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The Association Between Parenting Factors And Light And Moderate-To-Vigorous Physical Activity Levels In Overweight African American Adolescents

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ABSTRACT

Overweight adolescents are less likely to meet physical activity (PA) recommendations as compared to healthy weight youth. Family environment and parenting practices may influence PA rates in adolescents, but few studies have examined this relationship in African American youth. The current study expands on past literature by examining associations between parenting factors and daily light PA (LPA), MVPA, and total PA. It was hypothesized that parenting factors would be positively associated with PA and that practices specific to PA (autonomy support for PA, emotional support, tangible support, and modeling) would be more strongly associated with PA outcomes compared to more general parenting practices (authoritative parenting style, autonomy support for health behaviors). Data were collected in a sample of African American adolescents (N = 148; M_{age} = 13.56 years; 66% female; $M_{BMI\%}$ = 96.54) and their caregivers (M_{age} = 43.36 years; 94% female) enrolled in the Families Improving Together (FIT) for Weight Loss trial. Parenting factors were measured using survey data, and minutes of PA were measured using Actical accelerometers. Regression analyses indicated that the overall model for child LPA was significant (F (10, 136) = 6.13; R^2 = 0.31). Parenting style (B= 16.43, SE= 4.37), emotional support (B= -10.27, SE= 4.79), and home environment (B= 9.55, SE= 3.97) significantly predicted LPA. The overall model for total PA was also significant (F (10, 136) = 7.02; R^2 = 0.34). Parenting style (B= 17.40, SE= 4.90), emotional support (B= -13.00, SE= 5.33), tangible support (B= 11.43, SE= 4.45), and autonomy support specific to PA (B= 12.31, SE= 5.69) were

significant predictors of total PA. Parenting factors did not significantly predict MVPA beyond covariates. Results provide initial support that parenting factors are associated with daily LPA and total PA in overweight African American youth. Factors related to home climate (parenting style and tangible support) were most strongly associated with PA overall. High levels of emotional support were associated with lower levels of LPA and total PA, consistent with some previous studies. Future interventions should aim to improve home climate and autonomy support for PA to encourage increased PA in overweight, African American youth.

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

Physical activity (PA) has been identified as an important factor influencing both general health and healthy weight maintenance in youth (Boone, Gordon-Larsen, Adair, & Popkin, 2007; Hanson & Chen, 2007). However, PA levels have been shown to decrease significantly as children transition into adolescence (Brodersen, Steptoe, Boniface, & Wardle, 2007; Gortmaker et al., 2012; Nader, Bradley, Houts, McRitchie, & O'Brien, 2008). Overweight adolescents are more likely to see these declines in PA (Basterfield et al., 2011) and have lower activity levels overall (Chung, Skinner, Steiner, & Perrin, 2012; Whitt-Glover et al., 2009). Currently only between 11.4% (as measured by accelerometry) and 29.4% (as measured by self-report) of African American adolescents meet national recommendations of engaging in 60 minutes of moderate-to-vigorous physical activities per day (Song, Caroll, & Fulton, 2013; Whit-Glover et al., 2009). These weight-related behavioral patterns established during youth track into adulthood (Craigie, Lake, Kelly, Adamson, & Mathers, 2011). Thus examining factors such as parenting behaviors that may facilitate PA in overweight and obese African American adolescents is important for addressing low levels of activity in this population.

Family environment plays a critical role in shaping youth activity (Sterdt, Liersch, & Walter, 2013). Parents have influence on youth PA levels through a variety of parenting behaviors such as facilitating activity by providing equipment or transportation, planning active family activities, encouraging or providing social support for activity,

role modeling positive health behaviors, setting limits for sedentary behaviors, and monitoring activity levels (Sleddens et al., 2012). Socialization of behaviors occurs within the family context with the caregiver's behaviors significantly impacting youth health behaviors, like PA, through observational learning (Davison & Birch, 2001). Literature examining the influence of parenting behaviors on youth PA has demonstrated that emotional support, tangible support, and modeling an active lifestyle are important predictors of increased youth activity levels (Pugliese & Tinsley, 2007). Previous research has shown that parent behaviors, such as parent participation in PA and tangible support (driving the child to sports practices, providing equipment for PA) are particularly influential on PA of high-risk youth (low activity, overweight) who may have fewer role models and peer supports for activity (Davison, Cutting, & Birch, 2001).

Previous investigators have described limitations in the measurement of parenting around health behaviors (Davison et al., 2013; Kremers et al., 2013; Patrick, Hennessy, McSpadden, & Oh, 2013), noting that future research is needed to examine the difference between conceptualizing general parenting style and parenting practices specific to health behaviors. Global parenting style has been referred to as the context in which the parent influences the child's behaviors (i.e. warm and responsive versus demanding), while parenting behaviors are aimed at improving behaviors that may vary across behavioral domains (eating, screen-time, PA; Patrick et al., 2013). Parenting practices specific to PA may be more predictive of youth PA behavior in comparison to general parenting measures (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). In the development of a measure of social support for diet and exercise, Sallis and colleagues (1987) found that scales measuring support specific to PA was significantly associated with youth PA

behavior. General measures of parent support (defined broadly) were not associated with health habits, suggesting that measures specific to PA are more predictive of PA behavior. However, in the PA literature, conceptualization of PA parenting behaviors varies significantly across study and instruments used, limiting comparisons of studies with varying PA outcomes and samples (Trost, McDonald, & Cohen, 2013).

Similarly, examining influences on youth PA can be difficult due to limitations of PA measurement (Sirad & Pate, 2001). Numerous studies have examined youth activity as the outcome, but often use self-report measures, such as surveys, 24-hour recalls, or activity frequency questionnaires, that are susceptible to overestimation bias (Welk, Corbin, & Dale, 2000). Accelerometry data can be used to estimate intensity and duration of activity more accurately without being susceptible to error due to social desirability or recall bias (Rachele, McPhail, Washington, & Cuddihy, 2012; Reilly, Penpraze, Hislop, Davies, & Paton, 2007). Furthermore, the majority of research on PA focuses on moderate-to-vigorous intensity of PA (MVPA; >3 metabolic equivalents (METS); Powell, Paluch, & Blair, 2011). However, interest and measurement of the impact of other levels of intensity of PA, such as light PA (LPA; 1.6-2.9 METs, stretching, walking, housekeeping) on health outcomes is increasing (Pate, O'Neill, & Lobelo, 2008; Powell et al., 2011).Greater levels of LPA have been associated with weight related outcomes and other health benefits including reduced blood pressure, cholesterol, plasma lipids, and diabetes risk in youth (Carson et al., 2013; Cliff et al., 2013) and adults (Healy et al., 2008; Hu, Li, Colditz, Willett, & Manson, 2003; Katzmarzyk, Church, Craig, & Bouchard, 2009; Powell et al., 2011). Additionally, increasing LPA may be more feasible than increasing MVPA in youth who are overweight or obese as this population has been

shown to experience increased barriers to more intense forms of activity (Powell et al., 2011; Taylor, Sallis, Dowda, Freedson, & Eason, 2002; Zabinski, Saelens, Stein, Hayden-Wade, & Wilfley, 2003).

The present study expanded on past literature by examining the associations between parenting factors and LPA and MVPA in overweight African American youth. This study also advanced the field by using accelerometry estimates that have been shown to be more valid than self-reported measures. Thus, this study specifically evaluated the associations of parenting behaviors (including parenting style, autonomy support, emotional support, tangible support, and modeling of MVPA) and accelerometry-measured LPA and MVPA in overweight African American adolescents.

1.1 Theoretical Foundations of Influences of PA in Youth

There is ample evidence that family factors influence health behaviors in youth (Berge, 2009; Ding, Sallis, Kerr, Lee, & Rosenberg, 2011; Kaushal & Rhodes, 2014; Lawman & Wilson, 2012; Sallis et al., 2000; Kitzman-Ulrich et al., 2010). According to family systems theory (FST), the family is a system of interconnected individuals and serves as a context for understanding behaviors (Broderick, 1993). The family environment can positively influence youth health behaviors by providing a warm and supportive setting for learning, growth, and development (Kitzman-Ulrich et al, 2010). Parenting styles describe the relationship and emotional environment parents create through interactions with their child (Patrick et al., 2013), and are usually described as in terms of level of responsiveness (acceptance, nurturance, warmth) and demandingness (monitoring, structure; Baumrind, 1971). Authoritative parents balance demandingness

and control over behaviors with high levels of warmth and support in contrast to parents who are authoritarian (high control, low warmth) or permissive (low control, high support). Authoritative parents typically engage in positive parenting behaviors including providing emotional (encouragement, praise), tangible (providing resources), and autonomy support (providing opportunity for youth to influence decisions and fostering self-regulation). Authoritative parents also set appropriate limits (often with the input from the child) and provide moderate levels of monitoring of behaviors, while maintaining a positive, warm parent-child relationship (high nurturance).

This authoritative parenting style is generally considered most conducive to positive child outcomes (in comparison to authoritarian, permissive or neglectful parenting) as it results in a supportive environment characterized by shared decision-making (autonomy support). Authoritative parenting behaviors are associated with decreased adolescent risk behavior, increased prosocial behavior, and improved health outcomes (DeVore & Ginsburg, 2005; Halliday, Palma, Mellor, Green, & Renzaho, 2014; Huebner & Howell, 2003; Jackson, Henriksen, & Foshee, 1998; Steinberg, Mounts, Lamborn, & Dornbusch, 1991). Previous research suggests that encouraging parenting behaviors consistent with authoritative parenting styles, such as autonomy-support, emotional support, and tangible support, in obesity interventions is an effective strategy for improving adolescent health behaviors and weight outcomes (Golan, 2006; Kitzman-Ulrich et al., 2010; Wilson et al., 2015). Autonomy support is a particularly relevant skill for parents of adolescents who are developing autonomy, independent decision making, and self-regulation as they move into youth adulthood (Ryan, Deci, Grolnick, LaGuardia, 2006; Zimmer-Gembeck & Collins, 2003). Consistent with family

systems theory, this study will evaluate parenting factors such as parenting style, autonomy support, emotional support, and tangible support as important predictors of adolescent LPA and MVPA.

Social cognitive theory (SCT) argues that health behaviors are reciprocally influenced by social, environmental, and cognitive factors (Bandura, 1998, 2001). Consistent with this framework, parents can shape adolescent health behaviors by influencing both the social context and cognitive factors surrounding health behaviors. Parents have the ability to transmit beliefs to their children around the values of health by role modeling healthy behaviors (Rimal, 2003), and there is evidence that these parental influences continue into young adulthood (Lau, Quadrel, & Hartman, 1990). Individuals are more likely to mimic behaviors by someone with whom they identify and have an emotional attachment (Bandura, 1971), which give parents a unique influential role in promoting positive health behaviors in their children. This social learning is facilitated by an interaction between behavior and appropriate environmental supports, which includes both emotional and tangible support from parents.

Previous research has shown that parent factors associated with SCT (modeling, emotional and tangible support) are important in understanding youth PA (Beets, Cardinal, & Alderman, 2010; Pugliese & Tinsley, 2007). For example, in one review of parent factors that have been shown to influence youth PA identified social supports and modeling as key parenting practices that promote youth PA (Pugliese & Tinsley, 2007). Based on the results of the meta-analysis of 30 cross-sectional studies, youth with parents who modeled PA behaviors (i.e. participated in activity themselves) were 1.49 times more likely to be active. Youth whose parents provided emotional support for PA

(encouragement, prompting, praise) were 2.34 times more likely to be active and youth whose parents provided tangible support (facilitated or provided opportunity for activity) were 2.07 times more likely to be active. These results suggest that parental modeling and emotional and tangible parent support are positively associated with youth PA behavior.

Support for the importance of parent factors for adolescent PA has also been shown in longitudinal studies. Parent emotional (encouragement) and tangible support (tangible support such as transportation) has been linked to attenuation of the typical rate of decline in PA into adolescence (Dowda, Dishman, Pfeiffer, & Pate, 2007). In a study by Bauer and colleagues, adolescent girls whose parents provided support for PA (defined as encouragement, joint participation in PA, and tangible support) were less likely to show a decline in PA over five years compared to girls whose parents provided low levels of support. Similar results have been shown for adolescent boys (Bauer, Nelson, Boutelle, & Neumark-Sztainer, 2008), such that males whose parents encouraged PA (provided emotional support) engaged in more hours of MVPA over five years compared to males receiving lower levels of parental emotional support. In addition, tangible support has been associated with PA longitudinally in both boys and girls (Siceloff, Wilson, & Van Horn, 2014). There is also evidence that parent modeling of PA is important over time (Davison & Jago, 2009; Madsen, McCulloch, & Crawford, 2009). For example, consistent parental modeling (being active with their child, participating in MVPA) has been shown to be protective against the decline of PA levels in girls in adolescence such that girls with parents who engaged in greater amounts of PA modeling were less likely to have declines in MVPA over time (Davison & Jago, 2009). Taken

together these studies show the importance of examining both types of parental support and parent modeling in understanding youth PA behaviors across adolescence.

In summary, there is evidence-based support for evaluating the associations of emotional support, tangible support, and modeling with youth PA. However, the present expands on past research by examining these factors in African American overweight youth with focus on LPA, MVPA and total PA.

1.2 Studies on Parenting Practices and PA in Adolescents

Previous literature reviews have shown associations between parenting practices and adolescent PA in numerous cross-sectional studies (Lawman & Wilson, 2012), however, interventions targeting parenting skills have only been modestly effective at impacting a range of targeted adolescent health behaviors including PA (Kitzman-Ulrich et al., 2010). Parenting practices associated with family systems theory and social cognitive theory (parenting style, autonomy support, emotional support, tangible support, and modeling of MVPA) may be important in influencing underserved/overweight adolescent PA behaviors. Below is a summary of the previous research on parenting factors and PA outcomes in youth.

Authoritative Parenting

There is limited previous research that has assessed the association of general parenting style with adolescent PA behavior. Few previous investigators have integrated general parenting style into studies describing youth obesogenic behaviors, including PA (Patrick et al., 2013), and overall there is not agreement on whether general parenting or specific parenting behaviors are more useful. General parenting style may serve as a

context in which specific parenting practices (providing social support, limits, etc.) occur (Patrick et al., 2013). However, previous studies have also shown that parenting practices specific to the health behaviors are more strongly associated with youth behaviors than general parenting practices (Sallis et al., 1987) or general parenting style (Vereecken, Legiest, de Bourdeaudhuij, & Maes, 2009). Existing studies examining associations between general parenting style and adolescent PA have shown inconsistent findings. Thus, more studies are needed to fill this gap in the literature.

Two studies have shown positive associations between authoritative parenting (moderate control, high support) and youth PA over time, providing support for the relationship between general parenting style and PA behaviors (Lohaus, Vierhaus, & Ball, 2009; Schmitz et al., 2002). A longitudinal study found predicted effects of general authoritative parenting on adolescent PA over one year for girls but not boys (Schmitz et al., 2002). Authoritative parenting was conceptualized broadly using the Authoritative Parenting Index (Jackson et al., 1998) and was positively associated with adolescent girl's self-reported PA. Lohaus, Vierhaus, & Ball (2009) also found positive associations between authoritative parenting and PA (as included in a self-report positive health behavior index) over 3 years. Authoritative parenting, measured from the child's perspective, was conceptualized as having high levels of warmth and support with moderate levels of control and was not specific to a health behavior. These two studies offer preliminary support that an authoritative general parenting may be associated with adolescent PA.

Some studies, however, have not demonstrated significant relationships between general parenting style and adolescent PA. Berge and colleagues (2010) found that

parenting style was not significantly associated with adolescent self-report PA in a 5-year longitudinal study. Parenting style was measured using three items assessing parent responsiveness and demandingness, with authoritative parenting classified as high responsiveness and high demandingness. A cross-sectional study using accelerometry MVPA data also found no positive association between general authoritative parenting and adolescent PA (Jago et al., 2011). Authoritative parenting was conceptualized using youth-report measures of warmth and control (high warmth, high control). In contrast to the current hypothesis, permissive parenting (conceptualized as high warmth, low control) was associated with increased minutes of MVPA. These results, however, may be due to the measurement of parenting style, as authoritative parenting is generally conceptualized as high support, *moderate* control. Taken together, the studies described demonstrate the inconsistency of the literature around general parenting style and PA outcomes.

While existing studies examining the association between parenting style and PA have strengths (longitudinal design, accelerometry-measured PA), there are some limitations in the literature. Of note, studies conceptualizing and measuring authoritative parenting separately (using an authoritative parenting index or other authoritative parenting style-specific measure) or conceptualized authoritative parenting as high warmth, moderate control found positive associations between authoritative parenting and adolescent PA. In contrast, studies that did not find a significant association used composite measures of warmth/responsiveness and control/demandingness from which authoritative parenting was categorized (high warmth, high control). Further, in three of the four studies, the PA outcome was either self-report or part of a self-report index of

health behaviors. Strengths of the current study include the use of an authoritative parenting index (Jackson et al., 1998) coupled with accelerometry -measured PA outcomes. In summary, while there is some support for the association between parenting style and youth PA, further research is needed to better understand whether general measures of authoritative parenting style will be associated with accelerometry -measured PA outcomes in overweight African American youth.

Autonomy Support

Autonomy support has been increasingly integrated into PA interventions and has included encouraging youth's independence, offering choice in type of PA activities, and being respectful and responsive to youth's perspective, opinions, and preferences (Lekes, Gingras, Philippe, Koestner, & Fang, 2010). Several successful school-based interventions have incorporated autonomy support as a successful strategy for increasing PA in adolescents (Lonsdale et al., 2013; Wilson et al., 2005; Wilson et al., 2011). Lonsdale and colleagues (2013) conducted a small randomized controlled trial involving providing choice to adolescents in physical education classes. Classes were randomized to three conditions in addition to usual practice: explaining relevance of PA, providing a choice of two organized games, or complete free choice in which the teacher provided equipment and allowed each youth to choose their own activity. Adolescents in classes given free choice (autonomy to make decisions) spent significantly more time in accelerometry -measured PA compared to the other conditions, suggesting that increased autonomy was predictive of engagement in MVPA. Other school-based interventions that have incorporated autonomy-support have also been successful at increasing adolescent PA (Wilson et al., 2005, 2011). Additionally, a positive relationship was found between

perceived autonomy support from coaches and accelerometry-measured MVPA in adolescent males (Fenton, Duda, Quested, & Barrett, 2014). Taken together, these school-based studies provide evidence that autonomy around PA is associated with increases in PA behaviors in youth, which suggests that autonomy support may be an important parenting skill related to adolescent PA.

Several cross-sectional studies have examined associations of autonomy support from parents with adolescent PA, with results suggesting that autonomy support is associated with youth health behaviors (Christiana, Davis, Wilson, McCarty, & Green, 2014; Gonzalez-Cutre, Sicilia, Beas-Jimenez, & Hagger, 2014; McDavid, Cox, & Amarose, 2012; Rutten, Boen, & Seghers, 2013). McDavid and colleagues (2012) evaluated the impact of autonomy support from parents on leisure-time MVPA (PA behavior after school and on weekends) in youth. This study found that both autonomy support from mothers and autonomy support from fathers, as measured by a youth-report measure assessing parent's autonomy support specific to PA, were associated with adolescent self-report leisure-time PA. Gonzales-Cutre et al. (2014) found similar results. Perceived parental autonomy support for PA was significantly associated with self-report adolescent leisure-time PA. Youth perceptions of parent autonomy support specific to PA has also been positively associated with other adolescent PA behaviors, including youth reports of noncompetitive outdoor PA (cooperative unstructured activities such as playing tag, biking, swimming, etc.; Christiana, Davis, Wilson, McCarty, & Green, 2014). An association between parental autonomy support and objectively-measured PA has also been shown (Rutten et al., 2013). Adolescent reported parental autonomy support specific to PA was associated with PA as measured by pedometers in early adolescents. The

positive associations found between parent autonomy support for PA and adolescent PA behaviors lends support to autonomy support for PA being a valuable parenting skill that may be associated with PA in adolescents.

While the majority of literature supports the relationship between autonomy support and adolescent PA and suggests it may be a useful parenting skill for encouraging PA, two known studies did not find a significant association (Rutten, Boen, & Seghers, in press; Vierling, Standage, & Treasure, 2007). Rutten et al. (in press) assessed associations between perceived parental support for PA at 6th grade and adolescent PA (pedometer and self-report) at 8th grade and found no significant association over time. It was not reported if perceived autonomy support from parents was significantly associated with PA behavior at baseline. Adolescent-reported autonomy support from parents was not significantly associated with pedometer-measured PA in a sample of Hispanic youth (Vierling et al., 2007). This study used a measure of autonomy support that included items related to general autonomy support (12 items) and autonomy support specific to PA (3 items). Taken together, these results suggest that it may be important for autonomy support from parents to be specific to PA behaviors and that there is not yet evidence for a longitudinal relationship between parental autonomy support and adolescent PA.

In summary, there is evidence that autonomy support specific to PA is an important construct related to adolescent PA and that autonomy support as a parenting skill is related to youth PA behaviors. The present study will expand on past literature by evaluating cross-sectional associations of parent autonomy support specific to health behaviors, autonomy support specific to PA, and accelerometry-measured MVPA and LPA outcomes in African American adolescents.

Social Support

Extensive literature has examined the relationship between parent-provided emotional support, tangible support, and adolescent PA behaviors and found generally positive associations (Beets et al., 2010; Cislak et al., 2012, Pugliese & Tinsley, 2007). However, these types of social support are distinct and may not influence adolescent PA in the same way (Beets et al., 2010). Emotional support is defined as encouragement or praise that motivates youth to participate in PA, while tangible support directly facilitates PA behavior and may include providing transportation, paying fees associated with activity, or providing equipment for PA (Beets et al., 2010; Cislak et al., 2012). There is little research that describes the relative associations of differing types of social support on adolescent PA behavior in African American youth (Siceloff et al., 2014). Therefore, it is important to evaluate the relationship of both types of support (emotional vs. tangible) with youth PA.

Tangible support is conceptualized in the present study as provision of PA equipment in the home has been positively associated with adolescent PA behaviors in cross-sectional studies and in longitudinal studies. Providing equipment for PA may directly facilitate adolescent PA behaviors. Siceloff et al. (2014) found positive associations between parent tangible support (measured as a composite of purchasing PA equipment for the home and providing transportation) and accelerometry-measured MVPA at baseline measure and over time (19 weeks). Parent provision of PA equipment in the home (including outdoor/yard, sports, and fitness equipment) was positively associated with accelerometry-measured MVPA in a sample of adolescents (Sirad, Laska, Patnode, Farbakhsh, & Lytle, 2010). Parent provision of home PA equipment (such as

sports and fitness equipment) was also positively associated with MVPA in an adolescent sample using energy expenditure as the PA outcome variable (Fein, Plotnikoff, Wild, & Spence, 2004). Similar positive associations have been found when self-report PA outcomes are used. In a sample similar to the current study (adolescents who are minimally active), home PA equipment (items including treadmill, bicycle, basketball hoop, weights, and others) was significantly associated with self-reported active lifestyle activities (taking the stairs, walking; Dunton, Jamner, & Cooper, 2003). Rosenberg et al., (2010) found significant positive associations between adolescent PA and home PA equipment using a 2-item self-report measure of PA when using the measure utilized in the current study. Further, increased exercise equipment in the home was associated with increased likelihood of the female (not male) adolescents meeting PA guidelines (OR= 1.27), measured using a 7-day PA recall (Kerr, Norman, Sallis, & Patrick, 2008). The studies described provide strong evidence that tangible support in the form of parent provision of PA equipment is associated with PA outcomes in youth.

There is also support for the positive association between parent emotional support and adolescent PA. In a sample of predominantly African American adolescents participating in the Active by Choice Today trial, parental support was associated with higher adolescent accelerometry-measured MVPA (Wilson, Lawman, Segal, & Chappell, 2011). In this study support for PA was measured using an adolescent-report measure (Sallis et al., 1987; used in the current study). Emotional support has also been associated with self-report PA behavior. Adolescent-reported parental emotional support was significantly associated with adolescent MVPA as measured by a 7-day PA recall in a sample of urban adolescent girls (Kuo, Voorhees, Haythornthwaite, & Young, 2007).

McGuire et al. (2002) also examined the effects of parent-reported and adolescent-reported parent emotional support (encouragement) on total adolescent PA and found a positive relationship for both male and female adolescents. Further, in a national sample of youth, parent emotional support was associated with an increase in youth PA in both boys and girls (Sallis, Prochaska, Taylor, Hill, & Geraci, 1999). Youth PA in this study was measured as a composite of youth-reported behavior and parent perceptions of their child's PA. Taken together, there is evidence that emotional support may be an important parenting skill associated with adolescent PA.

Despite the evidence for associations between tangible and emotional support, there is some literature that found mixed or insignificant results. A longitudinal study of participants in the ACT trial did not find a significant association between parent emotional support and accelerometry-measured MVPA at baseline or over time (Siceloff et al., 2014), but showed significant associations for tangible support. A second longitudinal study found that parent-reported emotional support (encouragement of PA) was not associated with adolescent PA (measured using a composite of self-report 1-day recall, parent report, and 1 day of accelerometry data) at baseline or over time, while tangible support (conceptualized as transportation) was significantly associated with change in PA over time (Sallis, Alcaraz, McKenzie, & Hovell, 1999). These studies, taken together, suggest that instrumental support may be more strongly associated with MVPA in adolescents compared to emotional support and more research including both types of parent support should be conducted.

Mixed results have also been found in studies including LPA as an outcome. Increasing LPA may be a successful strategy for obtaining health benefits associated with

PA in populations facing increased barriers to intensive exercise (Powell et al., 2011). While few studies have evaluated the effects of parent emotional social support on LPA, a recent study found that emotional support was a significant predictor of accelerometry-measured LPA in a sample of overweight/obese predominantly African American adolescents (Lawman & Wilson, 2014). However, the association was not significant for parent emotional support and MVPA. This study also included tangible support (provision of home PA equipment). Home PA equipment was not associated with MVPA, but a trend ($p=0.10$) was found for the association with LPA. While this study only provides preliminary evidence, it suggests that parent support behaviors may be associated with LPA, but not to MVPA in overweight/obese samples.

Additionally, there is a small body of research that has shown differences in associations between parent social support and adolescent PA depending on measurement approach. Prochaska, Rodgers, & Sallis (2002) examined associations of a composite measure of youth-reported parent social support for PA (including tangible support and emotional support) with both self-report PA and PA as measured with accelerometry. Parent social support was significantly associated with self-report PA (measured with a 2-item screener), but was not associated with MVPA as measured by accelerometry data. Similarly, access to and use of home PA equipment was positively associated with MVPA as measured by a self-report PA recall in a sample of adolescents (Maddison et al., 2009). However, this study did not find significant associations with accelerometry data. In sum, these results suggest that measurement of PA and parent support may be important in understanding the relationship between parent support and adolescent PA

behavior and more studies using objective measurement of PA should be conducted to clarify the relationships.

The current study will build on this literature by using valid and reliable measures of parent emotional and tangible support as predictors of accelerometry-measured MVPA and LPA. Despite some limitations of the literature including the use of self-report PA in many studies, there is support for positive associations between parent emotional and tangible support on adolescent PA behaviors. Emotional support for PA has been associated with MVPA across studies (Cislak et al., 2012) and recent research has suggested that it is an important parenting behavior for LPA as well (Lawman & Wilson, 2014). Tangible support as measured by provision of PA equipment may be particularly influential for populations who are less likely to participate in organized PA behaviors (Kerr et al., 2008). Therefore, in the current sample of overweight/obese adolescents that are less likely to participate in organized sports outside the home (Elkins, Cohen, Koralewicz, & Taylor, 2004), home PA supports (specifically availability of exercise equipment such as basketball hoops, jump rope, home aerobic equipment, or weight lifting equipment) may be an important facilitator of PA behavior. Consistent with previous literature, it is hypothesized that both emotional support and tangible support will significantly influence levels of adolescent MVPA. However, based on studies examining both emotional and tangible support, it is hypothesized that the relationship between tangible support and adolescent PA may have a larger effect size than the relationship between emotional support and PA. Because there is not a strong literature base for the impacts of types of parent supports on LPA, this study will explore possible associations.

Modeling of MVPA

The literature is somewhat mixed on whether parent role modeling of MVPA is associated with adolescent behavior (Lawman & Wilson, 2014; Sallis et al., 2000; van der Horst, Paw, Twisk, & Mechelen, 2007). However, several longitudinal studies have shown positive associations between parent and adolescent PA behaviors. Consistent parental modeling has shown to be protective against the decline of PA levels in girls across adolescence, such that girls with parents who engaged in greater amounts of PA (as measured by self-report survey) were more likely to maintain higher levels of accelerometry-measured MVPA over time (Davison & Jago, 2009). Madsen, McCulloch, & Crawford (2009) also evaluated the impact of parental modeling of PA on female adolescent PA over time. In this sample, girls who reported their parents exercised 3 or more times a week were 50% more active than girls whose parents were sedentary. Modeling of PA was measured using adolescent reports of the frequency of their parent's exercise behaviors and adolescent PA was measured with a self-report PA frequency questionnaire. A third study found that self-report parent modeling of PA was associated with self-report adolescent PA, but parent and child PA behaviors were not associated with changes in PA over 3 years (Kahn et al., 2008). These studies suggest that parent modeling of PA is an important parenting practice associated with adolescent MVPA and may be related to adolescent PA over time.

Cross-sectional studies have also shown associations between modeling of PA and adolescent PA outcomes. A recent study of examined the relationship between parent modeling and overweight/obese adolescents using accelerometry data for both parent and adolescent MVPA (Tu, Watts, & Masse, in press). Parent MVPA and adolescent MVPA

were positively associated across weekdays, weekday evenings, and weekends. Other studies using objective measurement for both parent and child MVPA using accelerometry data (Fuemmeler, Anderson, & Masse, 2011) and step-counts (pedometer data; Craig, Cameron, & Tudor-Locke, 2013) have also shown positive associations between parent modeling of PA and adolescent activity behavior. There is some support that self-reported parent modeling of PA is associated with adolescent PA. Parent modeling of MVPA predicted adolescent MVPA as measured by a 3-day PA recall (Bauer et al., 2011). Parent modeling of MVPA was defined using three self-report questions around the parent's weekly PA behaviors. Modeling was positively associated with adolescent MVPA when including other parenting related PA influences (home PA resources, parent support), suggests that parent modeling of PA behaviors plays a separate and significant role in adolescent PA behaviors. In summary, there is strong support that parent PA behaviors are associated with adolescent PA, especially when objective measurement is used for both PA outcomes.

There is some literature that did not find significant associations between modeling and adolescent PA behavior. In a longitudinal study, self-reported parent modeling of PA (frequency of parent PA, enjoyment of PA, and the extent to which the parent uses their own activity to motivate their child) was not associated with adolescent PA (neither self-report nor pedometer measured) three years later (Rutten et al., in press). McGuire and colleagues (2002) also found no association between parent PA behavior and adolescent PA behaviors. However, parent PA behavior was measured using a single self-report question and adolescent PA was measured using a self-report questionnaire. Additionally, in a sample of African American early adolescents (8-12 years) and their

parents, parent moderate PA was not correlated with adolescent moderate PA and a small negative correlation was found for vigorous PA (Nichols-English et al., 2006). PA behaviors for both adolescent and parent participants were measured using a 7-day PA recall. In contrast to the majority of studies showing a positive association, these studies use self-report measurement of parental modeling of PA, which suggests that measurement of parental modeling is important.

While the literature is generally mixed around the associations between parent and adolescent PA (Gustafson & Rhodes, 2006; Trost & Loprinzi, 2011), there are several limitations of the current literature. In a recent literature review it was suggested that measurement around parent modeling may be impacting results (Ferreira et al., 2006). The majority of studies that did not show associations use self-report data to measure parental modeling of PA and adolescent PA. Studies using more objective measures for both predictor and outcome, while few, have shown positive associations (Craig et al., 2013; Fuemmeler et al., 2001; Tu et al., 2014). This study will add to the literature by using accelerometry data to measure both parent modeling of PA and the adolescent PA outcomes. Based on other studies using objective measures, it is hypothesized that there will be positive associations between parent modeling of PA and adolescent PA outcomes.

1.3 Study Purpose and Hypotheses

In summary, associations between parenting style (authoritative parenting) and parenting practices (autonomy support, emotional support, tangible support, and role modeling) and adolescent PA behaviors have been shown to be significant. However,

measurement differences in PA behaviors (objective versus self-report) and parenting constructs (general parenting versus parenting specific to PA) have complicated the literature describing PA parenting. While the majority of the literature does not examine LPA as an outcome, it has been suggested that influencing LPA may be more feasible than influencing MVPA in populations who experience increased barriers to more intense levels of activity (overweight, underserved).

The current study expands the current literature by including a variety of parenting practices specific to PA, associated with FST and SCT, which are hypothesized to be associated with adolescent PA behaviors. The inclusion of relevant parenting constructs related to PA allowed for testing of relative associations for each parenting style or behaviors. A strength of the current study is the use of accelerometry measurement of PA for both parent role modeling and adolescent PA outcomes. The current study also includes adolescent LPA as an outcome, which may be particularly relevant in the present sample (overweight/obese African American adolescents). This study aimed to better understand the associations between authoritative parenting style, autonomy support, emotional and tangible support, parental modeling of PA, and adolescent PA behaviors. Based on the previous literature it was hypothesized that:

1. Authoritative parenting style, autonomy support for health behaviors, autonomy support for PA, emotional and tangible support for PA, and parental modeling of PA would be positively associated with accelerometry-measured MVPA and total PA in youth.
2. Parenting practices specific to PA (autonomy support, emotional and tangible support, and parental modeling of PA) would be more strongly related to

adolescent MVPA and total PA compared to general parenting style or autonomy support for health behaviors as research has shown more support for specific parenting practices compared to general parenting.

3. The relationship between tangible support for PA and adolescent PA (MVPA and total PA) would show a stronger positive association than the relationship between emotional support for PA and adolescent PA (MVPA and total PA).

This study also explored the associations between parenting practices of interest (parenting style, autonomy support, emotional and tangible support, parental modeling of LPA) and LPA. While there is a paucity of literature on this intensity of PA, the current study is generally exploratory. However, based on the available literature, hypotheses were similar to those for MVPA.

4. Authoritative parenting style autonomy support for health behaviors, autonomy support for PA, emotional and tangible support for PA, and parental modeling of LPA would be positively associated with accelerometry-measured LPA in youth.
5. Parenting practices specific to PA (autonomy support, emotional and tangible support, and parental modeling of LPA) would be more strongly related to adolescent LPA compared to general parenting style or autonomy support for health behaviors as research has shown more support for specific parenting practices compared to general parenting.
6. The relationship between tangible support for PA and LPA would show stronger positive associations than the relationship between emotional support for PA and LPA.

CHAPTER II

METHODS

2.1 Participants

Data were collected from 148 African American families, including parent and adolescent, who are participants of the Families Improving Together (FIT) for Weight Loss randomized controlled trial. Culturally relevant recruitment strategies including partnerships with local churches, pediatric clinics, and schools, culturally targeted advertisements, and health screening information booths at community events and festivals were used to identify eligible families. Families were eligible to participate if: 1) they had an African American adolescent between the ages of 11-16 years old, 2) the adolescent was overweight or obese, defined as having a BMI $\geq 85^{th}$ percentile for age and sex, 3) at least one parent or caregiver living in the household with the adolescent was willing to participate, and 4) the family had internet access. Exclusion criteria included presence of a medical or psychiatric condition that would interfere with changing PA or dietary behaviors, taking medication that could interfere with weight loss or concurrent participation in a weight loss program. All participants signed informed consent and were compensated for their participation in the FIT trial.

2.2 Study Design

The primary aim of the FIT trial is to test a motivational and family based weight-

loss intervention compared to a comprehensive health education program in African American adolescents and their families. The FIT randomized controlled trial and procedures are described elsewhere (Wilson et al., 2015). While the FIT trial assesses families longitudinally, only baseline data collected prior to participation in the program was analyzed in this study. The current study design was a cross-sectional approach.

2.3 Procedures

Prior to randomization to condition, each FIT family attended a two-week orientation (run in phase) to the program during which PA level of both parent and adolescent were measured and survey assessments of parenting variables and environmental supports were completed. After completing all measurements, participants received a monetary incentive for their time. PA levels were collected using the Actical accelerometer device (Mini-mitter, Bend, OR) worn on the right hip, which measures frequency and intensity of movement. Participants were given Acticals for one to two weeks.[1] Parent-report of tangible support (availability of PA supports in the home) was collected via a self-report survey measure. Adolescent perception of parent autonomy support, social support for PA, and parenting style were also assessed using self-report survey measures.

2.4 Measures

Demographic Information. Parent education will be used an indicator of socioeconomic status and was measured using a parent self-report item. Responses include 'never

[1] Participants in cohorts 1-5 returned Acticals after two weeks. Protocol was changed at the beginning of cohort 6 such that families returned the devices after one week.

attended school, ‘grades 1-8 (elementary),’ ‘grades 9-11,’ ‘grades 12 or GED (high school graduate,’ ‘college 1 year to 3 years (some college or technical school),’ ‘college 4 years or more (college graduate), and ‘graduate training or professional degree.’ Number of children in the household was measured using a parent self-report item. Child age was calculated at the time of baseline measurement using the birth date of the child and the date of the measurement appointment. Sex was measured using parent-report data at time of consent. Parent body mass index (BMI) was calculated from height (measured to 0.1cm/Shorr height board) and weight (measured to 0.1 kg/SECA 880 digital scale).

Adolescent PA. Objective measurement of PA duration and intensity was obtained using Actical accelerometers estimates (Mini Mitter, Bend, OR). Actical accelerometers are small electronic devices that detect acceleration of body movement omnidirectionally. Digital values of this movement (energy expenditure counts) are summed over an interval (epoch) and cut points established by calibration studies in similar populations are used to classify the PA intensity of each epoch. Actical accelerometers have been shown to account for 81% of variability in activity energy expenditure in youth ages 7-18 years and has been shown to be correlated with energy expenditure ($r = 0.83$), activity energy expenditure ($r = 0.79$), and PA ratio ($r = 0.87$; Puyau, Vohra, Zakeri, & Butte, (2004). In this study 60 second epochs and cut points developed for use in youth populations (Puyau, et al., 2004) to classify activity as LPA (counts between 100 and 1500) and MVPA (counts above 1500) were used to calculate these outcomes. Total PA was calculated by summing minutes of LPA and MVPA. Minutes of activity were averaged across days of wear (between 3 and 14 days). Twenty consecutive zero counts were coded as time of non-wear.

Emotional support for PA. Parent emotional support for PA behaviors was measured using a modified version of a self-report measure that assesses social support from family and friends for diet and exercise behaviors (Sallis et al., 1987). This measure was originally developed and validated in a sample of college students, had adequate reliability (α = 0.91; test-retest reliability = 0.77), and was significantly associated with self-reported exercise. Sample items of the scale include "In the past month, how often has your parent been active with you?" and "In the past month, how often has your parent encouraged you to stick with being active?" scored on a 3-point Likert scale ranging from 'none' to 'many times.' This modified version has previously been used in predominantly African American adolescent samples (Kitzman-Ulrich, Wilson, Van Horn, & Lawman, 2010; Lawman & Wilson, 2014; Wilson, et al., 2011) and has been shown to have adequate internal consistency (α=0.80 - 0.89). Family social support for PA, as measured by this scale, has been associated with adolescent PA in numerous studies (Jamner, Spruijt-Metz, Bassin, & Cooper, 2004; Lawman & Wilson, 2014; Sallis et al., 1999).

Friend support for PA was also measured using items from this measure that referenced support from peers (Sallis et al., 1987). The peer support measure was validated with the same sample and showed adequate reliability (α = 0.84; test-retest reliability = 0.79).

Tangible support for PA. PA equipment availability in the home was conceptualized as a measure of tangible support for PA in the present study. Tangible support was assessed using a parent-reported checklist of adolescent's use of PA supports in the home environment (Rosenberg et al., 2010). The scale consists of 15 items (including bike, basketball hoop, jump rope, sports equipment, swimming pool, roller

skates/skateboard/scooter, fixed play equipment, home aerobic equipment, weight lifting equipment, water or snow equipment, yoga/exercise mats, exercise/play room, trampoline, stairs, and yard) and elicits responses on 5 point Likert scale ranging from 'not available' to 'uses once a week or more.' PA supports in the home as measured by this scale (both parent-report and adolescent-report) have been shown to be positively associated with self-report adolescent PA and sedentary behavior (Rosenberg et al., 2010).

Parenting style. Parenting style was assessed using six items from the Authoritative Parenting Index (API; Jackson et al., 1998), a youth self-report measure. The API is based on Baumrind's (1977) 4 parenting styles (authoritative, authoritarian, indulgent, and uninvolved) and consists of two subscales, responsiveness and demandingness, that are scored on a 4 point Likert scale. Sample items include "My parents want to hear about my problems" and "My parents have rules that I must follow." This measure was validated in a large sample of elementary and high school students who were primarily Caucasian. For adolescents, both the demandingness and responsiveness subscales were reliable ($\alpha = 0.77$ and 0.85 respectively). This measure has previously been used in predominantly African American samples of adolescents (Ornelas, Perreira, & Ayala, 2007; Rath et al., 2008). This study will use 3 items from each subscale. The API has shown predictive validity for health and risk behaviors in adolescents so that youth with authoritative parents were less likely to partake in tobacco use, alcohol use, and violent behaviors, and were more likely to report higher self-esteem, self-control, adjustment, and conflict resolution (Jackson et al., 1998). Authoritative parenting, as indicated by the

API has also been associated with increased PA for adolescent girls (Schmitz et al., 2002) and child attitudes towards healthy activity (Taylor, Wilson, Slater, & Mohr, 2011).

Autonomy support for health behaviors. Autonomy support for health behaviors was measured using a nine-item adolescent-report scale. Items are scored on a 4-point Likert scale ranging from '1 = strongly disagree' to '4 = strongly agree.' Sample items include "My parents allow me to choose what types of exercise activities (e.g., sports, dance) I do" and "My parents encourage me to help in making decisions about how long I should watch TV." This survey has been previously used in African American adolescents participating in a health promotion program and has demonstrated adequate reliability (α = 0.75; St. George, St. George, Wilson, Schneider, & Alia, 2013). Three items of the measure specific to PA behaviors were used separately in the data analysis.

Modeling of PA. Parental modeling of PA was measured objectively using Actical accelerometers worn between 3 and 14 days by the participating parent in each dyad. Cut points developed for adults (study sample $M_{age}\,(SD)$ = 44.7, $M_{BMI}\,(SD)$ = 25.9 (4.4)) were used to reduce the accelerometry data into LPA and MVPA minutes per day (Colley & Tremblay, 2011; Wong, Colley, Conner, & Tremblay, 2011). Minutes of MVPA was classified as counts above 1535 for each 60-second epoch, while LPA was classified as counts between 100 and 1534. Minutes of PA each day were averaged across the total number of measurement days to represent average daily activity. Daily total PA was calculated by summing LPA and MVPA. Sixty consecutive zero-counts were coded as time of non-wear.

2.5 Data Analytic Plan

To answer the research questions, separate multiple regression analyses were used to examine the associations between parenting practices and LPA, MVPA, and total PA. Because of their known relationships with adolescent PA behaviors, adolescent age, adolescent sex, parent BMI and parent education were included as potential covariates in each model. Support for PA from friends was included in the model in addition to support for PA from parents to better test differences in overall supports. Number of children in the household was also included as a potential covariate to account for household structure. A dummy variable for cohort was included to account for seasonal changes on PA behavior. Age was coded as the age of the adolescent at data collection in years. Sex was coded as '1' for male and '0' for female. The following regression equations were used to answer the research questions.

LPA Equations

Equation 1. LPA = $\beta_0 + \beta_1 Cohort + \beta_2 Age + \beta_3 Male + \beta_4 ParentBMI + \beta_5 Parent\ Education + \beta_6 NumChildren + \varepsilon,$

Equation 2. LPA = $\beta_0 + \beta_1 Cohort + \beta_2 Age + \beta_3 Male + \beta_4 ParentBMI + \beta_5 Parent\ Education + \beta_6 NumChildren + \beta_7 Parenting\ Style + \beta_8 Autonomy\ Support\ for\ Health\ Behaviors + \beta_9 Emotional\ Support + \beta_{10} Friend\ Support + \beta_{11} Tangible\ Support + \beta_{12}\ Parent\ LPA + \varepsilon,$

Equation 3. LPA = $\beta_0 + \beta_1 Cohort + \beta_2 Age + \beta_3 Male + \beta_4 ParentBMI + \beta_5 Parent\ Education + \beta_6 NumChildren + \beta_7 Parenting\ Style + \beta_8 Autonomy\ Support\ for\ PA + \beta_9 Emotional\ Support + \beta_{10} Friend\ Support + \beta_{11} Tangible\ Support + \beta_{12}\ Parent\ LPA + \varepsilon,$

MVPA Equations

Equation 1. MVPA = $\beta_0 + \beta_1 Cohort + \beta_2 Age + \beta_3 Male + \beta_4 ParentBMI + \beta_5 Parent\ Education + \beta_6 NumChildren + \varepsilon,$

Equation 2. MVPA = $\beta_0 + \beta_1 Cohort + \beta_2 Age + \beta_3 Male + \beta_4 ParentBMI + \beta_5 Parent\ Education + \beta_6 NumChildren + \beta_7 Parenting\ Style + \beta_8 Autonomy\ Support\ for\ Health\ Behaviors + \beta_9 Emotional\ Support + \beta_{10} Friend\ Support + \beta_{11} Tangible\ Support + \beta_{12}\ Parent\ MVPA + \varepsilon$

Equation 3. MVPA = $\beta_0 + \beta_1 Cohort + \beta_2 Age + \beta_3 Male + \beta_4 ParentBMI + \beta_5 Parent\ Education + \beta_6 NumChildren + \beta_7 Parenting\ Style + \beta_8 Autonomy\ Support\ for\ PA + \beta_9 Emotional\ Support + \beta_{10} Friend\ Support + \beta_{11} Tangible\ Support + \beta_{12}\ Parent\ MVPA + \varepsilon$

Total PA Equations

Equation 1. Total PA = $\beta_0 + \beta_1 Cohort + \beta_2 Age + \beta_3 Male + \beta_4 ParentBMI + \beta_5 Parent\ Education + \beta_6 NumChildren + \varepsilon,$

Equation 2. Total PA = $\beta_0 + \beta_1 Cohort + \beta_2 Age + \beta_3 Male + \beta_4 ParentBMI + \beta_5 Parent\ Education + \beta_6 NumChildren + \beta_7 Parenting\ Style + \beta_8 Autonomy\ Support\ for\ Health\ Behaviors + \beta_9 Emotional\ Support + \beta_{10} Friend\ Support + \beta_{11} Tangible\ Support + \beta_{12}\ Parent\ Total\ PA + \varepsilon$

Equation 3. Total PA = $\beta_0 + \beta_1 Cohort + \beta_2 Age + \beta_3 Male + \beta_4 ParentBMI + \beta_5 Parent\ Education + \beta_6 NumChildren + \beta_7 Parenting\ Style + \beta_8 Autonomy\ Support\ for\ PA + \beta_9 Emotional\ Support + \beta_{10} Friend\ Support + \beta_{11} Tangible\ Support + \beta_{12}\ Parent\ Total\ PA + \varepsilon$

where β_0 is the intercept, $\beta_{1\text{-}6}$ are the effects of covariates (cohort, age, sex, parent BMI, parent education, number of children in the household), $\beta_{7\text{-}11}$ are parameters examining the effects of PA parenting behaviors on each PA outcome, and ε is the residual. The research questions were answered by examining the β coefficients for each parenting behavior of interest. The influence autonomy support for health behaviors and autonomy support specific to PA were assessed using separate equations.

Missing Data

Missing data was assumed to be missing at random. Originally, missing data was to be dealt with using an imputation model which included 35 LPA variables (i.e., 5 time points per day over a week), 35 MVPA variables, parenting measures (e.g., social support, autonomy support, monitoring, modeling), and demographic variables (e.g., sex, BMI, age, parent sex, parent BMI). After the accelerometry data was reduced in SAS and coded for missingness (wear time equal to at least 80% of a measurement day defined as the length of time during which at least 70% of participants wore the Actical; Catellier et al., 2005) imputation procedures were attempted in the statistical package R using both the Amelia and MI packages. Several iterations of imputation models were attempted including separate models for parent and child data, separate models for LPA and MVPA data, models with PA by block, and models with PA by day. However these imputation models (chains = 200, iterations = 2000) failed to converge, possibly due to high missingness within PA blocks and/or high correlations between blocks.

As a result, another commonly used wear criteria was utilized which defined a valid day of wear as 10 hours (600 total minutes of wear time) and required a minimum of 3 valid days for PA data to be included (Mitchell et al., 2013; Hooker, in press).

Minutes of PA (LPA, MVPA, and total PA) were averaged across total valid days of wear. Based on the new wear criteria, approximately 8% of parents and 22% of child participants' activity data was coded as missing (see Table 1). Youth with valid activity data had an average of 7.01 days of valid wear, while parents had an average of 8.10 valid days of wear. See Table 2 for days of valid PA data for youth and parent included in the sample. A single imputation using the Amelia package in R was used to predict missing data, which allowed the use of the full data set (n=148) in the analysis. Descriptive statistics and t-tests were used to examine potential differences between original and imputed demographic (child age, parent age, child BMI, parent BMI, child sex, parent sex, parent education, number of children), parenting (emotional support, tangible support, autonomy support, parenting style, parent modeling), and outcome variables (LPA, MVPA, and total PA). No significant differences were found and all imputed values fell within the range of variables in the pre-imputation data set.

Preliminary Analyses and Assumptions Testing

Scores for each parenting measure were calculated by norming each item contributing to the scale (converting each item score to a z-score) to allow each item to contribute equally to the overall scale score. These normed scores were then summed to create a score for the measure. Finally, the measure score was converted to a z-score to aid in analysis and interpretation of the regression models. Internal consistency of each parenting scale was calculated and determined to be acceptable ($\alpha > 0.70$; see Table 3). However, using only autonomy support items specific to PA behaviors yielded a scale with lower internal consistency ($\alpha=0.64$).

Diagnostics were then conducted to test potential violations of multiple regression analysis. Histograms and scatterplots were examined to check for normal distribution of variables and residuals. Examination of residual plots for each hypothesized relationship between predictor and outcome allowed for testing of linearity of the relationships and independence of residuals. MVPA data was positively skewed and transformed using a square-root transformation to achieve a more normal distribution of the data. LPA and total PA minutes were not transformed. Correlations were examined to assess for potential multicollinearity among independent variables. Autonomy support for health behaviors and autonomy support specific to PA were highly correlated, as expected ($r = 0.87$) and were tested in separate models. However, no other predictors were highly correlated. Influential cases in each model were examined by comparing leverage, Cook's distance, and DFFITS values to proposed cut-off values (Cohen, Cohen, West, & Aiken, 2003). One case was removed from the models predicting LPA and total PA, and two cases were removed from the models predicting MVPA.[2]

[2] Models reported reflect removal of influential cases. However, results were examined both including and excluding these cases. Differences between models are noted in each table.

Table 2.1. Missing Data by Variable

Variable	Fraction Missing
Cohort	0.00
Child Age	0.00
Child Male	0.00
Parent Education	0.03
Parenting Style	0.01
Autonomy Support HB	0.01
Autonomy Support PA	0.01
Emotional Support	0.01
Friend Support	0.01
Tangible Support	0.02
Parent PA Outcomes	0.08
Child PA Outcomes	0.22

Table 2.2 Days of Valid PA Data in Sample

Days of Wear	Youth (*n* (%))	Parent (*n* (%))
<3	32 (21.62%)	12 (8.11%)
3	10 (6.76%)	9 (6.08%)
4	16 (10.81%)	9 (6.08%)
5	15 (10.14%)	15 (10.14%)
6	23 (15.54%)	22 (14.86%)
7	23 (15.54%)	40 (27.03%)
8	2 (1.35%)	7 (4.73%)
9	1 (0.68%)	3 (2.03%)
10	6 (4.05%)	5 (5.15%)
11	9 (6.08%)	4 (3.38%)
12	6 (4.05%)	4 (3.38%)
13	4 (2.70%)	7 (4.73%)
14	1 (0.68%)	11 (7.43%)
Mean	6.81 days	7.50 days

Note. Participants with less than 3 valid days of wear were considered missing and the data were imputed. Means reported reflect participants with ≥ 3 days of valid wear.

Table 2.3. Internal Consistency of Measures

Scale Name	Cronbach's α Value
Emotional Support for PA	0.86
Tangible Support for PA	0.73
Friend Support for PA	0.91
Authoritative Parenting	0.79
Autonomy Support for Health Behaviors	0.82
Autonomy Support for PA Only	0.64

CHAPTER III

RESULTS

3.1 Demographic Data

First, descriptive statistics were calculated for the total sample (n=148, see Table 4). The total sample was predominantly female (66%) with primarily female caregivers (94%). The average household included two children ($M_{NumChildren}$ = 2.06, *SD* = 1.11). The majority of the sample had obese parents (M_{BMI} = 37.41, *SD* = 8.31) with at least some college education. Youth engaged in an average of 217.96 minutes of LPA (*SD* = 54.53), 22.18 minutes of MVPA (*SD* = 16.40), and 240.13 minutes of total PA (*SD* = 62.64) per day. Parents engaged in an average of 192.89 minutes of LPA (*SD* = 68.16), 9.16 minutes of MVPA (*SD* = 10.98), and 202.05 minutes of total PA (*SD* = 70.84) per day.

3.2 Correlation Analyses

Correlations were used to test individual relationships between covariates, predictors, and outcome variables (see Table 5). Several covariates were significantly correlated with the outcome variables in the expected directions. Child age was negatively correlated with LPA (*r*=-0.29) and total PA (*r*=-0.29). Child sex was correlated with all child PA outcomes (LPA (*r*=0.18), MVPA (*r*=0.24), and total PA (*r*=0.22)), such that being male was correlated with increased activity levels. Parent education level was significantly correlated with all child PA outcomes (LPA (*r*=-0.22),

MVPA (r=-0.24), and total PA (r=-0.26)), such that increased parent education was correlated with lower activity levels. Number of children in the household and parent BMI were not significantly correlated with any outcome variables and thus were not included in the final regression models.

Several parenting variables were also significantly correlated with child PA outcomes. Parenting style (r=0.26) and tangible support (r=0.22), were positively correlated with child LPA minutes. Parenting style (r=0.24) and tangible support (r=0.23) were also positively correlated with child total PA minutes. There were also significant correlations between PA intensities in the child participants (LPA and MVPA, r = 0.38, LPA and total PA, r = 0.97, MVPA and total PA, r = 0.59). Parent PA intensities were also significantly correlated (LPA and MVPA, r = 0.17, LPA and total PA, r = 0.99, MVPA and total PA, r = 0.32).[3]

3.3 LPA

A hierarchical regression model was used to examine whether the effects of parenting factors were significant predictors of child LPA above and beyond the covariates specified in the model (results reported in Table 6). The first model, which included only the covariates, was significant (F (4,142) = 6.62, p < 0.05) and accounted for 16% of the variance in child LPA. Child age (B= -8.22, SE= 2.42, p <0.05) and parent education (B= -8.81, SE= 3.91, p <0.05) significantly predicted child LPA. Each additional year in child age was associated with an 8.22 minute decline in daily LPA.

[3] Unexpectedly, parent MVPA minutes were negatively correlated with both child LPA (r=-0.19) and child total PA (r=-0.17). Similar trends were found in the data pre-imputation (r=-0.16, p=0.09; r=-0.15, p=0.12).

Additionally, each increase in parent education level (for example from high school graduate to some college) was associated with an 8.81minute decline in daily LPA.

The second model tested the effects of parenting and other support variables above and beyond the effects of the covariates. The model including the parenting variables accounted for additional variance above and beyond the covariates (F (6,136) = 4.81, p < 0.05) in predicting child LPA. The full model was significant (*F* (10,136) = 5.96, *p* < 0.05) and accounted for 30% of the variance in child daily LPA. Child age (*B*= -7.84, *SE*= 2.29, *p* <0.05), parent education (*B*= -8.00, *SE*= 3.70, *p* <0.05), parenting style (*B*= 16.53, *SE*= 4.43, *p* <0.05), emotional support (*B*= -10.00, *SE*= 4.87, *p* <0.05), and tangible support (*B*= 9.53, *SE*= 4.00, *p* <0.05) significantly predicted child LPA. A one standard deviation increase in authoritative parenting style was associated with an additional 16.53 minutes of daily LPA, while a one standard deviation increase in tangible support was associated with an additional 9.53 minutes of LPA. Contrary to expectations, a one standard deviation increase in emotional support was associated with 10.00 fewer minutes of LPA. The effects of autonomy support for health behaviors, friend support, and parental modeling of LPA were not significant.

An additional analysis was conducted to examine the effects of parent autonomy support specific to PA (see Table 7) on child LPA. The model including the specific parenting variables (including autonomy support for PA) accounted for additional variance above and beyond the covariates (F (6,136) = 5.05, p < 0.05) in predicting child LPA. The full model was significant (*F* (10, 136) = 6.13, *p* < 0.05) and accounted for 31% of the variance in LPA. Child age (*B*= -7.94, *SE*= 2.29, *p* <0.05), parent education (*B*= -8.89, *SE*= 3.74, *p* <0.05), parenting style (*B*= 16.43, *SE*= 4.37, *p* <0.05), emotional

support (*B*= -10.27, *SE*= 4.79, *p* <0.05), and tangible support (*B*= 9.55, *SE*= 3.97, *p* <0.05) significantly predicted child LPA. Autonomy support specific to PA was not a significant predictor of daily child LPA.

3.4 MVPA

The model predicting MVPA including covariates was significant (*F* (4,141) = 4.86, *p* < 0.05; see Table 8) and accounted for 12% of the variance in child MVPA. Child sex (*B*= 0.69, *SE*= 0.31, *p* <0.05) and parent education (*B*= -0.30 *SE*= 0.13, *p* <0.05) significantly predicted child MVPA. Being male was associated with a 0.69 unit increase of MVPA while an increase in parent education (for example from high school graduate to some college) was associated with a 0.30 unit decline in MVPA.

The second model tested the effects of parenting and other support variables above and beyond the effects of the covariates on child MVPA. The model including the parenting variables did not account for additional variance beyond the covariates (F (6,135) = 1.43, p > 0.05) in predicting child MVPA.

An additional analysis was conducted to examine the effects of parent autonomy support specific to PA (see Table 9). The model including the parenting variables (including autonomy support for PA) did not account for additional variance above and beyond the covariates (F(6,135) = 1.86, p > 0.05) in prediction child MVPA; inclusion of parenting variables (including autonomy support specific to PA) did not significantly improve model fit.

3.5 Total PA

The model predicting child total PA including covariates was significant F (4,142) = 7.99, $p < 0.05$; see Table 10) and accounted for 18% of the variance in child total daily PA. Child age (B= -9.30, SE= 2.73, p <0.05), sex (B= 23.87, SE= 10.28, p <0.05), and parent education (B= -11.67, SE= 4.41, p <0.05) significantly predicted child total PA. Being male was associated with an additional 23.87 minutes in daily total PA. Each additional year in age was associated with a decrease of 9.30 minutes of total PA, while an increase in parent education (for example from high school graduate to some college) was associated with a 11.67 minute decline in total PA.

The second model tested the effects of parenting and other support variables above and beyond the effects of the covariates on predicting child total PA. The model including the parenting variables accounted for additional variance above and beyond the covariates (F (6,136) = 4.94, p < 0.05) in predicting child total PA. The full model was significant (F (10,136) = 6.70, $p < 0.05$) and accounted for 33% of the variance in child daily total PA. In addition to effects of the covariates, parenting style (B= 17.63, SE= 4.98, p <0.05), emotional support (B= -12.50, SE= 5.43, p <0.05), and tangible support (B= 11.38, SE= 4.49, p <0.05) significantly predicted child total PA. A one standard deviation increase in authoritative parenting style was associated with a daily increase of 17.63 PA minutes, while a one standard deviation increase in tangible support was associated with an increase of 11.38 daily PA minutes. Unexpectedly, a one standard deviation increase in emotional support was associated with a 12.50 reduction in minutes per day in child total PA. Autonomy support for health behaviors, friend support, and parent total PA were not significantly associated with total PA.

An additional analysis was conducted to examine the effects of parent autonomy support specific to PA (see Table 11). The model including the parenting variables (including autonomy support for PA) accounted for additional variance above and beyond the covariates (F (6,136) = 5.40, $p < 0.05$) in predicting child total PA. The full model was significant (F (10, 136) = 7.02, $p < 0.05$) and accounted for 34% of the variance in total PA. Similar to the model including autonomy support for health behaviors, parenting style (B= 17.40, SE= 4.90, p <0.05), emotional support (B= -13.00, SE= 5.33, p <0.05), and tangible support (B= 11.43, SE= 4.45, p <0.05) were significant predictors of total PA. In addition to these predictors, the parent autonomy support specific to PA measure was significant (B= 12.31, SE= 5.69, p <0.05) and was associated with an increase of 12.31 minutes in total daily PA per standard deviation increase.

Table 3.1. Descriptive Data for the Total Sample

Variable	Value
Child Age *M(SD)*	13.56 (1.74)
Child BMI % *M(SD)*	96.54 (4.14)
Child (Female), *(%)*	66%
Parent Age *M(SD)*	43.36 (8.21)
Parent BMI *M(SD)*	37.41 (8.26)
Parent (Female) *(%)*	94%
Parent Education, *N (%)*	
<12 years	5 (3.38%)
12 Years	18 (12.16%)
Some College	55 (37.16%)
4 Year College	33 (22.30%)
Professional Degree	37 (25.00%)
Number of Children	2.06 (1.11)
Kid LPA *M(SD)*	217.96 (54.53)
Kid MVPA *M(SD)*	22.18 (16.40)
Kid Total PA *M(SD)*	240.13 (62.64)
Parent LPA *M(SD)*	192.89 (68.16)
Parent MVPA *M(SD)*	9.16 (10.98)
Parent Total PA *M(SD)*	202.05 (70.84)

Table 3.2. Correlation Matrix

Variable	Age	Male	BMI	P.BMI	Ed.	#Child	E.S	P.Style.	T.S.	A.S.	F.S.
Age	-										
Male	0.02	-									
BMI	-0.15	0.08	-								
P. BMI	**-0.16***	0.05	**0.25***	-							
Ed.	0.06	**-0.21***	0.01	-0.15	-						
#Child	-0.10	-0.03	**-0.16***	0.08	-0.08	-					
E.S.	-0.04	-0.02	0.14	0.00	0.07	-0.14	-				
F.S.	0.04	0.12	**0.18***	0.06	-0.13	-0.12	**0.46***				-
P. Style	0.03	-0.07	-0.07	0.05	0.01	-0.07	**0.29***	-			0.16
T. Sup.	**-0.16***	0.02	0.05	0.08	-0.04	0.16	0.05	0.05	-		0.05
A.S.	0.03	-0.06	0.10	0.10	0.02	**-0.20***	**0.46***	**0.42***	0.00	-	**0.44***
A.S.PA	0.05	-0.04	0.12	0.07	0.11	**-0.20***	**0.46***	**0.38***	0.01	**0.87***	**0.46***
P.LPA	-0.01	-0.06	0.00	-0.14	-0.07	0.00	-0.13	0.14	-0.04	**-0.21***	-0.02
P.MVPA	**0.18***	-0.15	-0.03	**-0.17***	**0.18***	-0.07	**0.17***	0.06	-0.04	0.11	-0.05
P. Total	-0.29	-0.09	-0.01	-0.16	-0.04	-0.01	-0.10	0.15	-0.04	**0.21***	-0.03
LPA	**-0.29***	**0.18***	0.11	0.12	**-0.22***	0.14	0.02	**0.26***	**0.22***	0.13	0.16
MVPA	-0.14	**0.24***	-0.01	0.16	**-0.24***	0.10	-0.07	0.05	0.13	0.08	0.08
Total PA	**-0.29***	**0.22***	0.09	0.15	**-0.26***	0.15	0.00	**0.24***	**0.23***	0.14	0.16

Note. * indicates correlations significant with alpha criteria of 0.05.

Table 3.2. Correlation Matrix (continued)

Variable	A.S.PA	P. LPA	P.MVPA	P.Total	LPA	MVPA
Age						
Male						
BMI						
P. BMI						
Ed.						
#Child						
E.S.						
F.S.						
P. Style						
T. Sup.						
A.S.						
A.S.PA	-					
P.LPA	0.13	-				
P.MVPA	0.10	**0.17***	-			
P. Total	0.14	**0.99***	**0.32***	-		
LPA	0.14	0.02	**-0.19***	-0.01	-	
MVPA	0.11	0.11	-0.03	0.10	**0.38***	-
Total PA	0.15	0.05	**-0.17***	0.02	**0.97***	**0.59***

Table 3.3. Youth LPA Regression Model with Autonomy Support for HB

	B	SE	*t*	*p*	R^2	ΔR^2
Model 1: $F(4,142) = 6.62$, $p < 0.05$					0.16	
β_0	357.63	40.56	8.82	<0.01*		
β_1, Cohort	3.68	2.22	1.66	0.10		
β_2, Child Age	-8.22	2.42	-3.40	<0.01*		
β_3, Child Male	17.02	9.11	1.87	0.06		
β_4, Parent Education	-8.81	3.91	-2.25	0.03*		
Model 2: $F(10,136) = 5.96$, $p < 0.05$					0.30	0.14*
β_0	364.16	40.68	8.95	<0.01*		
β_1, Cohort	2.40	2.09	1.15	0.25		
β_2, Child Age	-7.84	2.29	-3.42	<0.01*		
β_3, Child Male	15.75	8.53	1.85	0.07		
β_4, Parent Education	-8.00	3.70	-2.16	0.03*		
β_5, Parenting Style	16.53	4.43	3.73	<0.01*		
β_6, Autonomy Support HB	6.47	5.22	1.24	0.22		
β_7, Emotional Support	-10.00	4.87	-2.05	0.04*		
β_8, Friend Support	6.04	4.70	1.29	0.20		
β_9, Tangible Support	9.53	4.00	2.39	0.02*		
β_{10}, Parent LPA	-0.06	0.06	-0.93	0.35		

Note. Total *n*=147; * indicates significance with alpha criteria of 0.05. One influential case was removed. With the case included, $R^2 = 0.28$ and parent education (p=0.06) and emotional support (*p*=0.07) were not significant. All other effects were similar and in the same direction.

Table 3.4. Youth LPA Regression Model with Autonomy Support for PA

	B	SE	*t*	*p*	R^2	ΔR^2
Model 1: $F(4,142) = 6.62$, $p < 0.05$					0.16	
β_0	357.63	40.56	8.82	<0.01*		
β_1, Cohort	3.68	2.22	1.66	0.10		
β_2, Child Age	-8.22	2.42	-3.40	<0.01*		
β_3, Child Male	17.02	9.11	1.87	0.06		
β_4, Parent Education	-8.81	3.91	-2.25	0.03*		
Model 2: $F(10, 136) = 6.13$, $p < 0.05$					0.31	0.15*
β_0	371.31	40.97	9.06	<0.01*		
β_1, Cohort	2.11	2.09	1.01	0.31		
β_2, Child Age	-7.94	2.29	-3.48	<0.01*		
β_3, Child Male	15.37	8.49	1.81	0.07		
β_4, Parent Education	-8.89	3.74	-2.37	0.02*		
β_5, Parenting Style	16.43	4.37	3.76	<0.01*		
β_6, Autonomy Support PA	8.40	5.07	1.65	0.10		
β_7, Emotional Support	-10.27	4.79	-2.14	0.03*		
β_8, Friend Support	5.07	4.75	1.07	0.29		
β_9, Tangible Support	9.55	3.97	2.40	0.02*		
β_{10}, Parent LPA	-0.05	0.06	-0.91	0.36		

Note. Total n=147; * indicates significance with alpha criteria of 0.05. One influential case was removed. With the case included, $R^2 = 0.28$ and emotional support was not significant (p=0.05). All other effects were similar and in the same direction.

Table 3.5. Youth MVPA Regression Model with Autonomy Support for HB

	B	SE	*t*	*p*	R^2	ΔR^2
Model 1: $F(4,141) = 4.86$, $p < 0.05$					0.12	
β_0	7.15	1.36	5.24	<0.01		
β_1, Cohort	0.13	0.07	1.79	0.08		
β_2, Child Age	-0.14	0.09	-1.73	0.09		
β_3, Child Male	0.69	0.31	2.25	0.03*		
β_4, Parent Education	-0.30	0.13	-2.31	0.02*		
Model 2: $F(10,135) = 2.84$, $p < 0.05$					0.17	0.05
β_0	6.98	1.37	5.10	<0.01*		
β_1, Cohort	0.12	0.07	1.58	0.10		
β_2, Child Age	-0.14	0.08	-1.64	0.10		
β_3, Child Male	0.68	0.31	2.20	0.03*		
β_4, Parent Education	-0.27	0.13	-2.01	0.05*		
β_5, Parenting Style	0.14	0.16	0.86	0.39		
β_6, Autonomy Support HB	0.24	0.18	1.34	0.18		
β_7, Emotional Support	-0.38	0.17	-2.20	0.03*		
β_8, Friend Support	0.09	0.17	0.54	0.59		
β_9, Tangible Support	0.22	0.14	1.57	0.12		
β_{10}, Parent MVPA	-0.01	0.01	-0.04	0.97		

Note. Total n=146; * indicates significance with alpha criteria of 0.05. Two influential cases were removed. With the cases included, $R^2 = 0.14$ and emotional support was not significant (p=0.07). All other effects were similar and in the same direction.

Table 3.6. Youth MVPA Regression Model with Autonomy Support for PA

	B	SE	*t*	*p*	R^2	ΔR^2
Model 1: $F(4,141) = 4.86$, $p < 0.05$					0.12	
β_0	7.15	1.36	5.24	<0.01		
β_1, Cohort	0.13	0.07	1.79	0.08		
β_2, Child Age	-0.14	0.09	-1.73	0.09		
β_3, Child Male	0.69	0.31	2.25	0.03*		
β_4, Parent Education	-0.30	0.13	-2.31	0.02*		
Model 2: $F(10,135) = 3.13$, $p < 0.05$					0.19	0.07
β_0	7.32	1.37	5.36	<0.01*		
β_1, Cohort	0.11	0.07	1.41	0.16		
β_2, Child Age	-0.14	0.08	-1.71	0.09		
β_3, Child Male	0.66	0.30	2.17	0.03*		
β_4, Parent Education	-0.31	0.13	-2.30	0.02*		
β_5, Parenting Style	0.12	0.15	0.80	0.42		
β_6, Autonomy Support PA	0.37	0.18	2.06	0.04*		
β_7, Emotional Support	-0.40	0.17	-2.36	0.02*		
β_8, Friend Support	0.04	0.17	0.21	0.83		
β_9, Tangible Support	0.23	0.14	1.60	0.11		
β_{10}, Parent MVPA	-0.01	0.10	-0.08	0.94		

Note. Total n=146; * indicates significance with alpha criteria of 0.05. Two influential cases were removed. With the cases included, $R^2 = 0.16$ and autonomy support specific to PA was not significant (p=0.13). All other effects were similar and in the same direction.

Table 3.7. Total PA Regression Model with Autonomy Support for HB

	B	SE	*t*	*p*	R^2	ΔR^2
Model 1: $F(4.142) = 7.99, p < 0.05$					0.18	
β_0	404.39	45.75	8.84	<0.01*		
β_1, Cohort	4.53	2.50	1.81	0.07		
β_2, Child Age	-9.30	2.73	-3.40	<0.01*		
β_3, Child Male	23.87	10.28	2.32	0.02*		
β_4, Parent Education	-11.67	4.41	-2.65	0.01*		
Model 2: $F(10,136) = 6.70, p < 0.05$					0.33	0.15*
β_0	407.30	45.25	9.00	<0.01*		
β_1, Cohort	3.10	2.35	1.32	0.19		
β_2, Child Age	-8.77	2.58	-3.40	<0.01*		
β_3, Child Male	22.46	9.61	2.34	0.02*		
β_4, Parent Education	-10.56	4.16	-2.54	0.01*		
β_5, Parenting Style	17.63	4.98	3.54	<0.01*		
β_6, Autonomy Support HB	9.10	5.88	1.55	0.12		
β_7, Emotional Support	-12.50	5.43	-2.30	0.02*		
β_8, Friend Support	6.53	5.30	1.23	0.22		
β_9, Tangible Support	11.38	4.49	2.53	0.01*		
β_{10}, Parent Total PA	-0.05	0.07	-0.77	0.44		

Note. Total n=147. * indicates significance with alpha criteria of 0.05. One influential case was removed. With the case included, $R^2 = 0.30$. All other effects were similar and in the same direction.

Table 3.8. Total PA Regression Model with Autonomy Support for PA

	B	SE	*t*	*p*	R^2	ΔR^2
Model 1: $F(4.142) = 7.99$, $p < 0.05$					0.18	
β_0	404.39	45.75	8.84	<0.01*		
β_1, Cohort	4.53	2.50	1.81	0.07		
β_2, Child Age	-9.30	2.73	-3.40	<0.01*		
β_3, Child Male	23.87	10.28	2.32	0.02*		
β_4, Parent Education	-11.67	4.41	-2.65	0.01*		
Model 2: $F(10,136) = 7.02$, $p < 0.05$					0.34	0.16*
β_0	418.13	45.40	9.21	<0.01*		
β_1, Cohort	2.67	2.34	1.14	0.26		
β_2, Child Age	-8.92	2.56	-3.49	<0.01*		
β_3, Child Male	21.93	9.53	2.30	0.02*		
β_4, Parent Education	-11.89	4.19	-2.84	0.01*		
β_5, Parenting Style	17.40	4.90	3.56	<0.01*		
β_6, Autonomy Support PA	12.31	5.69	2.17	0.03*		
β_7, Emotional Support	-13.00	5.33	-2.44	0.02*		
β_8, Friend Support	5.01	5.33	0.94	0.35		
β_9, Tangible Support	11.43	4.45	2.56	0.01*		
β_{10}, Parent Total PA	-0.05	0.06	-0.76	0.45		

Note. Total n=147. * indicates significance with alpha criteria of 0.05. One influential case was removed. With the case included, $R^2 = 0.31$ and autonomy support specific to PA was not significant (p=0.12). All other effects were similar and in the same direction.

CHAPTER IV

DISCUSSION

The current study examined the relationship between parenting style and parenting practices related to PA and accelerometry-measured LPA, MVPA, and total PA in overweight, African American youth. Results showed that authoritative parenting style was positively associated with daily LPA and total PA minutes as hypothesized, but not MVPA minutes. Tangible support (home environmental supports) was also positively related to LPA and total PA as expected, but a relationship was not found for MVPA. Unexpected results were found for emotional support such that emotional support for PA from parents was negatively associated with LPA and total PA in the sample, but no association for MVPA was found. Interestingly, autonomy support for PA emerged as a predictor of total PA (but not LPA or MVPA). However, associations were not found for the more general measure of autonomy support. The hypothesized relationship between parental modeling and youth PA was not found for any intensity of youth PA (LPA, MVPA, or total PA). In summary, authoritative parenting style and parent support for PA, including tangible and emotional support, significantly predicted LPA and total PA.

This study is one of the few to show positive relationship between accelerometry-measured LPA and total PA minutes and authoritative parenting style. Previous literature examining the relationship between parenting style and PA has utilized self-report measures (Berge et al., 2010; Jackson et al., 1998; Lohaus et al., 2009; Schmitz et al., 2002) or focused on accelerometry-measured MVPA (Jago et al., 2011). Further, no

studies have focused specifically on describing the relationship between authoritative parenting style and PA in overweight, African American adolescents. Results are consistent with cross-sectional studies that found relationships with parenting style and self-reported PA behaviors (including total PA; Lohaus et al., 2009). The current findings are also consistent with longitudinal research which utilized similar measures of parenting style as the present study and which reported a significant positive relationship between authoritative parenting and self-reported total PA in girls (Schmitz et al., 2002). Similar to the current results, studies that have focused on MVPA have not found positive relationships. A cross-sectional study using accelerometry-measured MVPA found no associations with authoritative parenting, while Berge and colleagues (201) found no relationship between authoritative parenting and self-reported MVPA. The results of the current study fill an important gap in the literature by clarifying the relationships between authoritative parenting style and PA intensities and suggest that general parenting style is associated with LPA and total PA, but not MVPA in overweight African American youth.

Tangible support was also identified as having a positive relationship with child LPA and total PA. The only known study which evaluates LPA in African American adolescents found a trend for the association between accelerometry-measured LPA and parent tangible support and no association with MVPA in overweight, African American populations (Lawman & Wilson, 2014), which is consistent with the current findings. However, a number of previous studies have shown a positive relationship between accelerometry-measured MVPA and parental tangible supports both cross-sectionally and in longitudinal studies. Tangible support was positively associated with accelerometry-

measured MVPA over 19 weeks in a primarily minority sample of adolescents (Siceloff et al., 2014). Tangible supports, as measured by provision of home PA resources have been shown to be associated with accelerometry-measured MVPA (Sirad et al., 2010), PA as measured by energy expenditure (Fein et al., 2004), and self-reported PA (Dunton et al., 2003; Rosenbergy et al., 2010). Previous studies that have also shown positive associations between parent tangible support and child MVPA have not focused exclusively on overweight African American adolescents as in the current study. Overweight adolescents experience a number of barriers to engaging in MVPA compared to healthy weight youth including self-consciousness, lack of interest in PA, being teased, perceived lack of skill, and perceived difficulty (Deforche, De Bourdeaudhuij, & Tanghe, 2006; Zabinski et al., 2003). It is possible that because overweight youth experience greater numbers of barriers to PA, parent tangible support is not sufficient to encourage MVPA. The current findings do suggest, however, that there is an association between parental tangible supports for PA and LPA and total PA in overweight African American youth.

Emotional support from parents was associated with child LPA and total PA, but in an unexpected direction. As adolescent-perceived emotional support from parents increased, LPA minutes and total PA minutes decreased. However, the finding that emotional support from parents may actually be associated with lower levels of PA is in contrast to many studies that found positive associations (Kuo et al., 2007; Sallis, Prochaska et al., 1999; Wilson et al., 2011) or no association (Siceloff et al., 2014; Sallis, Alcaraz et al., 1999) between emotional support and PA. However, there is a known sex difference in the effects of emotional support on health behavior compliance in African

American adolescents (Wilson & Ampey-Thornhill, 2001; Wilson et al., 1999). Follow up analyses were conducted to further examine this effect in the current sample. Emotional support only emerged as significant for males and only when all other parenting variables were included in the model. This suggests that emotional support may function differently across gender. Further, in the presence of other parenting factors (for example, if positive aspects of emotional support are already accounted for by shared variance between authoritative parenting style and emotional support), increased encouragement to be active may be perceived as nagging or negative support, especially in overweight adolescents who experience increased levels of body dissatisfaction (Makinen, Puukko-Viertomies, Lindberg, Siimes, & Aalberg, 2012; Sonneville et al., 2012). There is some evidence that perceived conflict with parents around PA is negatively related to PA rates in adolescents managing chronic disease (Mackey & Streisand, 2008). However, more research is needed to clarify this relationship.

Autonomy support for PA emerged as a positive predictor of child total PA minutes in this sample. This finding is consistent with previous literature which found positive associations between autonomy support for PA and PA behaviors as measured by self-report (Christiana et al., 2014; Gonzales-Cutre et al., 2014; McDavid et al., 2012) and pedometer counts (Rutten et al., 2013). However, more research is needed to determine if this relationship is maintained longitudinally, as a recent study did not find relationships over time (Rutten et al., in press). Autonomy support for health behaviors, the more general measure, was not found to be significantly associated with PA in the current sample, which is consistent with a previous study that found no association between general autonomy support and pedometer-measured PA (Vierling et al., 2007).

The current study fills a gap in the literature by being the first known study which used accelerometry estimates of PA to estimates relationships between LPA, MVPA, total PA, and autonomy support for PA.

Findings of the current study provide preliminary support for the importance of including a spectrum of PA intensities (LPA, MVPA, total PA) in research to better understand correlates of activity in overweight and obese populations. As a result of barriers to participation in PA, influencing MVPA in overweight youth may be less feasible than promoting higher levels of LPA. Previous research has often found positive associations between parenting practices and MVPA (Beets et al., 2010; Lawman & Wilson, 2012; Pugliese & Tinsley, 2007; Sleddens et al., 2012). However, past literature has predominantly used self-report PA data (Sallis et al., 2000) and has not focused on overweight samples of underserved ethnic minorities who engage in lower levels of PA (Belcher et al., 2011). Parenting practices were not found to be significantly associated with MVPA levels in the current sample, which suggests that parenting-related predictors of PA may function differently in samples with a high numbers of barriers to PA and lower overall engagement in PA compared to healthy-weight, active youth. A recent study examining differences between social and environmental correlates of PA found similar differences in associations for LPA compared to MVPA (such that parent support and neighborhood supports were associated with LPA but not MVPA) in a predominantly African American adolescent sample (Lawman & Wilson, 2014).

These results suggest that future studies should focus on increasing understanding of the relationship between parenting factors and PA in overweight African American adolescents for interventions. While parenting-related factors were not associated with

significant changes in MVPA, the results suggest that parenting factors are associated with other intensities of PA. Based on the results, improving home climate (general authoritative parenting and available PA resources) may be associated with LPA and total PA in overweight, African American youth and could be targeted in interventions.

Limitations of the current study should be considered in the interpretation of the results. The current study is cross-sectional which does not allow for causal inferences or definitive conclusions about the directions of the effects. It is not clear from the current study whether parenting practices positively influenced youth PA levels or if parents exhibited positive parenting practices in response to higher levels of child LPA or total PA engagement. Future studies should consider implementing longitudinal study designs to clarify the direction of effects. There may also be generalizability limitations to the present study. The sample included a small sample of overweight African American youth in the Southern U.S. Finally, the scale measuring autonomy support specific to PA was comprised of a subset of three items from the larger, more general measure, and had moderate to low reliability. Thus caution should be used to interpreting these findings given the low number of items in the scale, and the modest internal consistency. As a result, more research is needed to clarify the association between autonomy support for PA and youth PA behaviors.

It is also important to note the strengths of the current study. The inclusion of a broad range of PA intensities (LPA, MVPA, and total PA) to examine potential parenting-related predictors of PA in youth is a novel feature of the study. A wide variety of parenting factors were included in the analysis, including both general parenting style and PA-specific behaviors, which allows for differentiation and comparison of

associations between parenting behaviors and PA. Objective accelerometry estimates were used for adolescent PA and parent modeling variables, which are not susceptible to social desirability or recall bias, providing more reliable estimates of minutes of PA in the sample in comparison to self-reported or parent-reported data. A lack of research focusing on youth's perception of their parent's parenting style and parenting practices has been noted as an important gap in the current literature on child obesity (Patrick et al., 2013). With the exception of tangible support for PA, parenting practices in this study were youth-reported (emotional support for PA, authoritative parenting style, autonomy support for health behaviors and PA), which measures the adolescent's perception of their parent's behavior compared to the parent's intention or self-report. Finally, the majority of research regarding youth health behaviors has been conducted in healthy-weight, White samples. However, it is underserved populations (those that are overweight/obese, minority, and/or low SES) that suffer the greatest consequences from poor health behaviors. This study fills a gap in the literature by examining the associations between parenting factors and PA in an overweight/obese African American adolescent sample.

In summary, this study provides support for associations between authoritative parenting, tangible support, and emotional support with objectively-measured adolescent LPA and total PA in overweight, African American youth. The results underscore the importance of examining predictors of PA across the PA intensity spectrum in samples that are less likely to engage in MVPA.

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