (Wing, Papandonatos, Fava, Gorin, Phelan, McCaffery, & Tate, 2008; Wing & Phelan, 2005). Information about the consistency to which the participants applied the behavioral skills they learned during the group intervention is unknown, and follow up studies should measure for this to determine the impact of skill utilization on weight maintenance in obese adolescents.

Can Stages of Change, Parenting Relationship, Parenting Stress, , and/or the use of atypical Antipsychotic Medication Explain Initial BMI Differences in Adolescents at the Beginning of a Behavioral Weight Management Intervention (RQ2)?

Stages of change. Stages of change were not found to be significantly related to initial BMI differences in adolescents at baseline. On the other hand, parenting confidence and the use of atypical antipsychotic medication were found to be significantly related to differences in initial BMI between participants.

Parenting Confidence. Parenting practices and parenting style were measured with the use of the PRQ-CA (Kamphaus & Reynolds, 2006). The communication, parenting confidence, involvement, attachment, and discipline practices scales on the PRQ-CA were used to serve as measures of parenting relationship. Higher parenting confidence was a significant predictor of lower initial BMI. Parenting confidence was operationalized as the comfort, control, and confidence of the parent when actively involved in the parenting process and when making parenting decisions. Evidence supports that parents and caregivers are a critical influence on adolescents' health related behaviors and BMI (Avula et al., 2011; Rhee et al., 2006; Sen, 2006). Higher parenting confidence may enable parenting decisions that create structure and consistency for

adolescents in their daily life, thereby contributing to protective factors of healthy lifestyle for adolescents and resulting in a lower BMI, when compared to other adolescents whose parents perceived lower parenting confidence.

Atypical Antipsychotics. The use of atypical antipsychotic medication was determined by examining patient charts. Two individuals in the sample of this study were found to be taking atypical antipsychotic medication in conjunction with another psychotropic medication. As previously, explained, atypical antipsychotics with the presence of other psychotropic medications was collapsed to one category and considered a part of the variable that examined the presence of atypical antipsychotic medication.

In this study, the presence of atypical antipsychotic medication was significantly related to higher BMI at baseline. This finding supports existing research that has established increases in body weight and in BMI as side effects associated with the use of atypical antipsychotics in the pediatric population (Jerrell & McIntyre, 2008; Kelly et al., 1998; Ratzoni et al., 2002; Varley & McClellan, 2009). However, it must be interpreted with limitations in mind, which are further discussed in the limitations section.

How do rates of change in BMI vary by stages of change (RQ3)?

In terms of stages of change as a predictor of rate of change in BMI, it was hypothesized that the action stages of change (action/maintenance) would be predictive of greater decreases in BMI than the preaction stages (precontemplation/contemplation). Although, statistical significance was not realized for predicting outcome, a pattern was discovered with marginal means comparisons between the stages of change, (when treated as a categorical variable in this study) and initial BMI. Individuals in the action/maintenance stage presented at baseline with lower mean BMI (M=37.80) than

individuals in precontemplation (*M*= 39.32) and in the contemplation stage (*M*=38.19). Consistent with the TTM theory, individuals in this study that were in the action stages prior to the start of the intervention presented with a lower mean BMI at baseline than those individuals in the preaction stages. Predictive validity of stages of change was not established in this study; however, there is a need for future studies in this area to pursue predictive validity of stages of change in highly motivated treatment seeking obese adolescents.

Can parenting relationship predict change in BMI in adolescents with obesity (RQ4)?

An aim of this study was to examine parenting relationship and its effect on adolescent BMI. It was hypothesized that positive parenting relationship, characterized by parenting style and parenting practices, would be predictive of greater decreases in adolescent BMI. Although, parenting confidence was a significant predictor of initial BMI status as discussed earlier, it was not found to be a significant predictor of change in BMI across time. The remaining variables within the parenting relationship cluster of variables did not reach significance in predicting initial lower BMI and change in adolescent BMI. Although, parenting relationship was not a significant predictor of change in BMI over time, the model fit criteria (CAIC and BIC) for the statistical analysis indicated that the multilevel model was a better fit across all of the parenting relationship variables when compared to Model 1, where no covariates were entered into the analysis. A better model fit suggests that parenting relationship variables may potentially be predictive of initial BMI and/or change trajectories over time in a larger sample size of treatment seeking adolescents. For this treatment seeking adolescent

sample, it was found that on average, the parents of this sample endorsed ratings below the normative mean of 50 for the PRQ-CA on all of the parenting relationship scales. The parents rated the parenting relationship in the communication (*M = 46.3*, *SD*= 11.73), involvement (*M* = 48.67, *SD* = 10.61), confidence (*M*=44.45, *SD*=10.40) attachment (*M* = 48.64, *SD* = 11.40), and discipline practices (*M* = 45.79, *SD* = 11.36) domains as below the normative mean.

The PRQ-CA is a measure that has a mean of 50 and a standard deviation of 10. The mean endorsements by the parents on the PRQ-CA subscales were below the normative mean, indicating that parents in this sample perceived their parenting styles as less effective than did the normative sample of the PRQ-CA. The standardization sample for the PRQ-CA included children ages 12-18 from four ethnic categories (African American, Hispanic, White, and Other) and four regions of the United States (including rural and urban communities) with parent education ranging from less than high school to several years of college. The sample included in the current study was very different from the normative sample for the PRQ-CA. In fact, Eurocentric measures are common in light of the increasing need for treatment outcome evaluation with ethnic minority groups (Huey & Polo, 2008). Future studies would need to examine the statistical significance of these ratings in comparison to norms that are specific to ethnic minority populations. At this time, normative data specific to individual ethnic minority groups is not available for the PRQ-CA. Future studies are needed to determine if ratings below the normative mean by ethnic minority parents are a result of random variation or ethnic group characteristics. For example, future studies may examine if endorsements below the normative mean are indicative of below average communication skills, below average

levels of involvement, below average attachment styles, below average use of discipline practices, or other factors in this sample, or in parents from ethnic minority groups. Below average ratings on these domains, may indicate that parenting relationship poses a challenge in diverse, low SES populations and may contribute to ecological risk factors of adolescent obesity. Because research has established that positive parenting relationship is associated with better outcomes for obese children/adolescents (Avula et al., 2011; Rhee et al., 2006; Sen, 2006) parenting interventions that focus on positive parenting relationship in addition to behavior weight management related interventions, may improve outcomes for treatment seeking families. Furthermore, parenting relationship interventions that integrate diversity and multicultural issues into treatment may enhance parenting relationship in terms of communication, involvement, attachment, and discipline practices, thus improving outcomes for adolescents with obesity.

How does parenting stress affect change in BMI in adolescents with obesity (RQ5)?

This study aimed to explore parenting stress (relational frustration on the PRQ-CA) associated with obesity in the adolescent population. Consistent with existing research, results indicated that relational frustration was not a significant predictor of initial BMI status or change over time in this adolescent, largely ethnic minority sample. The mean rating of relational frustration from the parents of this sample was above the normative mean for the PRQ-CA *(M =55.1*) indicating higher than average stress levels in the parents of the study sample. Although, relational frustration from the PRQ-CA was not predictive of adolescent BMI, it was negatively correlated with the attachment scale (r = -0.083), communication scale (r = -0.5), discipline practices scale (r = -0.27), and parenting confidence scale (r = -0.4). Future studies need to investigate whether

relational frustration can negatively influence other aspects of positive parenting relationship and thereby potentially hindering parent effectiveness in providing a supportive environment that fosters success for treatment seeking adolescents with obesity in both ethnic minority and majority samples. Because adolescents rely on their caregivers, addressing parenting stress levels may be critical when families and adolescents present for treatment. Enabling parents to better cope with stress, could improve the parenting relationship, and thus enhance the likelihood of positive outcomes for treatment seeking individuals.

Does the use of atypical antipsychotic medication influence change in BMI in adolescents with obesity (RQ6)?

The last aim of this study was to explore the relationship between the presence of psychotropic medications and adolescent BMI and changes over time. For this sample, there was not a significant relationship between the use of atypical antipsychotic medication and changes in BMI over time. This trend is consistent with the minimal change in BMI over the seven-week period observed in this study. Research provides evidence that atypical antipsychotics are associated with weight gain and higher BMI over time. (Jerrell & McIntyre, 2008; Klein et al., 2006). Evidence suggests that individuals gain weight as a side effect of using atypical antipsychotic medication and their use in the adolescent population is increasing, thus this topic warrants further investigation for obese adolescents (Jerrell & McIntyre, 2008; Klein et al., 2006). For this study, only two individuals in the sample were using atypical antipsychotic medication, thus limiting the investigation with this variable. However, understanding the impact of atypical antipsychotics on BMI trajectories for adolescents can inform

treatment and outcomes. Augmentative or alternative treatments may be necessary, if atypical antipsychotics interfere with psychotherapeutic interventions aimed at improving BMI for adolescents by either limiting the effectiveness or counteracting the positive effects of psychosocial treatments. Future studies need to explore the impact of atypical antipsychotics on treatments for obesity in order to determine appropriate treatment recommendations for ethnic minority and majority adolescents and their families.

Supplemental Analysis.

Supplemental analyses were conducted to examine the potential impact of attendance on outcomes, and to determine differences between using BMI or body fat percentage as the outcome variable. Participants' attendance at weekly group sessions was examined for potential confounding affects on changes in BMI and was not found to have a significant effect on initial BMI or change in BMI. Group member attendance ranged from attendance at only one session to attendance at all seven sessions with a Mean attendance for the sample of four sessions. Body fat percentage was examined as an outcome variable to compare its use with the use of BMI as the outcome variable in this study.

Results of using body fat percentage as the outcome variable instead of BMI yielded mixed outcomes. Parenting confidence was a significant predictor of initial body fat percentage, similar to the original model with BMI as the outcome. Contrary to the original model, the use of atypical antipsychotic medication was not significant when body fat percentage was examined as the outcome variable instead of BMI. Given that the general consensus in the adolescent obesity literature is that body fat percentage tends to overestimate overweight and obesity in youth (Aguilar, Gonzalez, Garcia, Garcia.,

Alvarez, Padilla, & Mur, 2012) the finding that the use of atypical antipsychotic medication was not significant when body fat percentage was examined as the outcome variable is unexpected. Thus, idiosyncratic differences in the development of the adolescents in this sample may have contributed to this outcome and would have to be explored further in future studies.

Limitations

Potential limitations of this study include methodological concerns. A primary concern is the lack of a comparison group. Often in studies with participants who have chronic conditions an absence of a comparison group other than unaffected siblings is common. This study did not include any comparison group. In addition, almost 95% of the sample was primarily composed of individuals that identified as being part of an ethnic minority group (e.g., Hispanic, Black, or Other). Although the nature of this sample may enhance its generalization to minority populations, particularly the Hispanic population, caution is necessary when generalizing the results of this study because the sample is not representative of the United States population.

Furthermore, the small sample size may have limited the power of this study. Several variables provided a better model fit and approached significance; however, the sample size may have not been large enough to capture the potential effect of these variables. For example, only two individuals in the sample used atypical antipsychotic medication, and both of these individuals used other psychotropic medications, thereby potentially limiting the predictive relationship between this variable and change in BMI in the sample. In terms of parenting relationship and parenting stress, the sample size

was not large enough to capture the full parenting model because of a lack of observations per parenting variable.

Another concern includes measurement concerns with the URICA and PRQ-CA and the use of atypical antipsychotic medication. Specifically, utilizing stages of change models and the URICA in adult substance abuse populations is quite common; however, psychometric properties and utility of the URICA in adolescent clinical samples with chronic health conditions such as obesity have not been established. Furthermore, the TTM theorizes movement through stages of change on a continuum rather than sequentially. The URICA is a continuous measure, reflecting the potential for movement through the stages of change on repeated measures of the URICA. Therefore, it is possible for individuals to move through the stages of change from week to week in a longitudinal study, and the individuals of this study may have moved through the stages of change over the seven-week period. However, these potential time influenced fluctuations in stage of change position were not captured in this study because only baseline data were used to determine pre-intervention stages of change, and data were utilized in a categorical manner rather than a continuous manner. This approach did not capture the potential movement through the stages of change that may have occurred in the sample as the treatment program progressed.

Similar to the URICA, limitations with the PRQ-CA exist. It has not been used in previous studies that examined weight status in the adolescent population. Although it has strong psychometric properties, validation in a clinical sample has not occurred, nor has it been systemtically studied with samples in which ethnoic minorities comprised 95% of the sample. Furthermore, the scales on the PRQ-CA are broad screeners of the

different aspects of the parenting relationship and do not necessarily target all aspects of parenting practices , parenting styles, and parenting stress that have been examined in relation to adolescent weight status in previous studies. For the purposes of this research, the scales on the PRQ-CA were used as an estimate of different aspects of parenting relationship and parenting stress. Previous validity studies have not been conducted to support its use in this manner.

There are several limitations to consider when interpreting the results that pertain to the use of atypical antipsychotic medication. Only two individuals in the study sample were taking atypical antipsychotic medication, thus results about medication status and BMI are based on a small proportion of the sample. Furthermore, the reason that the two individuals were prescribed atypical antipsychotic medication was unknown. Typically, atypical antipsychotics are meant to be prescribed to adolescents that present with emotional and behavioral difficulties. Thus, significant emotional and behavioral difficulties may have the potential to not only affect adolescent BMI, but may also affect the parent child relationship differently than those adolescents who do not present with significant emotional and behavioral difficulties. In addition, these results represent the impact of atypical antipsychotic medication in conjunction with another psychotropic medication, thus the significance of the use of atypical antipsychotic medication as a monotherapy is unknown. Moreover, information about the dosage of medication and the duration of atypical antipsychotic medication use prior to the start of this study was not available. In obese individuals, the presence of an atypical antipsychotic may pose a risk of increasing BMI even further, and in overweight individuals, the presence of atypical

antipsychotic medication may have the potential to put them at higher risk for obese status.

Furthermore, information about lifestyle changes the participants may have made prior to this study was not available, making it difficult to determine if increased BMI was indeed a side effect of atypical antipsychotic medication, let alone any other variable examined in this study. It is also difficult to determine if increased BMI is a side effect of atypical antipsychotic medication in this study because when body fat percentage was examined in supplemental analysis as the outcome variable, the effect of atypical antipsychotic medication use was not significant. This contradiction in results based on outcome variable highlights the importance of interpreting the results surrounding atypical antipsychotic medication with these limitations in mind.

Lastly, change in BMI was calculated using baseline height instead of post-treatment height. This was due to measurement error in the post-treatment heights that were collected for the participants in the study. There may be implications for not using the post-treatment height of participants in the BMI calculations. Using baseline height measurements failed to account for potential growth spurts of the participants over the seven week period of the study. If the participants had growth spurts over the seven week period, there is potential that changes in BMI over time were underestimated, thus possibly contributing to the minimal differences in change in BMI over time between participants in this study.

Future Directions

Future studies may investigate the predictive validity of the URICA in more representative adolescent clinical populations. Specifically, diverse, low SES populations

are at higher risk for obesity and stages of change measures may prove beneficial for informing prevention and treatment in these populations, but their applicability to non-minority populations may differ. Furthermore, parenting relationship has been found to be a critical influence on children who are obese or overweight (Kitzman-Ulrich, et al, 2010; Rhee, 2008; Barlow & Chang, 2007). Interventions that include a parenting component would likely benefit from a measure like the PRQ-CA that provides a broad perspective of the parenting relationship and can inform necessary interventions. Future studies may investigate the validity of such a measure in a clinical adolescent population and its generalizability to multicultural populations. Furthermore, evidence suggests that parenting stress is not a significant predictor of adolescent BMI or change in BMI (Barlow & Chang, 2007; Guilfoyle et al., 2010). Although not significant, trends from this study suggest that parenting stress may be correlated with deficiencies in other components of the parenting relationship (i.e., communication, attachment, etc.). Future investigation into the possible influence of parenting stress on the relationship between parenting relationship and adolescent BMI is warranted.

Given that atypical antipsychotics can induce weight gain and may make it difficult for motivated adolescents to lose weight despite healthy lifestyles, future studies can investigate the impact of psychosocial treatments on obese adolescents who are using atypical antipsychotics. Research in this area may provide important information about the efficacy of such treatments when atypical antipsychotics are also employed.

Conclusions

This study targeted an important topic in today's global society. Childhood obesity is a global epidemic and little is known about factors that influence weight status

and treatment outcomes in the adolescent population that struggles with this chronic condition. The results obtained in this study may provide groundwork for interventions intended to increase treatment outcomes for adolescents with obesity and ultimately their quality of life.

Specifically, the use of atypical antipsychotic medication was found to be a significant predictor of lower baseline BMI, although there were only two individuals in the sample that were using atypical antipsychotic medication at the time of the study. The prescription of atypical antipsychotics to children/and adolescents will almost certainly continue to increase. Consequently, it is likely that the number of adolescents taking atypical antipsychotics will also continue to increase.

Implications for School and Child-Focused Psychologists. It is important for psychologists across settings to engage in multidisciplinary collaboration when providing psychotherapeutic prevention and treatment to adolescents with obesity. Psychologists with awareness of the potential impact of atypical antipsychotic medication may be able to contribute to understanding and treatment of adolescents with obesity in ways that are beyond the capabilities of other professionals. Child-oriented psychologists with competency in evidence-based psychosocial interventions across all settings (e.g. hospitals, schools, and community) may help inform thoughtful consideration of psychosocial alternatives, or the integration of drug, psychosocial, and educational interventions. Integrated treatment may enable lower doses of the drug (Pelham, Burrows-MacLean, Gnagy, E., Fabiano, Coles, & Tresco, 2005) potentially limiting side effect risk. For obese adolescents in particular, limiting the increases in body weight and BMI may be especially important in reducing risk for secondary complications (e.g.

diabetes) and psychosocial difficulties associated with obesity Parenting confidence was found to be a significant predictor of lower initial BMI in adolescents. Interventions that target improving the parenting relationship, an important ecological influence on adolescent functioning, in conjunction with behavior weight management interventions may enhance outcomes for adolescents and future investigation into this area is warranted.

Although the other variables examined in this study were not found to be significant, future studies should explore the impact of parenting relationship, parenting stress, and individual motivation to change. Future studies that examine these variables could contribute to a better understanding of factors influencing adolescent obesity and improved treatment outcomes in this population.

Lastly, the care of obese adolescents requires a multidisciplinary approach. Schools are important settings to implement prevention and intervention strategies that can influence the health behaviors of adolescents. Schools are a logical setting to provide treatment to adolescents and their families. Targeting the eating and exercise habits of young people early may produce patterns with lasting effects. School psychologists can play an important consulting role in bridging communication and treatment efforts between the family, school, and medical systems of adolescents to address the issues of adolescent motivation and parenting relationship that impact obesity prevention and treatment outcomes.

With an understanding of intraindividual and ecological factors such as readiness to change and parenting relationship, psychologists and other professionals working with adolescents with obesity can target psychosocial interventions that are feasible for the

individual's motivation level and family system. Adolescent treatments that account for systemic factors can improve the applicability of interventions across settings to create consistency for adolescents and foster successful decreases in BMI to potentially reduce adulthood obesity, improve quality of life, and help to overcome the global obesity epidemic.

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Appendix A

Tables and Figures

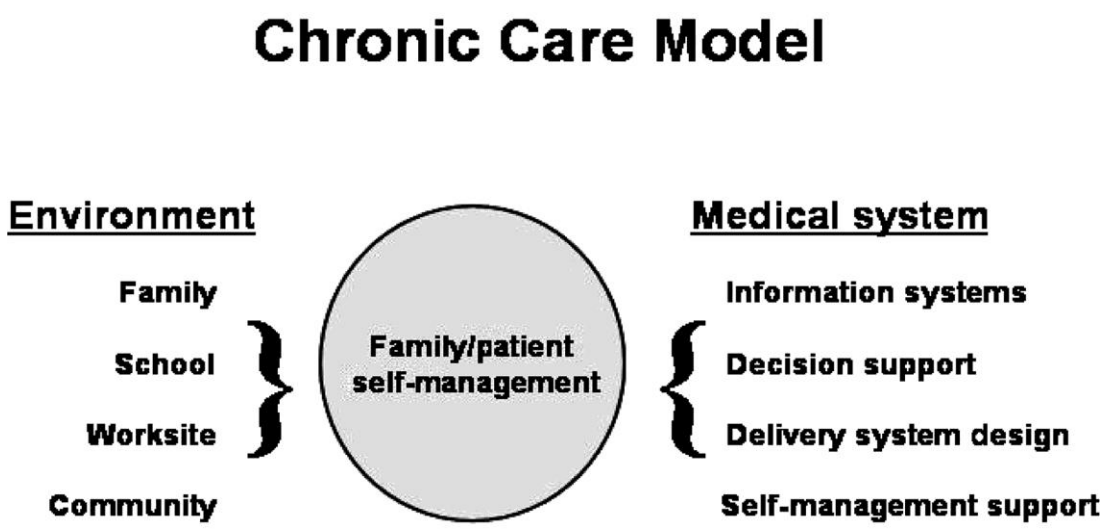

Figure 1: Chronic Care Model for Pediatric Obesity. (Bodenheimer, Wagner, & Grumbach, (2002).

Table 1

PRQ-CA Scale Definitions (Kamphaus & Reynolds, 2006)

Scale	**Definition**	**Parenting Practices**	**Parenting Style**	**Parenting Stress**
Communication	The quality of information exchanged between the parent and child and the parent's listening skills that promote a trusting relationship.	**x**		
Parenting Confidence	The comfort, control and confidence of the parent when actively involved in the parenting process and when making parenting decisions.	**x**		
Involvement	The extent to which the parent and child participate together in variety of common activities, along with the parent's knowledge of the child's activities.	**x**		
Attachment	The affective, cognitive, and behavioral relationship between a parent and child that results in feelings of closeness, empathy, and understanding on the part of the parent for the child.		**x**	
Discipline Practices	The tendency of a parent to consistently apply consequences or punishment in response to a child's misbehavior, along with a belief that rule establishment and adherence to rules is desirable.		**x**	
Relational Frustration	The parent's level of stress or distress in relating to and controlling the behavior and affect of the child along with the tendency to overreact and become frustrated in common parenting situations.			**x**

Table 2

Sample Demographic Statistics (n=41)

Variable	
Adolescent age M± SD (range), years	14.35 ± 1.51 (12.2-18.3)
Participant gender (%)	
Female	53.7
Male	39.0
No Response	7.3
Race/Ethnicity (%)	
White	4.9
Black	19.5
Hispanic	63.4
Other	12.2
Total Family Income (%)	
Less than $10,000	9.8
$10,000-$19,000	36.6
$20,000-$29,999	17.1
$40,000-$49,999	9.8
$50,000+	12.2
No Response	14.5
Participant Weight at baseline M± SD (range), kg	105.43±24.08 (66.8-164.00)
Participant Height at baseline M±SD (range), cm	162.9±5.65 (149.5-175.2)

Table 3

Adolescent Weight Management Program: Topics Covered by Week

Week	**Topic**
1	Informed Consent, Rapport Building, Group Rules
2	Setting Goals
3	Problem Solving and Reinforcement
4	Assertive Communication
5	Stimulus Control
6	Personal Strengths and Self-Esteem
7	Next Steps

Table 4

Descriptive Statistics for Level 2 Variable: Stages of Change (n=32)

Stage	**Percent**	***n***
Precontemplation	21.9	***7***
Contemplation	62.5	*20*
Action/Maintenance	15.6	*5*

Note: Missing data for Stages of Change (n= 9)

Table 5

Descriptive Statistics for Level 2 Variables: Parenting Relationship Questionnaire (n=33)

Scale	Mean	SD	Min.	Max.
Attachment	48.64	11.40	23	71
Communication	46.30	11.73	25	66
Discipline Practices	45.79	11.36	24	67
Involvement	48.67	10.61	33	74
Parenting Confidence	44.45	10.40	26	66
Relational Frustration	55.61	11.11	38	86

**Parenting Relationship Questionnaire reported in T-scores, M=50, SD=10*
Note:Missing data for Parenting Relationship Questionnaire (n = 8)

Table 6

Descriptive Statistics for Level 2 Variables: The use of Atypical Antipsychotic Medication (n=39)

Atypical Antipsychotic Status	N	%
Atypical Antipsychotic Present	2	5.1
Atypical Antipsychotic Absent	37	94.9

Note:Missing data for the use of Atypical Antipsychotic Medication (n=2)

Table 7

Descriptive Statistics BMI by week

Week	n	Mean	SD	Min.	Max.
1	37	39.44	8.19	28.2	58.23
2	19	38.05	6.49	29.05	57.50
3	22	39.22	7.91	28.16	57.95
4	25	38.39	7.41	27.99	58.91
5	20	39.84	8.11	29.21	58.79
6	17	39.14	8.76	28.08	58.79
7	20	38.53	8.07	27.99	58.35

Table 8

Multilevel Regression Modeling Analysis Results: The Full Model(Model 3)

Variable	Coefficient	SE	*p*	Information Criterion (CAIC/BIC)
Level 1				
Intercept	39.49	1.33	.000**	382.00
Week	0.020	0.019	.309	376.00
Level 2Full Model				
Stages of Change* **				
Precontemplation	1.44	4.19	.733	330.68
Precontemplation x week	0.023	0.081	.783	330.68
Contemplation	0.378	3.50	.915	320.47
Contemplation x week	0.004	0.067	.954	320.47
Atypical Antipsychotic Presence	-13.44	4.12	.003**	310.49 300.49
Atypical Antipsychotic Presence X Week	0.01	0.071	.880	
Attachment	-0.117	0.119	.334	317.29
Attachment X Week	-0.002	0.002	.327	309.29
Communication	0.009	0.116	.941	319.41
Communication X Week	-0.000	0.002	.923	311.41
Discipline Practices	0.106	0.111	.350	317.92
Discipline Practices X Week	-0.002	0.002	.382	309.92
Involvement	0.033	0.126	.793	319.33
Involvement X Week	0.003	0.002	.890	311.33
Parenting Confidence	-0.25	0.10	.016*	310.49
Parenting Confidence X Week	-0.001	0.002	.550	300.49
Relational Frustration	0.060	0.117	.611	318.79
Relational Frustration X Week	0.001	0.002	.576	310.79

Note. *Statistically Significant, $p<.05$ ** Statistically Significant, $p<.01$ ***versus baseline Action/Maintenance stage