The Effect of the Family Structure on Child Physical Activity Within a Fitness Intervention: A Theoretical Approach

By

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ABSTRACT

Overweight or obese children are five times more likely to become obese adults, and obesity-related conditions (i.e. heart disease, type 2 diabetes, and certain types of cancers) are now the leading causes of preventable death. However, recent studies have suggested that children with higher levels of physical fitness can significantly decrease their risk for various health conditions, compared to children with lower fitness levels. One way to increase physical fitness in children is by promoting their physical activity. Parents and caregivers can play a large role in their child's physical activity engagement by providing autonomy-supportive structure within the household and engaging in physical activity themselves. In the present study, the *Famtastically Fit* intervention provided opportunities for both children and parents to learn about physical activity and strategies for implementation within the household. Participants consisted of 8 families; parents (n=9) who identified as sedentary and children (n=10) who were considered obese (> 93rd percentile). Families were asked to come once weekly for a 60-90 minute session involving separate but concurrently running exercise sessions for children and adults, parental health education, and family group sessions for 9 weeks. Variables of interest included physical activity, body composition (lean mass, fat mass, and bone mineral content), motivation, parental perception of their child's competence, parental self-efficacy, child perceived competence, child self-efficacy, and the child proxy efficacy. In addition, we conducted semi-structured interviews with the children pre- and post-assessment and with the parents during post-assessment to explore the implementation of structure and learned strategies within the household. Our results suggested no significant difference in physical activity for parents or children over the course of the intervention; however, there was a significant (p=.001) relationship between maternal and child physical activity. Children experienced significant differences in lean mass (p=0.000) and bone mineral content (p=0.000). Parents had significant increases in their self-efficacy (p=.04), identified motivation (p=.04) and their perception of their child's competence (p=.02), and a significant decrease in their amotivation (p=.01). Our qualitative analyses provided insight into the family's implementation of structure, household changes since the onset of the intervention, and barriers to physical activity engagement. The findings of this *Famtastically Fit* intervention underline the importance of the role of parents and caregivers in child physical activity, how implementation of autonomy-supportive structure can be beneficial in promoting children's autonomous engagement in desirable behaviors, and identifies environmental barriers to physical activity.

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I. INTRODUCTION

Introduction

The prevalence of overweight and obese individuals continues to steadily increase, and the health consequences associated with overweight and obesity have been well documented (NIH, 2010). Childhood obesity has more than doubled in children and adolescents in the past 30 years, with more than one-third of U.S. children considered overweight or obese (Ogden, Carroll, Kit, & Flegal, 2014). Research suggests that overweight or obese children are five times more likely to become obese adults (Freedman et al., 2009), and obesity- related conditions (i.e. heart disease, type 2 diabetes, and certain types of cancers) are now the leading causes of preventable death (CDC, 2010). Obesity is most basically defined as having too much body fat (Harvard School for Public Health, 2016) and is often measured using body mass index (BMI). BMI is defined as body mass in kilograms divided by the square of body height in meters. Overweight for adults aged 20 and older is defined as having a BMI between 25.0 and 29.9; and a BMI of 30.0 or higher is considered obese. Children and adolescents age 2 to 20 years old are considered overweight with a BMI between the 85th to 94th percentiles and obese with a BMI in the 95th percentile or above (CDC, 2016).

Although the exact etiology of obesity is not known, obesity is associated with an energy imbalance. There are a number of factors that can have an influence on the amount of energy an individual can burn (i.e. age, body size, genetic factors); however, the most variable factor is the amount of daily physical activity (Harvard School of Public Health, 2012). Physical activity refers to any bodily movement, whether it's for work or play, daily chores, or the daily commute.

Exercise is a subcategory of physical activity that refers to planned, structured, and repetitive activities aimed at improving physical fitness and health (Casperson, Powell, & Christenson, 1985; Harvard School of Public Health, 2012). Being physically fit has been defined as "the ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies" (President's Council on Physical Fitness, 1971). Physical fitness is further broken down into health-related and skills-related components. The skills-related components pertain more to athletic ability, whereas the health-related components are more important to public health. The health- related components of physical fitness include: (a) cardiorespiratory endurance (b) muscular strength (c) muscular endurance (d) body composition and, (e) flexibility. Exercise is intended to improve or maintain these components of physical fitness (Casperson, Powell, & Christenson, 1985). All aspects of fitness are important and should be included in exercise programming to improve overall health and quality of life.

The current physical activity guidelines for Americans recommend that children and adolescents participate in at least 60 minutes of MVPA (moderate-to-vigorous physical activity) on most days of the week (ACSM, 2015). Moderate physical activity refers to activities equivalent in intensity to brisk walking or bicycling. Vigorous physical activity produces large increases in breathing or heart rate, such as jogging or bicycling uphill. A study examining the association between MVPA and health related fitness in youths aged 10-18 years old found that time spent in MVPA was significantly associated ($B=0.002$, $p<0.001$) with their fitness score (assessed using the FITNESSGRAM) (Marques, Santos, Ekelund, & Sardinha, 2015).

Childhood obesity is a multifaceted phenomenon that can have detrimental effects on lifetime health. However, change in obesity status or weight loss alone may not have the most beneficial impact on overall health. Incorporating more physical activity and structured exercise into interventions to promote an increase in childhood physical fitness, compared to a decrease in weight status, could encourage more positive psychological and physiological benefits than a weight loss intervention. For example, a study examining the differences between obese individuals with high fitness levels (fitness assessed on maximal treadmill test) compared to obese individuals with low fitness levels found that the individuals with better fitness levels had lower risk (30-50%) of all-cause mortality, non-fatal and fatal heart disease, and cancer mortality than their lower fitness, obese counterparts (Ortega et al., 2013). Some research has suggested that higher aerobic fitness in childhood, independent of abdominal fat, can reduce the risk of developing metabolic syndrome by 36% compared to those children with lower levels of fitness (Schmidt, Magnussen, Rees, Dwyer, & Venn, 2016).

Regular physical activity (i.e. 60 minutes of most days of the week) has also been suggested as beneficial psychologically for youth regardless of weight, with regular exercise in children being associated with an increase in self-esteem and self-concept and a decrease in anxiety and depression (Calfas and Taylor, 1994; Digelidis, Papaioannou, Laparidis, & Christodoulidis, 2003; Haugen, Säfvenbom, & Ommundsen, 2011).

Statement of the Problem

Although the benefits of exercise are well known, reports show that only 78% of children meet physical activity recommendations, with obese and overweight children typically participating in less physical activity than their normal weight counterparts (National Physical Activity Plan, 2016; Troiano, Berrigan, Dodd, Masse, Tilbert, & McDowell, 2008). When investigating potential factors related to childhood obesity, researchers have utilized various cognitive theories and techniques (i.e. transtheoretical model, self-determination theory, social cognitive theory, and the theory of planned behavior) to help increase the efficacy of exercise interventions and create a better understanding of behavior change within the physical activity context. However, these interventions have done little to help decrease the prevalence of childhood obesity and encourage lifetime exercisers (CDC, 2015). Behavior change has been found to be a multidirectional process that could have multiple levels of influence, particularly for children. Parents and caregivers are often viewed as their child's primary gatekeeper; therefore, the child's physical activity could be dependent upon the regulatory capacity of their parents. The social ecological model provides a framework to better understand the complex interaction of multiple levels of influence on a child's ability and motivation to be physically active (Zhang and Solomon, 2013). Research has suggested that interventions are most effective when they incorporate multiple levels of influences; the social ecological model and the self-determination theory both address the interaction of individual factors and multilevel factors that can provide direction for future intervention designs (Bauman, Sallis, & Owen, 2002; Sallis, Owen, & Fisher, 2008). Therefore, the goal of this family-based intervention was to target child physical activity behavior by also targeting the multiple levels of influence (i.e. psychological constructs and characteristics of their immediate built environment) that can have an effect on their physical activity behavior.

Purpose of the Study and Study Objectives

The purpose of this intervention is to assess the effect of parental implementation of autonomy-supportive structure on children's feelings of competence, autonomy, and self-efficacy and its effect on child physical activity.

Primary Objective: Increase physical activity levels in both parents and children from baseline measures.

Secondary Objectives: Encourage the family household to be more conducive to physical activity behavior; increase motivation for physical activity behavior; increase parental self-efficacy, parental perception of their child's competence, child competence and self-efficacy; increase fitness measures for children from baseline.

Tertiary Objectives: Increase lean mass and bone mineral content/bone mineral density, and decrease fat mass in parents and children.

Research Questions and Hypotheses

1. What is the effect of a face-to-face family fitness intervention on the following physiological factors: physical activity behavior (measured by wrist worn accelerometery), fitness (measured by the FITNESSGRAM) and body composition (measured by iDEXA)? We hypothesize that participants that adhere to the components

of the intervention will experience positive changes in daily physical activity, overall fitness, and body composition. We expect positive changes in child physical activity, fitness, and body composition measures will be a function of parental involvement, adherence to the intervention program, and parental increases in daily physical activity.

2. What the effect of a face-to-face family fitness intervention on the following psychological and family factors: parental self-efficacy, perceived competence, motivation for physical activity (measured by the Parental Self-Efficacy Scale, Modified Perceived Competence Scale, and the Sport Motivation Scale), child perceived competence, autonomy, and self-efficacy (measured by the Perceived Competence Scale for Children, Self-Efficacy to Be Physically Active scale, and semi-structured interview), and family autonomy supportive structure (measured by semi-structured interviews)? We hypothesize that initial parental self-efficacy will be predictive of family adherence to the components of the intervention. Initial parental self-efficacy is said to have an influence on number of sessions attended and child success during the intervention (Gunnarsdottir et al., 2011). Parental adherence and involvement in the intervention will predict changes in parental psychological factors. We expect children to experience positive changes in psychological factors as a function of parental psychological factors. Additionally, we hypothesize that these positive changes in psychological factors will have a positive effect on motivation for physical activity.
3. What is the relationship between parental physical activity and child physical activity on a day-to-day basis? We hypothesis that there will be a positive linear relationship

between parent physical activity and child physical activity on a daily basis. Research has suggested that when parents are more active, their children are more active, and maternal physical activity has been a consistent predictor of child physical activity (Erkelenz, Kobel, Kettner, Drenowatz, &Steinacker, 2014; Holm, Wyatt, Murphy, Hill, & Ogden, 2012; Van Allen, Borner, Gayes, & Steele, 2015); therefore, we also expect a stronger relationship between mother's physical activity and their child's physical activity, compared to father's physical activity.

4. To what extent does parental provision of structure (i.e. clear and consistent rules and expectations, and utilization of rationale in promoting physical activity) in an autonomy-supportive manner (i.e. contexts that take in child perspectives, encourage self-initiation, and promote joint problem solving) predict child perceived competence, autonomy, and self-efficacy? Moreover, to what extent will parental structure provision and autonomy-supportive behavior predict child physical activity behavior and changes in fitness and fat mass? We hypothesize that autonomous parental structure provision will have a positive impact on child perceived competence for physical activity. By providing this type of structure in the household, opportunities for the facilitation of competence will be more prominent. We also hypothesize that children will be less likely to acquire self-efficacy without parental structure being implemented in an autonomy supportive manner. Moreover, we expect child acquisition of both competence and self- efficacy will predict the degree to which they participate in physical activity and fitness behavior as well as changes in body composition.

5. To what extent will parental self-efficacy (i.e. confidence in providing support for their child's physical activity) and perceived competence (i.e. belief in their child's ability to successfully engage in physical activity) predict child perceived competence and self-efficacy? Moreover, to what extent will parental self-efficacy and perceived competence predict child physical activity? We hypothesize that if parents do not feel competent in their child's ability to engage in physical activity, they will offer less support and less monitoring, which could result in fewer opportunities for that child to engage in physical activity, thereby decreasing physical activity behavior and changes in fitness.

Significance of the Study

Most interventions targeting weight loss in obese children have a moderate to little effect and do not result in long-term weight loss, physical activity engagement, or health benefits. With the incorporation of behavioral theory into intervention designs, researchers have been able to suggest particular psychological constructs that can affect weight loss, physical activity participation, and adherence; however, the rate of adherence to these programs are not optimal. By incorporating an additional level of influence (i.e. parental influence and the child's immediate built environment) into our intervention design, this study attempts to add to the current framework to help better understand child engagement in physical activity.

In examining family-based studies, cross-sectional studies are the most prominent designs being used. These studies have provided valuable insight into what particular constructs (i.e. parental self-efficacy, parental perceived competence, child competence and self-efficacy) have been suggested to have significant effects on child physical activity participation (Gao, 2008; Gunnarsdottir, Njardvik, Olafsdottir, Craighead, & Bjarnason, 2011; Loprinzi and Trost, 2009; Loprinzi, Schary, Beets, Leary, & Cardinal, 2013; Van Der Horst, Paw, Twisk, & Van Mechelen, 2007). These findings give us an indication of what constructs to examine, or "where to start", but by incorporating these constructs into an intervention we can begin to identify how to implement and the appropriate means of doing so effectively. By teaching parents physical activity components and strategies for implementation, their self-efficacy, perceived competence of their children, and the ability to provide physical activity support could increase. These changes could have a positive impact on the structure they provide in their homes and their child's self-efficacy, competence, and overall physical activity behavior.

In the few intervention studies and systematic reviews that have been conducted, they suggest that face-to-face and group education sessions are found to be the most effective in parental support for child physical activity interventions (Kader, Sundblom, and Elinder, 2015). Based on the following literature review, a face-to-face intervention promoting physical activity, exercise and physical fitness through a family-based intervention targeting individual correlates as well as ecological correlates of physical activity would be the most beneficial for children who are overweight or obese.

<u>Summary</u>

The purpose of this family-based fitness intervention was to enhance the limited literature and add to the current framework surrounding the promotion of child physical activity behavior by targeting psychological and physical constructs of both parent and child. This intervention will teach parents and children components of exercise and physical activity and provide strategies for implementation outside of the intervention. Emphasis is being placed on physical activity, instead of weight loss, because it is considered the most variable aspect of energy expenditure. Additionally, the intervention is targeting increases in physical fitness due to the growing support that this change can result in positive health outcomes, regardless of weight status (Ortega et. al, 2013; Schmidt et. al, 2016). This intervention could help increase overall physical activity and fitness levels which can lead to improvements in physical and psychological health. By targeting psychological, as well as ecological, constructs of physical activity behavior, we hope to increase the likelihood of long-term behavior change.

II. LITERATURE REVIEW

Overview

When examining individual factors, a child's self-efficacy, perceived competence, and perceived barriers all have the potential to play a significant role in whether that child is physically active. Research also suggests that a child's parents or caregivers (i.e. microsystem) can also have an effect on whether a child feels competent or efficacious in this particular domain. Some of the most salient findings across the proceeding studies are the effects of parental confidence (i.e. self-efficacy) in being able to provide physical activity support, parental perceived importance for physical activity, and parental perceived competence in their child's ability to successfully engage in physical activity. Overall, parents who perceive physical activity as important and had confidence in providing support for their child's physical activity, were more likely to employ activity- facilitating parenting practices and behaviors (parental support and monitoring).

Particular parenting practices were also suggested to be significant in increasing physical activity levels. Parenting practice such as control, monitoring, limit setting, and discipline were all seen to have significant effects on reducing screen-time and increasing physical activity in children. These findings in particular underscore the importance of parental provision of structure within the home because they illuminate opportunities for parents to provide clear expectations and rules so children can orient their behavior towards particular outcomes. According to a self-determination theory perspective, structure is defined as the degree to which the environment is organized to facilitate competence. Competence, or a sense of control over one's outcomes, can be enhanced by parental provision of structure (Grolnick and Ryan, 1989). Most interventions targeting weight loss in obese children have a moderate to little effect and do not result in long-term weight loss. In this body of literature, cross- sectional studies are the most prominent designs being used. These studies have provided valuable insight into what particular constructs (i.e. parental self-efficacy, parental perceived competence, child competence and self-efficacy) have been found to have significant effects on child physical activity participation. In the few intervention studies and systematic reviews that have been conducted, they suggest that face-to-face and group education sessions are found to be the most effective in parental support for child physical activity interventions.

Self-Determination Theory Perspective on Structure

The self-determination theory (SDT) examines the underlying psychological needs that contribute to an individual's motivation and behavior. This theory proposes that individuals have three innate, psychological needs-autonomy, competence, and relatedness- that are crucial in achieving intrinsic motivation (i.e. behavior that is driven by internal satisfaction) for a particular behavior (Ryan and Deci, 2002). This model also incorporates Vallerand's (2000) model of motivation. Globally, motivation refers to a broad disposition to engage in activities with an intrinsic or extrinsic orientation. Intrinsic motivation is behavior driven by internal satisfaction; whereas, extrinsic motivation is behavior that is externally regulated through various external rewards and reinforcements (Vallerand, 2000). Vallerand's model suggests that intrinsic, extrinsic, and amotivation (i.e. the relative absence of motivation) result from environmental factors at three hierarchical levels: global (or personality), contextual (or life domain), and situational (or state). This impact of environmental factors on motivation is mediated by perceptions of competence, autonomy, and relatedness at each of the three levels.

Within the family context, relatedness needs can be met through relationships that are warm, caring, and involved. Children's autonomy can be supported through contexts that take their perspectives, encourage self-initiation, and promote joint problem solving (Grolnick et al., 2014). From a SDT theory perspective, structure is defined as the degree to which the environment is organized to facilitate competence. Competence, or a sense of control over one's outcomes, can be enhanced by parental provision of structure. This includes providing clear and consistent rules so that children can orient their behavior, and provide predictable and consistent consequences in which children can anticipate outcomes. This type of structured parenting environment could provide children with a link between how their actions are related to specific outcomes (Grolnick and Ryan, 1989).

Self-Determination Determinants for Exercise

In a systematic review conducted by Sterdt, Liersch, and Walter (2014) examining correlates of physical activity of children and adolescents, they were able to identify seven psychological, cognitive and emotional correlates of physical activity: intention, physical activity preference, perceived barriers, perceived competence, self- efficacy, attitudes and outcome expectations, and goal orientation. In children, a review of 108 studies showed a consistently negative association between perceived barriers and physical activity and a consistently positive association between intention and physical activity (Sallis, Prochaska, & Taylor, 2000). In an additional review, six out of six studies examined found positive associations between self-efficacy and physical activity in children (Van Der Horst et al., 2007). Gao (2008) investigated the predicative strength of perceived competence and enjoyment on physical activity and cardiorespiratory fitness in 6th, 7th and 8th graders. Their results suggested that enjoyment (R2= 16.5) and perceived competence (R2=4.2) accounted for 20.7% of the variance of physical activity, and perceived competence was the only significant contributor to cardiorespiratory fitness (R2=19.3%).

When examining correlates in adolescents, Sallis et al. (2000) found positive associations between physical activity and achievement orientation, perceived competence, and intention to be active. Perceived competence was also found to be positively associated and perceived barriers associated negatively with physical activity in a review targeting adolescent girls (Biddle, Whitehead, O Donovan, & Nevill, 2005). Sterdt, Liersch, and Walter (2014) also identified three reviews that found a consistently positive association between self-efficacy and participation in sport by adolescents (Biddle et al., 2005; Lubans, Foster, & Biddle, 2008; Van der Horst et al., 2007). Although individual characteristics (i.e. self-efficacy, perceived competence, perceived barriers, etc.) can often be influenced by a child or adolescent's built environment, these characteristics alone can play a role in whether a child or adolescent is physically activity. The most salient findings across these studies are the importance of perceived competence (i.e. self-evaluation of one's effectiveness or capability in a particular situation), self-efficacy (i.e. the belief in one's ability to succeed in a particular situation), and perceived barriers or autonomy to overcome barriers (i.e. circumstances or obstacles that prevent access to physical activity) having an effect on child and adolescent physical activity. Self-efficacy has been a strong and consistent predictor of physical activity (Pan et al., 2009). These variables highlight the needs for competence, autonomy, and self-efficacy for long-term exercise participation. When self- determined, individuals partake in physical activity because they value or derive satisfaction from the activity (Sweet, Fortier, Strachan, & Blanchard, 2012). Theoretical integration of these concepts could enhance our research ability to better predict physical activity behavior change. In order to promote long-term adherence across the lifespan these individual characteristics must be taken into account.

Ecological Model

The Social Ecological Model was developed to further the understanding of the dynamic interrelations among various personal and environmental factors. Formalized into a theory in the 1980s, at the core of the ecological model is the child's biological and psychological makeup. This makeup continues to be affected and modified by the child's immediate physical and social environment (microsystem) as well as interactions among the systems within the environment (mesosystem). Other broader social, political, and economic conditions (exosystem) influence the structure and availability of the microsystems and the manner in which they affect the child. Finally, social, political and economic conditions are themselves influenced by the general beliefs and attitudes (macrosystem) shared by members of the society (Bronfenbrenner, 1994).

Figure 2.1

Note: Social Ecological Model of Health (CDC, 2011)

When examining the model from a child perspective, at the core of the ecological model is the child's biological and psychological makeup. This makeup consists of the child's various genetic characteristics, personality, temperament, etc. These individual characteristics continue to be affected and modified by the child's immediate physical and social environment (i.e. microsystem), including such settings as family, school, and peer groups, as well as interactions among the systems within the environment (i.e. mesosystem). In other words, a mesosystem is a system of microsystems. For example, the mesosystem comprises of linkages and processes taking place between settings, such as the relations between home and school, school and peer groups, etc. Other broader social, political, and economic conditions (i.e. exosystem) influence the structure and availability of the microsystems and the manner in which they affect the child. The exosystem consists of processes taking place between two or more settings that can indirectly influence processes within the immediate setting in which the child lives. For a child this could be the relationship between the home and the parent's workplace. The parent's workplace conditions could affect their availability to be present and active within the home; which could result in an indirect influence on their child's various psychological characteristics. Social, political, and economic conditions are themselves influenced by the general beliefs and attitudes (i.e. macrosystem) shared by members of the society. The macrosystem may be thought of as a societal blueprint for a particular culture or subculture. Various labels of class or culture can have an effect on all systems, which can result in an indirect effect on the child's individual characteristics. Finally, characteristics of a child and the environment in which that child lives has a tendency to change over time (i.e. chronosystem), which can affect other systems. These changes could include changes over the life course in family structure, change in socioeconomic status, parental employment, place of residence, or sense of stress within the home. (Bronfenbrenner, 1994).

Microsystem Influences on Child Physical Activity

Parental provision of structure within the home can be considered a characteristic of the child's microsystem (i.e. their immediate physical and social environment). Structured parenting environments can give children a sense of how their actions are connected with certain outcomes (Grolnick and Ryan, 1989), which can have an influence on various psychological characteristics, such as perceived competence and self-efficacy, in that child. The implementation of structure within the home could promote parenting practices (i.e. limit-setting, monitoring, reinforcement, and support for a child's physical activity) and parental orientations (i.e. perceived competence in their child and perceived importance for physical activity) that have been suggested to increase a child's feelings of competence and self-efficacy in engaging in physical activity (Gunnarsdottir et al., 2011; Lloyd, Lubans, Plotnikoff, Collins, & Morgan, 2014; Loprinzi, Cardinal, Kane, Lee, & Beets, 2014). Within the ecological model, the availability of this microsystem to provide parental structure could be influenced by the other systems. For example, parental workplace conditions (i.e. exosystem) could have an effect on that parent's ability to be present and active in the household hindering their means of providing structure. Similarly, cultural differences (i.e. macrosystems) could affect parental workplace conditions (i.e. exosystem) and/or parental provision of structure within the home (i.e. microsystem). All of these influences from the various systems that can affect a parent's ability to provide structure within the home could indirectly affect a child's individual characteristics (i.e. feelings of competence or self-efficacy for physical activity). In designing a child physical activity intervention, it would be advantageous to target not only individual characteristics, but also their immediate environment (i.e. microsystem) to increase the likelihood of behavior change.

Microsystem Literature Overview

Recent family-based intervention studies have suggested that when parents are more active, their children tend to be more active (Erkelenz et al., 2014; VanAllen et al., 2015); this was found to be especially true for younger sedentary children (Edwardson and Gorely, 2010) and for mothers that were more active (Holm et al., 2012). Additionally, parental influences such as, support for child physical activity; parental confidence in being able to provide that support and perceived competence have been suggested to have a significant impact on whether their child reaches exercise recommendations or experiences success from an exercise intervention (Gunnarsdottir et al., 2011; Loprinzi et al., 2013). A recent qualitative study conducted by Ickes, Mahoney, Roberts, and Dolan (2016), suggested that parental mental/physical health, time, self-confidence in enabling child physical activity, and decision making all played a role in a child's parent offering support for physical activity behavior. In a review of the literature examining the effects of family stressors on childhood obesity, Garasky, Stewart, Gunderson, Lohman, and Eisenmann (2009) identified differences in effects between younger and older children. Younger children that lacked cognitive stimulation and emotional support were positively associated with being overweight or obese; while older children's weight was more affected by family mental/physical health and financial strain. Their results suggested that when a child experienced one additional family mental/physical health stressor, there was a 6% decrease in the likelihood of having a healthy weight, and a 4.4% increase in the likelihood of being obese; likewise for financial strain, 2.6% and 1.9% increases, respectively.

Generally speaking, as children age, their level of physical activity decreases; however, some research suggests that the child's immediate environment can play a role in promoting physical activity as children develop. In further support for a more ecological approach, Cleland, Timperio, Salmon, Hume, Telford, and Crawford (2011) examined the longitudinal relationship between the family environment and physical activity among youth. Their results suggested that maternal modeling of exercise behavior was significantly associated with both boys' and girls' physical activity. For boys, they also found that direct support and reinforcement offered by fathers was also significant in predicting change in physical activity; whereas, girls benefited most from maternal and sibling co-participation in physical activity. The use of cognitive theories in physical activity research has provided valuable insight into understanding behavior change at the individual level; however, the incorporation of the ecological model gives direction for future research to design more comprehensive exercise interventions.

In examining the family-based intervention literature, cross sectional study designs are the most prominent, and these studies provide insight into important variables that can be utilized in more intervention designs. A recent systematic review assessing the overall effectiveness of parental support and child weight loss interventions identified that face-to-face counseling was most effective in changing children's diet, and group education was most effective concerning body weight, especially in low socioeconomic populations. Among the 35 studies they examined, they also found that intervention effectiveness was higher among younger children compared to older children (Kader, Sundblom, & Elinder, 2015). When assessing the efficacy of a brief parent report intervention for increasing preschool's physical activity, Jenson et al. (2015) used the preschoolers' 3-day accelerometer data to create a parental health report with their child's physical activity compared to national recommendations. After conducting post-testing 2 weeks later, their results suggested a slight increase of 5.12 minutes per day ($p=0.006$) in preschoolers' moderate physical activity. Rhodes, Naylor and McKay (2010) examined the effect of a planning intervention, in comparison to a standard intervention, on physical activity in families with young children. Their sample consisted of 85 families who self-identified with room to improve weekly family physical activity (less than 4 times per week at 60 minute duration). Each family had to be married and have a child (or children) between the ages of 4-10. Families were randomized to either the standard (control) group, which consisted of receiving a package of Canada's family guide to physical activity and recreation guides, or the planning (intervention) group, which received educational content, a workbook, and calendar along with information on how to plan, overcome barriers, and goal setting methods in addition to the Canada physical activity and recreation guides. One parent self-reported physical activity levels for all members of the family prior to and after the intervention. Families were asked to read over the material and follow the intervention instructions for four weeks. Their results showed a moderate effect of the planning intervention, compared to the standard group, in increasing unstructured physical activity frequency ($\eta2=.11$) and total minutes ($\eta2=.09$), which translated into a small to moderate effect of the intervention on a higher total family physical activity frequency ($\eta2=.08$) and total minutes ($\eta2=.06$). A similar study conducted by VanAllen et al. (2015) also examined the differences in self-reported physical activity between participants enrolled in the treatment versus active control to test parent-child associations. They targeted overweight children (BMI > 85th percentile) aged 7-17, with one parent willing to participate. Participants were randomized to the intervention group, which consisted of 90-minute weekly group sessions about nutrition, physical activity education, behavioral components, and goal setting, or the active control group, which consisted of receiving a *Trim Kids* manual and three face-to-face sessions with a dietician, for the duration of the 10-week intervention. Both child and parent provided height and weight and were given a 7-day physical activity recall at baseline, post intervention, and 12-month retention testing. They reported that participants in the intervention group reported higher levels of physical activity at the 12-month follow-up, compared to the active control group. They found this difference to be statistically significant ($p<.01$) and resulted in a small-medium effect size ($\omega 2=0.07$). However, their cross-sectional analysis indicated that change in parent physical activity was significantly and positively associated with change in youth physical activity between baseline and the 10-week post-test ($r2=.09$, $p<.05$), and between baseline and the 12-month follow-up ($r2=.194$, $p<.01$), irrespective of group.

The utilization of the ecological model in designing child physical activity interventions would be beneficial to increase the likelihood of intervention success by targeting the child's microsystem; taking a theoretical approach in targeting that child's individual characteristics (i.e. competence, autonomy and relatedness) is crucial in eliciting long-term physical activity behavior change.

Designs Targeting Microsystems and Individual Outcomes

The aforementioned interventions all reported significant findings; however, their overall effects were small to moderate. In the systematic review conducted by Kader, Sundblom, and Elinder (2015), they mentioned that 24 out of the 35 studies used for the review utilized some type of behavioral theory; additionally, 17 of those reported effectiveness of the parental components with at least one outcome. The previous mentioned literature provides us with evidence that supports the notion: if parents are more active, their children tend to be more active. However, it would be advantageous to incorporate and test constructs of behavioral theories to help identify the mechanisms through which this change can occur. In other words, interventions that target both environmental (i.e. microsystems) and individual determinants are more likely to produce long-lasting change. A cross-sectional study examined a range of potential behavioral and maternal/paternal correlates (screen-time, diet, and physical activity) of adiposity in children. Parenting practices (control, limit setting, monitoring, discipline, and reinforcement) were assessed by having both parents complete the Parenting Strategies for Eating and Physical Activity Scale (PEAS). Child outcomes included: 7-day pedometer data, screen-time and food frequency (provided by mothers), and BMI z-score. Their results suggested that mother's and father's control ($r=-.47$, $p<.01$; $r=-.31$, $p<.01$, respectively) were both inversely related to their child's BMI, and the father's BMI was moderately correlated with the child's BMI ($r=.41$, $p<.001$). Mother monitoring ($r=-.44$, $p<.001$) and discipline ($r=-.30$, $p<.05$), along with father's limit setting ($r=-.33$, $p<.01$) and discipline ($r=-.34$, $p<.01$), were inversely associated with screen time. Mother limit setting ($r=.39$, $p<.01$) and monitoring ($r=.48$, $p<.001$), along with father limit setting ($r=.30$, $p<.05$), was correlated with intake of core foods.

Mother's control (r=-.25, $p<.05$) was slightly, inversely correlated with child steps per day; while father's reinforcement (r= -.42, $p<.01$) was moderately correlated (Lloyd et al., 2014). Overall, their results suggest that certain parenting practices (control, monitoring, discipline, and limit setting) can play a role in decreasing BMI and screen time in children 5-12 years of age. Loprinzi et al. (2014) found similar results when examining the association between parental influences on preschool sedentary behavior. Their sample consisted of 186 parents of preschoolers, who completed an online survey to assess their child's media use and sedentary time, parental physical activity, parental practices (support for physical activity, restrictive play, rule and monitoring), parental dimensions (warmth, irritability, and control), and parental orientations (perceived competence of their child, perceived importance of child physical activity, perceived confidence in providing support/parental self-efficacy, and parent's physical activity experiences as children). Child sedentary time was validated using accelerometers. In accordance with Lloyd et al. (2014), their results suggest that parental control (r= -.46, $p<.001$) was inversely associated with preschool screen time among boys; moreover, when examining the association between parental influences on boys' sedentary behavior for the weekend, parental control accounted for 49% of the variance when all other predictors were included.

When taking an ecological model approach, we are considering the individual's motivation (in this case children) but we also need to consider parental motivation. The preceding cross-sectional studies examined various parental practices that could play a role in their child being physically active, but are skirting around an important construct to behavior change, motivation. Gunnarsdottir et al. (2011) investigated the role of parental motivation (importance, readiness, and confidence) for predicting dropout and outcome from a family-based behavioral treatment for childhood obesity. Their sample consisted of 84 obese children and their parents, all of which attended individual family and group sessions twice per week for 24 weeks. In addition, participants were instructed to complete self-monitoring records (nutrition and physical activity) weekly and were provided goals. Sessions included information about physical activity, weight control, self-monitoring, behavior change techniques, and maintenance of behavior change. Their results suggested that one of the reoccurring reasons for a family to drop out of the study was the child was not enjoying the treatment (i.e. lack of intrinsic motivation). Additionally, they found that parental confidence was significantly lower ($p<0.001$, Cohen's d= 1.0) in those that dropped out. Child weight loss at week three was inversely correlated with reported parental confidence at baseline (r- -0.358, p=0.00), suggesting that children experienced more weight loss when their parents reported higher levels of confidence in their ability to change their behavior. Child weight loss was also moderately correlated ($r= -0.328$, $p>0.01$) with the amount of self-monitoring records completed. Parental confidence was moderately correlated with group sessions attended ($r=.452$, $p< 0.001$) and self-monitoring records completed ($r= .472$, $p< 0.001$). Two variables (parental confidence and parental weight loss at week 5) were included in analysis for child weight loss at 5 weeks; these two variables explained 21.4% of the variance in the model. Five predictors (gender, baseline parental confidence, child weight loss at 5 weeks, change in parental BMI during treatment, and number of self-monitoring records completed) were included in examining child post-treatment weight; this model accounted for 45.4% of the variance for child weight loss at post-treatment. Self- monitoring records were also found to be more strongly associated with treatment success than attendance (r= -0.328, p< 0.001; r= -0.296, p<.05; respectively). Overall, their results suggest that parental confidence appears to be an important aspect of motivation for child weight loss; moreover, when examining readiness and importance both were moderately correlated with parental confidence (r= .536, p<0.001; r= .424, p< 0.001; respectively). This finding could imply that if parents are more confident in their ability to make a behavior change, they also have a sense of readiness and place importance on the behavioral change. However, it is important to note that this process would not necessarily work in a reciprocal manner; parents could be ready and understand the value of making a behavior change, but could not have the confidence to do so.

Similar findings were suggested by Loprinzi et al. (2013) in a cross-sectional study examining various parental influences on children's physical activity. Their sample included 176 parents of preschool children, all of whom completed online surveys assessing parental influences (parent physical activity, support of child's physical activity, restrictive rules, monitoring, perceived competence, perceived importance of child physical activity, parental self-efficacy to provide support, parent's physical activity experiences as children), parenting styles (warmth, control, irritability), and estimation of their child's physical activity (verified with accelerometer data). Their findings suggest parental self-efficacy (i.e. parental confidence in providing support) was significantly and positively associated with parental support, warmth, and monitoring of child physical activity (r= 0.33; r= 0.21; r= 0.15; p<0.05, respectively). Parental importance of child physical activity was significantly associated with parental support (r= 0.27) and monitoring (r= 0.21), and inversely associated with restrictive rules (r= -0.17).

Parental perceived competence was significantly associated with parental support for physical activity ($r = 0.18$), parental warmth ($r = 0.22$), and monitoring ($r=0.22$); furthermore, when controlling for parental gender and BMI, parental support ($\beta=0.29$, $p<0.001$) and monitoring ($\beta= 0.29$, $p=0.006$) were associated with child physical activity. Overall parents who perceive physical activity as important and had confidence in providing support for their child's physical activity, were more likely to employ activity-facilitating parenting practices and behaviors (parental support and monitoring). When designing a family-based intervention, you are taking a slightly more ecological approach; however, it is important to incorporate valuable cognitive constructs, such as motivation. Parental confidence could have an impact on parental motivation; which in turn, could affect the availability of their support for their child's physical activity. As children's primary gatekeepers, parents' and caregivers' motivation for various behaviors could have a direct impact on the environment in which they create for their children.

Cross-sectional studies have suggested that certain parental influences could have an effect on whether their child is physically active or not, but within the intervention studies only one study (Gunnarsdottir et al., 2011) has begun to identify how these parental influences could help aid in the acquisition of exercise behavior in obese children. Their results suggested that parental confidence at baseline was a significant predictor of whether the family stayed in the intervention and child weight loss occurred. An exercise intervention that promotes parental confidence and other regulatory skills could give valuable insight into how families can structure their home environment and parent-child relationship to help increase their physical activity and acquire newfound healthy behaviors.

As previously noted, it is important to consider obesity separately from physical activity. Previous research has cited the health consequences associated with carrying excess body fat (NIH, 2010); however, there has also been evidence suggesting that higher levels of fitness (achieved through increasing physical activity) can lower risk for health comorbidities regardless of obesity status (Ortega et al., 2013). When conducting a 20-year follow-up of 1792 adults who participated in fitness testing at ages 7-15, participants who had higher aerobic fitness in childhood, independent of abdominal fat, reduced the risk of developing metabolic syndrome by 36% compared to those participants with lower levels of fitness in childhood (Schmidt et al., 2016). Increasing daily MVPA in children has been suggested to improve cardiovascular and muscular fitness, improve bone health, reduce symptoms of depression, decrease the likelihood of developing heart disease or diabetes, and improve concentration and memory (Calfas and Taylor, 1994; CDC, 2015; Digelidis et al., 2003; Haugen et al., 2011; U.S. Department of Health and Human Services, 2008). Childhood obesity research interventions are most commonly assumed to be targeting a reduction in weight; however, an intervention targeting increasing physical activity and MVPA to improve physical fitness could offer more health benefits to children compared to weight loss intervention alone.

III. METHOD

Human Subjects Approval

In order to begin recruitment for our family-based fitness intervention (entitled *Famtastically Fit)*, a full-board research protocol review form was submitted to the Auburn University Institutional Review Board for Research Involving Human Subjects (IRB). Following regulations set forth by Auburn University IRB, the *Famtastically Fit* IRB request was approved for use from 8/24/2016 to 8/23/2017 under the following protocol number: 16-306 MR 1608 (Appendix A).

Participants and Setting

From August 25, 2016 to September 28, 2016, families were recruited from the community via flyers, email blasts, and social media (Appendix B). All families that had a least one child between the ages of 5-12 with a BMI over the 85th percentile and at least one parent willing to participate were invited to join the study. The participating parent(s) identified as being sedentary (i.e. engaging in structured exercise no more than 1 day per week). This cohort consisted of 8 families; 9 parents (8 mothers and 1 father) and 10 children (6 males and 4 females). All 9 parents consented for their family and all 10 children assented to be in the study. Families were asked to meet once per week for approximately 60-90 minutes.

Procedures

This family-based fitness intervention consisted of once weekly sessions for 10 weeks. All sessions took place in 2 university laboratories. Orientation sessions prior to the intervention consisted of obtaining informed consent for both parent and child; completion of the physical activity readiness questionnaire (PAR-Q) for adults (CSEP, 2002) and a PAR-Q adapted for children (University of Limerick, 2016); collecting demographic and Tanner Scale (Tanner, 1969) information from parents; conducting height and weight assessments on both parent and children; DEXA scans for all participants; parental perceived competence, motivation, and self-efficacy questionnaires; child perceived competence, motivation and self-efficacy questionnaires; semi-structured interview with participating children; FITNESSGRAM testing with children and a MOVband orientation.

Sessions were approximately 60-90 minutes in duration; with the first 40-45 minutes the parents and children in separate but concurrently run sessions. Parent sessions consisted of cardiovascular and resistance-training exercises that focused on teaching basic movements (i.e. squats, lunges, planks, overhead press) that were body weight movements or used minimal equipment and how these movements could be implemented outside of the intervention (Appendix H). These exercise sessions were followed by short (6-10 minute) education sessions, consisting of: health implications of sedentary behavior, nutrition, goal setting, self-regulation techniques, time management, relapse prevention, social support, and reinforcements. Parents were also sent three text messages per week; two text messages with information on how they could implement what they learned in their education sessions that week and 1 text message reminder to bring their self-regulation logs to their weekly session (Appendix I).

Child sessions were approximately 15 minutes in duration of structured lessons that focused on fitness education, motor skill development, and strategies for implementation outside of the intervention (Appendix G). These sessions included: how to be more active throughout your day, muscular strength oriented lessons, cardiovascular oriented lessons and child-led lessons. Muscular strength lessons focused on learning how to do various body weight exercises (push-ups, squats, lunges, sit-ups) and what area of the body each exercise was targeting (arms, stomach, legs). Cardiovascular oriented lessons focused on learning about different ways (running, quick step-ups, agility ladders, and jumping rope) to exercise their heart and lungs. Child-led lessons allowed children to design exercises that targeted different parts of the body and how they thought they could be more active throughout their day. Each 15-minute lesson was followed by approximately 25-30 minutes of free play.

For the final 15-20 minutes of each session, the family was brought back together for a group session. Group sessions consisted of going over weekly self-regulation logs and making individual and family-based goals, providing recommendations for exercise outside of the intervention, tips to help begin implementing lessons learned within the household. Take home material to promote parental confidence and implementation of structure and autonomy-supportive behavior was provided in the form of a family action plan. This action plan was in the form of a weekly calendar (Appendix E). Every week during group sessions, a researcher helped the family develop a plan of action for the upcoming week. The plan included daily goals, example exercise sessions that incorporated movements learned, and family physical activity ideas (i.e. walk to park, hiking, swimming, etc.). These family action plans were created using suggestions from both parents and their children. Nutrition education was primarily focused on offering healthy options (i.e. fresh fruits, vegetable; meat, low-processed carbohydrates and water) versus food restriction.

To promote self-monitoring and completion of self-regulation logs, research personnel reviewed the previous week's logs with each individual and helped set individual and family-based goals for the upcoming week. Individual goals were personalized and based on what that individual had done previously and what they hoped to accomplish. Family-based goals were created to promote accountability within the family. Recommendations for exercise and physical activity outside of the intervention were based on what had been learned in the exercise sessions and what resources the family had available.

Post-testing began one week following the cessation of the intervention and consisted of height and weight assessments on both parent and children, DEXA scans for all participants, parental perceived competence, motivation and self-efficacy questionnaires, child perceived competence, motivation and self-efficacy questionnaires, semi-structured interviews with participating children and parents, FITNESSGRAM testing with children, and a final MOVband download. A week-by-week intervention guide can be found in Figure 3.1

Figure 3.1 Week-by-Week Intervention

	Intervention						
	Exercise prescription			**Self-efficacy "action plans" and self-regulation logs**		**Structure, competence, health education**	
	Child	**Parent**	**Delivery strategy**	**Group Session**	**Delivery strategy**	**Group Session**	**Delivery strategy**
Week 0	MOVband baseline, DEXA, Fitgram	PAR-Q and informed consent for themselves and on the behalf of their participating children, Demographic info, Tanner, MOVband baseline, DEXA	Meeting at the lab	Parents: Self-efficacy Questionnaire Children: Self-efficacy questionnaire	Meeting at the lab	Parents: Perceived Competence and Motivation questionnaires Children: Perceived competence and Motivation questionnaires and Semi-structured interviews	Meeting at the lab
Week 1	~30 mins: "How can we be more active throughout our day?"	~30 mins: 5-8 min Warmup 12-18 min Workout 5-8 min Cooldown	Meeting at the lab Take home exercise recommendations, and exercise prescription MOVband download	~30 minutes: >Introduction of Self-regulation logs >Needs assessment for PA >Helps parents create an "action plan" for physical activity for the week, promote parental self-efficacy >Recommendations for individual and family-based goals	Meeting in the lab Take home self-regulation logs	~10 mins: >Provide parent and children with recommendations for creating joint rules about physical activity >Help parents develop rationale for why exercise and physical activity are important	Meeting in the lab 3 text messages over the course of the week reinforcing recommendations
Week 2	~40 minutes: ~20 minutes: "What are we exercising when…", muscular strength ~20 minutes free play	~40 minutes: 5-8 min Warmup 12-18 min Workout 5-8 min Cooldown	Meeting at the lab MOVband download	~10 mins: >Go over self-regulation logs >New goals, recommendations >Refine parental "action plan" for the week	Meeting in the lab Take home self-regulation logs	~10-15 mins >**Video: 23 ½ hours** Brief presentation on sedentary behavior and health consequences >Recommendations on how to be more active within your home/throughout the day	Meeting in the lab 3 text messages reinforcing recommendations
Week 3	~40 minutes: ~20 minutes: "What are we exercising when…", muscular strength ~20 minutes free play	~40 minutes: 5-8 min Warmup 12-18 min Workout 5-8 min Cooldown	Meeting at the lab MOVband download	~10 mins: >Go over self-regulation logs >New goals, recommendations >Refine parental "action plan" for the week	Meeting in the lab Take home self-regulation logs	~10-15 mins **>Video: Healthy Eating 101** Brief presentation on nutrition education and maintaining a healthy weight >Recommendations and healthy alternatives	Meeting in the lab 3 text messages reinforcing recommendations
Week 4	~40 minutes ~20 minutes "What are we	~40 minutes: 5-8 min Warmup 12-18 min Workout	Meeting at the lab	~10 mins: >Go over self-regulation logs	Meeting in the lab	~10-15 mins **>Video: Goal Setting**	Meeting in the lab

	exercising when…", cardiovascular ~20 minutes free play	5-8 min Cooldown	MOVband download	>New goals, recommendations >Refine parental "action plan" for the week	Take home self-regulation logs	Setting up strategies to stick with exercise Establishing and sharing personal goals. >Q&A, recommendations on getting children involved	3 text messages reinforcing recommendations
Week 5	~40 minutes ~20 minutes "Making obstacles with friends" ~20 minutes free play	~40 minutes: 5-8 min Warmup 12-18 min Workout 5-8 min Cooldown	Meeting at the lab MOVband download	~10 mins: >Go over self-regulation logs >New goals, recommendations >Refine parental "action plan" for the week	Meeting in the lab Take home self-regulation logs	~10-15 mins **>Video: Self-monitoring** Self-behavioral analysis (personal behavior inventory). >Q&A, recommendations on getting children involved	Meeting in the lab 3 text messages reinforcing recommendations
Week 6	~40 minutes ~20 minutes Child-led muscular strength ~20 minutes free play	~40 minutes: 5-8 min Warmup 12-18 min Workout 5-8 min Cooldown	Meeting at the lab MOVband download	~10 mins: >Go over self-regulation logs >New goals, recommendations >Refine parental "action plan" for the week	Meeting in the lab Take home self-regulation logs	~10-15 mins **>Video: Time management** Plan positive outcomes and negative outcomes. Setting up the time for PA >Q&A, recommendations on getting children involved	Meeting in the lab 3 text messages reinforcing recommendations
Week 7	~40 minutes ~20 minutes Child-led muscular strength ~20 minutes free play	~40 minutes: 5-8 min Warmup 12-18 min Workout 5-8 min Cooldown	Meeting at the lab MOVband download	~10 mins: >Go over self-regulation logs >New goals, recommendations >Refine parental "action plan" for the week	Meeting in the lab Take home self-regulation logs	~10-15 mins **>Video: Relapse prevention** Overcoming negative situations against doing PA. Plan B for unexpected events and Identifying barriers for PA. >Q&A, recommendations on getting children involved	Meeting in the lab 3 text messages reinforcing recommendations
Week 8	~40 minutes ~20 minutes Child-led cardiovascular ~20 minutes free play	~40 minutes: 5-8 min Warmup 12-18 min Workout 5-8 min Cooldown	Meeting at the lab MOVband download	~10 mins: >Go over self-regulation logs >New goals, recommendations >Refine parental "action plan" for the week	Meeting in the lab Take home self-regulation logs	~10-15 mins **>Video: Social support** Peer support and Family support >Q&A, recommendations on getting children involved	Meeting in the lab 3 text messages reinforcing recommendations

Week 9	~40 minutes ~20 minutes Child-led "how can we get more physical activity" ~20 minutes free play	~40 minutes: 5-8 min Warmup 12-18 min Workout 5-8 min Cooldown	Meeting at the lab MOVband download	~10 mins: >Go over self-regulation logs >New goals, recommendations >Refine parental "action plan" for the week	Meeting in the lab Take home self-regulation logs	~10-15 mins **>Video: Reinforcements** Identifying appropriate reinforcements and how to implement them. >Q&A, recommendations on getting children involved	Meeting in the lab 3 text messages reinforcing recommendations
Week 10	Post-test MOVband DEXA, Fitgram	Post-test MOVband DEXA	Meeting at the lab MOVband download	Parents: Self-efficacy Questionnaire Children: Self-efficacy questionnaire	**Meeting in lab**	Parents: Perceived Competence and Motivation questionnaires and Semi-structured interview Children: Perceived competence and Motivation questionnaires and Semi-structured interviews	Meeting in the lab
Week 24	Post-test MOVband DEXA, Fitgram	Post-test MOVband DEXA	Meeting at the lab MOVband download	Parents: Self-efficacy Questionnaire Children: Self-efficacy questionnaire	Meeting at the lab	Parents: Perceived Competence and Motivation questionnaires and Semi-structured interviews Children: Perceived competence and Motivation questionnaires and Semi-structured interviews	Meeting at the lab

Measures

Dual-Energy X-ray Absorptiometry

Anthropometric measures were collected prior to body composition scanning. Both parents' and children's weight were assessed with a calibrated electronic scale (Michelli Scales, Harahan, LA) to the nearest 0.1 kg and height measured to the nearest 0.25 inches using a standiometer. Body composition assessment was performed prior to beginning the intervention and following the intervention employing the *GE* iDEXA scanner (*GE Healthcare Lunar*, Madison, Wisconsin). The iDEXA scanner utilizes a fan beam x-ray and differentiating photon energy levels to detect differences in body tissue; resulting in high-resolution images that identify body tissue distribution and overall body composition. Variables for data analysis included change in overall fat mass, lean mass, segmental analysis (i.e. arms, legs, and trunk), and bone mineral content (BMC) for children and bone mineral density (BMD) for parents from the pre- and post-intervention assessments. BMC is reported for children because DEXA-derived BMD is an a real BMD (aBMD) rather than a true volumetric BMD (BMD= BMC/Bone Area); therefore, irregular bone growth and size of bones in children will be found to have a lower BMD than larger bones even if their volumetric BMD is the same, resulting in possible error when reporting BMD as opposed to BMC (Binkovitz and Henwood, 2007). Qualified research personnel performed all iDEXA measurements.

Physical Activity Data

Physical Activity data was collected using the *MOVABLE* MOVband3 activity tracker (*Dynamic Health Solutions, LLC,* Houston, Texas). The MOVband3 utilizes tri-axial accelerometery and demographic information to estimate "moves" or physical activity during a 24-hour period. The MOVband3 has companion software that can estimate physical activity in 1-hour intervals. Approximately 12,000 *moves* is equivalent to 10,000 steps (i.e. 1.2 *moves* is equivalent to 1 step). Each participant's demographic information (height, weight, birth date, and sex) was used to calibrate the activity tracker. Participating parents and children were given a MOVband3 during the week prior to the intervention and were instructed to wear the activity tracker on their wrist during the day; taking the activity tracker off only for water-based activities. Participants were instructed to continue wearing the activity tracker throughout the duration of the 9-week intervention. We used average daily moves for all participants for data analysis. The MOVband3 is charged and synced via USB; activity trackers were charged and synced during weekly sessions.

Fitness

Children were asked to complete the FITNESSGRAM (Meredith & Welk, 1999) pre- and post-intervention. The FITNESSGRAM is a series of health-related fitness activities to assess physical fitness in children. The three areas of assessment are cardiovascular endurance, muscular strength and endurance, and flexibility. Pre- and post-intervention scores on cardiovascular endurance and muscular strength and endurance were used for data analysis. Cardiovascular endurance was assessed using the Progressive Aerobic Cardiovascular Endurance

Run (PACER), which is a multistage fitness test adapted from the 20 meter shuttle run test. The test is progressive and gradually gets harder with each stage. Muscular strength and endurance were assessed using the following: the curl-up (i.e. sit-up) test, in which children were asked to do as many curl-ups as possible at a specified pace; the push-up test, in which the child did as many push-ups as possible in cadence of 20 push-ups per minute until they (a) must stop to rest (b) do not achieve a 90 degree angle with elbows each rep (c) do not maintain correct body position or (d) do not extend arms fully (Meredith & Welk, 1999).

Self-Regulation Logs

Participants were asked to self-monitor their food and beverage intake on at least one weekday and one weekend day per week and daily physical activity by recording nutrition intake, "moves" from their MOVband3, and specific activities that they engaged in to obtain their "moves". Food and beverage intake were included on the self-regulation logs to give the participants a well-rounded intervention and tips and recommendations for healthy food choices. Group education sessions involved a nutrition session and provided the opportunity to practice implementing and regulating food choices as a family under the supervision of research personnel. Self-regulation logs were given in paper form during the participating family's weekly sessions (Appendix F).

Tanner Scale

Child onset or progression of their pubertal status was assessed by their parents using the Tanner Scale, as puberty can have a profound effect on body composition values (Siervogel et al., 2004). Due to the variability in the onset and progression of puberty, Dr. James Tanner (1969) developed this 5-point scale to rate such changes in male and female children. The scale asks parents to rate their children's external genitalia and pubic hair development on a 1 to 5 scale (1 being prepubertal and 5 being an adult).

Parental Self-Efficacy and Perceived Competence

Parental self-efficacy, or parental confidence in providing support for their child's activity behavior, was assessed using the 5-item questionnaire developed by Adkins Adkins, Sherwood, Story, & Davis (2004). Within this questionnaire, parents were asked how difficult it is for them to provide various types of parental support for their child's activity behavior, with responses ranging on a 4-point scale from *not hard at all* to *very hard.* The Cronbach's α reported by Adkins et al. (2004) was .83. Data analysis was conducted by comparing the post-test score to the pre-test score. The range for this scale is 5-20 possible points; the higher the score indicates a high level of parental self-efficacy.

Parental perceived competence was assessed using the modified Perceived Competence Scale developed by Southall, Okely, & Steele (2004). Parents were asked to respond to 18 questions comparing their child's level of coordination compared to other children of the same age. Sample items include: compared to other children of the same age, my child "does well at games or activities that involve kicking balls" and "would rather play games and sports than watch them." Parent responses were recorded on a 4-point scale ranging from *strongly agree* to *strongly disagree.* The Cronbach's α reported by Southhall et al. (2004) was .87. Participating parents were asked to complete these two questionnaires prior to the intervention and again following the cessation of the 9-week intervention. Data analysis was conducted by comparing the post-test score to the pre- test score. The range for this scale is 18-72 possible points; the higher the score indicates a high level of perceived competence.

Parental and Child Motivation for Physical Activity

The revised Sport Motivation Scale assessed parental and child motivation for physical activity prior to and following the intervention. The scale was designed to assess individuals' level of motivation towards sport, using the self-determination theory framework (Pelletier, Rocchi, Vallerand, Deci, & Ryan 2012). The questionnaire was adapted to be physical activity oriented and simplified phrases for the children's version of the scale. Participants reported the extent to which the listed reasons for participating in physical activity corresponded with their own personal reasons. Participants' motivation was assessed using a 7-point Likert scale ranging from 1 (*Does not correspond at all*) to 7 (*Corresponds completely*). The scale consisted of the 18 items measuring six factors (intrinsic, integrated, identified, interjected, external, and amotivated). The reliability of each subscale (Cronbach's α) ranged from 0.73 to 0.86. Data analysis was conducted by comparing the post-test score to the pre-test score. The range for this scale is 18-126 total points or 3-21 points per factor; the higher the score per factor indicates the higher likelihood of having that particular type of motivation.

Child Perceived Competence and Self-Efficacy

Child perceived competence, or the perception a child has of his or her ability to accomplish certain tasks resulting from cumulative interactions with the environment, was assessed using the revised physical subscale of the Perceived Competence Scale for Children (Harter, 1985). This subscale consists of six items presented in a structured alternative format. Children responded to which items in the pair were true for them and then respond to bipolar statements (i.e. *really true or sort of true*). Each item was scored on a 1 to 4 scale, with a score of 1 referring to low perceived competence and a score of 4 indicating high-perceived competence. A sample item includes: "some kids don't do well at new outdoor games OR other kids are good at new games right away". The physical subscale Cronbach's α, reported by Harter, 1985 was .83. Data analysis was conducted by comparing the post-test score to the pre-test score. The range for this scale is 6-24 possible points; the higher the score indicates a high level of perceived competence.

Child self-efficacy, defined as children's confidence in their skills and abilities to be physically active to reach a desired outcome, was assessed using a questionnaire that assesses two separate constructs: self-efficacy to be physically active (SEPA) and proxy efficacy to influence parents to provide physical activity opportunities (PEPA-P) (Dzewaltowski, Geller, Rosenkranz, & Karteroliotis, 2010). Children were asked to respond to 11 total items (5 and 6, respectively) that are scored on a 3-point scale, choosing from "*not sure at all", "somewhat sure", "very sure".* Sample items include: (SEPA), "How sure are you that you can do physical activity 60 minutes each day?"; (PEPA-P), "How sure are you that you can get your parents to help you find different types of physical activities you can do?". The Cronbach's α reported by Dzewaltowski et al. (2010) for each subscale is as follows: SEPA (α=. 753) and PEPA-P (α=. 781). Data analysis was conducted by comparing the post-test score to the pre-test score. The range for this scale is 11-33 possible points; the higher the score indicates a high level of self-efficacy and proxy self-efficacy.

Structure Implementation

From a self-determination theory perspective, structure within the home should help facilitate child competence by utilizing clear rules and expectations. However, it is important that structure be implemented in an autonomy-supportive manner compared to a controlling manner because it could affect the extent to which that child feels they have control over their own behaviors and outcomes. Therefore, children could feel most competent and engage most fully when structure is implemented in an autonomy-supportive manner rather than through attempts to pressure or control their behavior to reach specific outcomes (Grolnick et al., 2014). Participating children were asked to respond to a short semi-structured interview to help identify how structure (clear rules, clear expectations, and utilization of rationale in promoting more physical activity) is implemented within the home and if these concepts are being implemented in an autonomy-supportive manner (jointly established rules, open exchange between parent-child, and permitting choice in promoting more physical activity). Semi-structured interviews with children took place prior to and post intervention, and semi-structured interviews with parents took place post-intervention with qualified research personnel.

Statistical Analyses

Quantitative

Descriptive statistics were used for demographic and physical characteristics. All body composition, fitness, and psychological measures were analyzed using paired t-tests in IBM SPSS Statistics 23 for Windows® to estimate if there was a significant change from pre- to post-assessment. Our original intention was to follow up the t-tests with regression analyses to examine the relationship between parent change in measures and their child's change in measures; however, individual significant differences were not found for the majority of the variables tested as discussed in the results.

Physical activity data were broken down into hourly segments, with 5:00am activity representing physical activity taking place between hours 5:00-5:59am. Physical activity data were downloaded from the hours of 5:00am to 12:00am on the six days per week outside of their weekly session. If a participant had more than three consecutive hours of "no-wear time" within of their normal wake hours, their data for that day was treated as missing. Normal wake hours were determined by visual inspection of habitual activity on weekdays and weekend days, separately. For this particular analysis, we utilized the participants' daily *moves.*

Data analyses were conducted using R and R Studio using the dplyr, lme4, and lmerTest packages (Bates; 2010; Kuznetsov et al., 2013; R Core Team, 2015; Wickham

& Francois, 2015). Linear mixed-effects models were used for both primary and secondary analyses to predict daily physical activity over time and child physical activity as a function of parent physical activity on a day-to-day basis. The change in physical activity and the relationship between parental activity and child activity was the focus of this set of analyses. Due to the nested nature of the data, linear mixed-effects models were chosen to account for the variance of time nested within individuals and individuals nested within families. These two levels of between-subjects factors are referred to as time and family status (i.e. whether a participant was a parent or child) within the statistical models. Mixed-effect regression was chosen over other techniques (e.g., RM ANOVA) as this method allows for participants with partially missing data and data being collected at different times. On average, each child was missing 29.4% and each parent was missing 20.4% of their daily *moves* for the 10-week, 60-day data collection.

To model changes in physical activity as a function of time and family status, a step-up procedure was used in which variables were added to successive models. All models started with predicting *moves per day* as function of the average number of moves for each participant (random intercepts, model 0). We then added *time* as a predictor to see if moves per day changed as a function of time (random slopes, model 1). To test potential differences within a family, *family status* was added to see if there were significant differences between parents and children on average (model 2). Next, we added the interaction family status and time to see if the rate of change in moves per day differed between parents and children (model 3).

To model the relationship between parents' physical activity and children's physical activity, we started with a model predicting children's daily moves as function of the average number of moves for each child (random intercepts, model 0). Given that maternal physical activity has been suggested to be a strong predictor of child physical activity (Cleland et. al, 2011; Holm et al., 2012), child daily *moves* were plotted against parent daily *moves* for each family to evaluate how the relationship should be modeled. For this analysis we needed to have an equal data set for each family and wanted to further investigate the relationships between maternal and child physical activity; therefore, for the one family that had both parents participate, only the mother's physical activity data was utilized. Upon visual inspection, on average it appeared that there was a positive linear relationship between children's daily *moves* and mother's daily *moves*. As such, we added a predictor of mother's daily *moves* (model 1). We subsequently added a random-effect of mother's daily *moves* (random slopes, model 2), to see if allowing different slopes for each child significantly improved the fit of the model. All models in both sets of analyses (*moves* a function of family status and the relationship between mother's and children's *moves*) were compared based on the Akaike information criterion (AIC) and the Wald Test of the change in deviance.

Qualitative

All interviews were conducted by two individuals who are trained in qualitative methodologies. Interviews lasted from 4-22 minutes, were recorded and then transcribed verbatim. Once transcripts were completed, two separate researchers inductively developed their own themes. Each researcher's themes were then compared to increase inter-rater reliability.

In analyzing our qualitative data, we wanted to treat each set of interviews as a separate data set, meaning that we developed separate themes and subordinate themes for the children's pre-intervention interviews, the children's post-intervention interviews, and the parent's post-intervention interviews. This approach allowed us to further explore the perspectives of the children and the perspectives of the parents to see if there were similarities across each group instead of each family. After themes were developed for each set of interviews, we then went back to the post-intervention interviews of both the parents and children and examined the perspectives of each group on family-by-family basis. This allowed us to explore the inter-workings of the household from the perspective of the children and from the parent(s).

IV. MANUSCRIPT I

Exploring the Relationship between Parent and Child Physical Activity during a Family-Based Fitness Intervention

Introduction

Health benefits from engaging in regular physical activity for children have been well documented (Centers for Disease Control and Prevention, 2015). Regular physical activity (i.e. 60 minutes on most days of the week) (ACSM, 2015) aids in the growth and development of children, and is associated with psychological benefits for youth regardless of weight status (Calfas & Taylor, 1994; Digelidis, Papaioannou, Laparidis, & Christodoulidis, 2003; Haugen, Säfvenbom, & Ommundsen, 2011). Although these benefits are relatively well known, reports suggest that only 78% of children meet physical activity recommendations, with obese and overweight children typically participating in less physical activity than their normal weight counterparts (National Physical Activity Plan, 2016; Troiano et al., 2008). Establishing physical activity behavior early in life is key, because regular physical activity behavior and skills developed in childhood and early adolescence are likely to translate into adulthood (Institute of Medicine, 2012).

Behavior change has been found to be a multidirectional process that could have multiple levels of influence, particularly for children. Parents and caregivers are often viewed as their child's primary gatekeepers; therefore, the child's physical activity could be dependent upon the regulatory capacity of their parents. Recent family-based intervention studies have suggested that when parents are more active, their children tend to be more active (Erkelenz et al., 2014;

VanAllen et al., 2015); this was found to be especially true for younger sedentary children (Edwardson and Gorely, 2010) and for mothers that were more active (Holm et al., 2012). In exploring determinants of child activity, it is important to recognize the role that parent physical activity behavior plays in their child's daily physical activity levels. Studies have suggested that when parents are physically active, they are offering modeling opportunities to their children to model similar behaviors and this may be especially important for girls' physical activity behavior (Edwardson and Gorley, 2010; Cleland et al., 2011). There is also evidence that suggests that active parents provide more support for their child to be physically active (Erkelenz et al., 2014; Loprinzi and Trost, 2009; Loprinzi et al., 2013) whether it's by providing more opportunity or taking an active role in facilitating physical activity behavior.

Additionally, studies that incorporate the use of an activity tracker as a means of objectively measuring physical activity have shown positive physical activity and health outcomes (de Vries, Kooiman, van Ittersum, van Brussel, & de Groot, 2016; Bravata et al., 2007). Activity trackers provide the ability to easily self-monitor by providing immediate feedback and activity as an environmental cue (i.e. a reminder to be active) (Tudor-Locke, 2002). Tudor-Locke, Meyers and Rodger (2001) also suggest the incorporation of progressive goal setting and refinement to encourage increases in physical activity. During long-duration intervention studies, wear-compliance to activity trackers can be an issue, especially in children. However, research has shown that children are more compliant to wrist-worn (compared to a hip-worn) monitors due to comfort and feedback mechanisms (Schaefer, Van Loan, and German, 2014; Fairclough et al., 2015).

Due to these factors, we implemented a family fitness intervention that utilized a wrist-worn activity tracker. There is a need to develop physical activity and fitness interventions that are applicable and feasible in families' daily lives. The research surrounding parental influence on child physical activity appears promising and needs to be further explored within an intervention setting. Therefore, the purpose of this paper is to examine 1) changes in daily physical activity and 2) the effect of parents' physical activity on their child's physical activity during a family-based fitness program.

Methods

Participants and Setting

Families were recruited from the community via flyers, email blasts, and social media. All families that had a least one child between the ages of 5-12 with a BMI over the 85th percentile and at least one parent willing to participate were invited to join the study. The participating parent(s) identified as being sedentary (i.e. engaging in structured exercise no more than 1 day per week). This cohort consisted of 8 families; 9 parents (8 mothers and 1 father) and 10 children (6 males and 4 females). All 9 parents consented for their family and all 10 children assented to be in the study. Ethical approval was obtained from the university's Human Research Ethics Committee prior to recruitment. Families were asked to meet once per week for approximately 60-90 minutes.

Procedures

This family-based fitness intervention consisted of once weekly sessions for 10 weeks. All sessions took place in two university laboratories. Orientation sessions prior to the intervention consisted of obtaining informed consent for both parent and child, completion of the physical activity readiness questionnaire (PAR-Q) for adults (CSEP, 2002) and a PAR-Q adapted for children (University of Limerick, 2016), collecting demographic information from parents, conducting height and weight assessments on both parent and children and a MOVband orientation.

Sessions were approximately 60-90 minutes in duration; with the first 40-45 minutes the parents and children in separate but concurrently run sessions. Parent sessions consisted of cardiovascular and resistance-training exercises that focused on teaching basic movements (i.e. squats, lunges, planks, overhead press) that were body weight movements or used minimal equipment and how these movements could be implemented outside of the intervention. These exercise sessions were followed by short (6-10 minute) education sessions, consisting of: health implications of sedentary behavior, nutrition, goal setting, self-regulation techniques, time management, relapse prevention, social support, and reinforcements. Parents were also sent three text messages per week; two text messages with information on how they could implement what they learned in their education sessions that week and 1 text message reminder to bring their self-regulation logs to their weekly session.

Child sessions were approximately 15 minutes in duration of structured lessons that focused on fitness education, motor skill development, and strategies for implementation outside of the intervention. These sessions included: how to be more active throughout your day, muscular strength oriented lessons, cardiovascular oriented lessons and child-led lessons. Muscular strength lessons focused on learning how to do various body weight exercises (push-ups, squats, lunges, sit-ups) and what area of the body each exercise was targeting (arms, stomach, legs). Cardiovascular oriented lessons focused on learning about different ways (running, quick step-ups, agility ladders, and jumping rope) to exercise their heart and lungs. Child-led lessons allowed children to design exercises that targeted different parts of the body and how they thought they could be more active throughout their day. Each 15-minute lesson was followed by approximately 25-30 minutes of free play.

For the final 15-20 minutes of each session, the family was brought back together for a group session. Group sessions consisted of going over weekly self-regulation logs and making individual and family-based goals, providing recommendations for exercise outside of the intervention, tips to help begin implementing lessons learned within the household. Take home material to promote parental confidence and implementation of structure and autonomy-supportive behavior was provided in the form of a family action plan. This action plan was in the form of a weekly calendar. Every week during group sessions, a researcher helped the family develop a plan of action for the upcoming week. The plan included daily goals, example exercise sessions that incorporated movements learned, and family physical activity ideas (i.e. walk to park, hiking, swimming, etc.). These family action plans were created using suggestions from both parents and their children. Nutrition education was primarily focused on offering healthy options (i.e. fresh fruits, vegetable; meat, low-processed carbohydrates and water) versus food restriction.

To promote self-monitoring and completion of self-regulation logs, research personnel reviewed the previous week's logs with each individual and helped set individual and family-based goals for the upcoming week. Individual goals were personalized and based on what that individual had done previously and what they hoped to accomplish. Family-based goals were created to promote accountability within the family. Recommendations for exercise and physical activity outside of the intervention were based on what had been learned in the exercise sessions and what resources the family had available.

Post-testing began 1 week following the cessation of the intervention and consisted of a final MOVband download.

Physical Activity Data

Physical activity data was collected using the *MOVABLE* MOVband3 activity tracker (*Dynamic Health Solutions, LLC,* Houston, Texas). The MOVband3 utilizes tri-axial accelerometery and demographic information to estimate "moves" or physical activity during a 24-hour period. The MOVband3 has companion software that can estimate physical activity in 1-hour intervals. Approximately 12,000 *moves* is equivalent to 10,000 steps (i.e. 1.2 *moves* is equivalent to 1 step) (*Dynamic Health Solutions, LLC,* Houston, Texas). Each participant's demographic information (height, weight, birth date, and sex) was used to calibrate the activity tracker. Participating parents and children were given a MOVband3 during the week prior to the intervention and were instructed to wear the activity tracker on their wrist during the day; taking the activity tracker off only for water-based activities. Participants were instructed to continue wearing the activity tracker throughout the duration of the 9-week intervention.

Self-Regulation Logs

Participants were asked to self-monitor their daily physical activity by recording their *moves* from their MOVband3, and specific activities that they engaged in to obtain their *moves*. Self-regulation logs were given in paper form during the participating family's weekly sessions.

Statistical Analysis

Physical activity data were broken down into hourly segments, with 5:00am activity representing physical activity taking place between hours 5:00-5:59am. Physical activity data were downloaded from the hours of 5:00am to 12:00am on the six days per week outside of their weekly session. If a participant had more than 3 consecutive hours of "no-wear time" within their normal wake hours, their data for that day was treated as missing. Normal wake hours were determined by visual inspection of habitual activity on weekdays and weekend days, separately. For this particular analysis, we utilized the participants' daily *moves.*

Data analyses were conducted using R and R Studio using the dplyr, lme4, and lmerTest packages (Bates; 2010; Kuznetsov et al., 2013; R Core Team, 2015; Wickham & Francois, 2015). Linear mixed-effects models were used for both primary and secondary analyses to predict daily physical activity over time and child physical activity as a function of parent physical activity on a day-to-day basis. The change in physical activity and the relationship between parental activity and child activity was the focus of this set of analyses. Due to the nested nature of the data, linear mixed-effects models were chosen to account for the variance of time nested within individuals and individuals nested within families. These two levels of between-subjects factors are referred to as time and family status (i.e. whether a participant was a parent or child) within the statistical models. Mixed-effect regression was chosen over other techniques (e.g., RM ANOVA) as this method allows for participants with partially missing data and data being collected at different times. On average, each child was missing 29.4% and each parent was missing 20.4% of their daily *moves* for the 10-week, 60-day data collection.

To model changes in physical activity as a function of time and family status, a step-up procedure was used in which variables were added to successive models. All models started with predicting *moves per day* as function of the average number of moves for each participant (random intercepts, model 0). We then added *time* as a predictor to see if moves per day changed as a function of time (random slopes, model 1). To test potential differences within a family, *family status* was added to see if there were significant differences between parents and children on average (model 2). Next, we added the interaction family status and time to see if the rate of change in moves per day differed between parents and children (model 3).

To model the relationship between parents' physical activity and children's physical activity, we started with a model predicting children's daily moves as function of the average number of moves for each child (random intercepts, model 0). Given that maternal physical activity has been suggested to be a strong predictor of child physical activity (Cleland et. al, 2011; Holm et al., 2012), child daily *moves* were plotted against parent daily *moves* for each family to evaluate how the relationship should be modeled. For this analysis we needed to have an equal data set for each family and wanted to further investigate the relationships between maternal and child physical activity; therefore, for the one family that had both parents participate, only the mother's physical activity data was utilized. Upon visual inspection, on average it appeared that there was a positive linear relationship between children's daily *moves* and mother's daily *moves*. As such, we added a predictor of mother's daily *moves* (model 1). We subsequently added a random-effect of mother's daily *moves* (random slopes, model 2), to see if allowing different slopes for each child significantly improved the fit of the model. All models in both sets of analyses (*moves* a function of family status and the relationship between mother's and children's *moves*) were compared based on the Akaike information criterion (AIC) and the Wald Test of the change in deviance.

Results

Descriptive information for participants is provided in Table 1. On average, children were getting 15794(±609.8) *moves* and parents were getting 13137(±109.7) *moves* at baseline. The participants' step equivalent would be approximately 13,161 steps for children and 10,947 steps for parents per day at baseline, suggesting that the participants were meeting step recommendations for both children and adults (Adams, Johnson, and Tudor-Locke, 2013; Tudor-Locke and Bassett, 2004) at the onset of the intervention. On average, physical activity for all participants decreased by 11.11(±14.0) moves per day, which was not significant ($p>.05$).

Table 2 provides results for models predicting daily physical activity over time. Comparing the different models for predicting daily physical activity, model 2 provided the lowest AIC and statistical significant decrease in deviance beyond model 1. As shown in Table 2, when adding in the effect of family status and controlling for time, this model was seen as the best-fitting and most significant predictor of daily physical activity. Model 2 suggested that on average participants decreased their physical activity by 11.11(±14.0) *moves* per day. In addition, there was a significant difference (p=.05) between daily child *moves* and daily parent *moves*. Parents were getting on average 2825.18(±1282.77) fewer *moves* than their children on a daily basis (Table 4). This model suggests that parents were getting fewer *moves* per day than their children; however, the rate at which their physical activity changed over the course of the intervention was not different from their children's.

When comparing the different models for examining the relationship between maternal physical activity and child physical activity, model 1 provided the lowest AIC (Table 3). After adding the predictor of maternal physical activity (Model 1) and mean centering maternal physical activity, this model suggested that when mothers' were achieving their average number of *moves*, children were getting on average 15806.73(±524.85) *moves* per day. When examining the relationship between mothers' physical activity and their children's activity, our results indicated that for every 1,000 *moves* a mother achieved above her average, her child achieved an additional 191.8(±57.3) *moves* per day (p=.001) (Table 4), indicating a significant relationship between maternal physical activity and their children's physical activity on a day-to-day basis.

Discussion

This study examined daily changes in physical activity over the course of a family fitness intervention. In addition, we aimed to determine the relationship between parental physical activity and child physical activity throughout the intervention. Our results suggest that overall there was a decrease in physical activity over the course of the intervention. However, it is important to note that the baseline physical activity suggested that all of the participants were meeting step recommendations at the onset of the intervention. All parents were sedentary at the onset of the study (i.e. engaging in structured exercise no more than 1 day per week) and the average BMI percentile for the participating children was 96.9 (±1.87). Although it cannot be assumed that parents not engaging in structured exercise sessions and children classified as obese are not physically active, it is important to note the possible novelty effect that the wrist- worn accelerometer had on their motivation for exercise. Reactivity to activity monitors has been documented for both adults and children (Foote et. al, 2017; Scott et.al, 2014; Clemes and Parker, 2009); however, such reactivity tends to be short-lived. It is possible that the extrinsic reinforcement provided by the activity monitor caused a reactive response that was not representative of their habitual physical activity behavior. In the initial stages of the intervention, the research team worked with families on self- regulatory skills and goal-setting ideas that could be implemented within the family. Parents and children were encouraged to develop their own goals and work together to create family goals. Nearly all individual and family-based goals were oriented around the activity monitor to promote self-monitoring, a key factor in self-regulation (Bandura, 2004). As the novelty or extrinsic reinforcement of the activity tracker lessened, motivation for physical activity behavior could have diminished as well, resulting in a decrease in physical activity over time. In addition, in speaking with the parents we found that environmental barriers, such as daylight savings time, the holiday season, and the change in weather conditions played a large role in their families' physical activity engagement. During this intervention daylight savings time ended, meaning that sunset on average for the intervention was around 5:00-5:15 pm. Discussions with parents and children suggested that this had a large effect on the amount of physical activity children were getting at home. Towards the end of the intervention, our participants' experienced roughly three weeks of daily rain and cold weather. With the majority of child physical activity occurring outside, these weather conditions could have had an impact of physical activity. Lastly, the Thanksgiving and Christmas holidays occurred at the end of the intervention and were mentioned by parents and children to be large factors in keeping their family's consistency in physical activity engagement. These findings appear consistent with previous literature suggesting that levels of physical activity, particularly with children, vary with seasonality and weather conditions (Tucker and Gilliland, 2007; Chan and Ryan, 2009). Although seasonal fluctuations in physical activity is commonly observed, research has suggested that the increase in activity in the warmer months typically do not compensate for the decrease in the colder months, resulting in an average decrease in physical activity of 7% yearly (Bélanger, Gray-Donald, O'loughlin, Paradis, & Hanley, 2009). Therefore, future research should place emphasis on overcoming environmental barriers to promote achieving adequate amounts of physical activity as children age.

When examining our first set of models, our results suggested that parents were getting approximately 2825.18(±1282.77) fewer *moves* than their children on a daily basis. However, the rate at which their physical activity changed throughout the intervention was not unlike the rate of their child's change in physical activity. This validated inquiry into our second research aim of the relationship between child change in physical activity and parent change in physical activity. Given that maternal physical activity has been suggested to be a strong predictor of child physical activity (Cleland et. al, 2011; Holm et al., 2012), our analysis only included the mothers' and children's data. Our results suggested that for every additional 1000 *moves* a mother made, their child made an additional 191.8(±57.3) *moves* per day. This finding is similar to that of Holm et al. (2012) where they found that when examining overweight and obese children, for every additional 1000 steps that a mother took above her baseline step count, her child took an additional 196.0 steps (p=.001).

This significant relationship between maternal and child physical activity shows the role that parents' physical activity behavior can play in their child's daily physical activity levels. Research suggests that parents who are more active tend to provide more physical activity support (i.e. providing more opportunities, taking a more active role in facilitating physical activity behavior) for their children (Erkelenz et al., 2014; Loprinzi and Trost, 2009; Loprinzi et al., 2013) and are offering modeling opportunities to their children to model similar behaviors (Edwardson and Gorley, 2010; Cleland et al.,2011). Although there are many possible mechanisms through which this phenomenon could be occurring, the most conclusive finding across this body of literature is simply that when parents are more active, their children tend to be more active (Erkelenz et al., 2014; Holm et al., 2012;Van Allen et al., 2015).

Limitations

The largest limitation that had the greatest impact on this intervention study was the small sample size. For this intervention we recruited for 5 weeks by a variety of methods and estimated to reach more than 8,000 people. We received interest from 12 families via email (2 didn't meet inclusion criteria; 2 had time conflicts), which resulted in 8 families that participated. One of the major factors affecting our recruitment may have been the possibility that parents were unable to identify if their child met the BMI inclusion criteria (>85th percentile), as all participating children were at least 93rd percentile with the average being in the 97th percentile. This is not a recent phenomenon and has been well documented (Katz, 2015; De La O, Jordan, et. al, 2009; Doolen et. al, 2009; Eckstein et. al, 2006). Second, this family-based fitness study did not employ a control or active-control group; therefore, the findings of this study are limited by the possibility that observed findings could be due to confounding variables not examined. Lastly, in attempting a more social ecological model approach we choose to only have the participants come in once per week. However, it could be that the overall dose of the intervention was not enough to elicit significant changes in physical activity.

Table 1 Descriptive Characteristics

Measure	Children (n=10) Mean (SD)	Parents (n=9) Mean (SD)
Age (yrs)	8.5 (1.78)	38.6 (6.54)
Gender, n		
Male, Female	6, 4	8, 1
Race/Ethnicity, n		
Caucasian, African American	8, 2	8, 1
Parental Education, n		
High School	-	2
Bachelor's	-	3
Master's	-	3
PhD	-	1
Parental Work Status, n		
Part-time	-	1
Full-time	-	8
Baseline BMI*	96.9 (1.87)	33.1 (6.70)
Baseline Moves	15794(609.8)	13137(109.7)

** Baseline BMI for children is provided as a BMI percentile as outlined by the Centers for Disease Control and Prevention classification's age- and sex-specific BMI cutoff points for 'normal weight' (84th percentile and below), 'overweight' (85th to 94th percentile) and 'obese' (95th and above).*

Table 2 Daily Physical Activity Over Time

Model	*AIC*	*Wald Test*
Model 0		
Baseline	17204	
Model 1		
Effect of time	17196	$\chi2(3) = 13.79$, $p = 0.003$
Model 2*		
Effect of family status, controlling for time	17194	$\chi2(1) = 3.86$, $p = 0.049$
Model 3		
Interaction of family status over time	17194	$\chi2(1) = 2.29$, $p = 0.129$

**Best fitting model*

Table 3 Child Physical Activity as a function of Maternal Physical Activity

Model	*AIC*	*Wald Test*
Model 0		
Baseline	2357.7	
Model 1*		
Fixed Effect of Maternal Activity	2349.1	$\chi2(1) = 10.63$, $p = 0.001$
Model 2		
Random Effect of Maternal Activity	2350.1	$\chi2(1) = 3.01$, $p = 0.222$

**Best fitting model*

Table 4 Parameters of Best Fitting Models

Model	Estimate *moves*	SE	95% Confidence Interval
Daily Physical Activity Over Time (M2)			
Baseline	14604.47	680.01	1360.02*
Change over time	-11.11	14.0	28.0
Parental Difference	-2825.18	1282.77	2565.54*
Child Activity as a Function of Maternal Activity (M1)			
Child Average[a]	15806.73	524.85	1049.7*
Maternal Influence[b]	191.82	57.26	114.52*

a Child average *moves* when mothers' achieve average *moves*
b Based on 1,000 increment change in maternal *moves*
* A confidence interval that does not contain zero (i.e. $p<.05$)

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V. MANUSCRIPT II

"Famtastically Fit": Exploring the Effect of a Family-Based Fitness Intervention on Body Composition, and Child Fitness

Introduction

Childhood obesity has more than doubled in children and adolescents in the past 30 years, with more than one-third of our children considered overweight or obese (Ogden, 2014). Research suggests that overweight or obese children are five times more likely to become obese adults (Freedman et al., 2009), and obesity-related conditions (i.e. heart disease, type 2 diabetes, and certain types of cancers) are now the leading cause of preventable death (CDC, 2016). Obesity is most basically defined as having too much body fat (Harvard School for Public Health, 2016) and is often measured using body mass index (BMI; body mass in kilograms divided by the square of body height in meters). Overweight for adults aged 20 and older is defined as having a BMI between 25.0 and 29.9; and a BMI of 30.0 or higher is considered obese. Children and adolescents age 2 to 20 years old are considered overweight with a BMI between the 85th to 94th percentiles and obese with a BMI in the 95th percentile or above (CDC, 2016).

Childhood obesity is a multifaceted phenomenon that can have detrimental effects on lifetime health. However, change in obesity status or weight loss alone may not have the most beneficial impact on overall health. Incorporating more physical activity and structured exercise into interventions to promote an increase in childhood physical fitness, compared to a decrease in weight status, could encourage more positive psychological and physiological benefits than a weight loss intervention. For example, a study examining the differences between obese individuals with high fitness levels (fitness assessed on maximal treadmill test) compared to obese individuals with low fitness levels found that the individuals with better fitness levels had lower risk (30-50%) of all-cause mortality, non-fatal and fatal heart disease, and cancer mortality than their lower fitness, obese counterparts (Ortega et al., 2013). Some research has suggested that higher aerobic fitness in childhood, independent of abdominal fat, can reduce the risk of developing metabolic syndrome by 36% compared to those children with lower levels of fitness (Schmidt et al., 2016).

Although physical activity and fitness are targeted in school through physical education, another avenue to increase children's fitness levels is through family-based interventions. As children's primary gatekeepers, parents' and caregivers' support for various behaviors could have a direct impact on the environment in which they create for their children. Recent family-based intervention studies have suggested that when parents are more active, their children tend to be more active (Erkelenz et al., 2014; VanAllen et al., 2015); this was found to be especially true for younger sedentary children (Edwardson and Gorely, 2010) and for mothers that were more active (Holm et al., 2012). A recent systematic review assessing the overall effectiveness of parental support and child weight loss interventions identified that face-to-face counseling was most effective in changing children's diet and group education was most effective concerning body weight, especially in low socioeconomic populations. Among the 35 studies they examined, they also found that intervention effectiveness was higher among younger children compared to older children (Kader, Sundblom, and Elinder, 2015). Therefore, the purpose of this intervention was to assess the effectiveness of a face-to-face, family-based fitness intervention on changes in physical activity, body composition, and child fitness status.

Method

Participants and Setting

Families were recruited from community via flyers, email blasts, and social media. All families that had a least one child between the ages of 5-12 with a BMI over the 85th percentile and at least one parent willing to participate were invited to join the study. The participating parent(s) identified as being sedentary (i.e. participating in structured exercise no more than 1 day per week). This cohort initially consisted of 8 families; 9 parents (8 mothers and 1 father) and 10 children (6 males and 4 females); however, 1 mother was unable to complete post measures due to possible pregnancy. All 9 parents consented for their family and all 10 children assented to be in the study. Ethical approval was obtained from the university's Human Research Ethics Committee prior to recruitment. Families were asked to meet once per week for approximately 60-90 minutes.

Procedures

This family-based fitness intervention consisted of once weekly sessions for 10 weeks. All sessions took place in 2 university laboratories. Orientation sessions prior to the intervention consisted of obtaining informed consent for both parent and child, completion of the physical activity readiness questionnaire (PAR-Q) for adults (CSEP, 2002) and a PAR-Q adapted for children (University of Limerick, 2016). Baseline assessments included: demographic information from parents, height and weight assessments on both parent and children, DEXA scans for all participants, FITGRAM testing for children, and a MOVband orientation.

Sessions were approximately 60-90 minutes in duration; with the first 40-45 minutes the parents and children in separate but concurrently run sessions. Parent sessions consisted of cardiovascular and resistance-training exercises that focused on teaching basic movements (i.e. squats, lunges, planks, overhead press) that were body weight movements or used minimal equipment and how these movements could be implemented outside of the intervention. These exercise sessions were followed by short (6-10 minute) education sessions, consisting of: health implications of sedentary behavior, nutrition, goal setting, self-regulation techniques, time management, relapse prevention, social support, and reinforcements. Parents were also sent three text messages per week; two text messages with information on how they could implement what they learned in their education sessions that week and 1 text message reminder to bring their self-regulation logs to their weekly session.

Child sessions were approximately 15 minutes in duration of structured lessons that focused on fitness education, motor skill development, and strategies for implementation outside of the intervention. These sessions included: how to be more active throughout your day, muscular strength oriented lessons, cardiovascular oriented lessons and child-led lessons. Muscular strength lessons focused on learning how to do various body weight exercises (push-ups, squats, lunges, sit-ups) and what area of the body each exercise was targeting (arms, stomach, legs). Cardiovascular oriented lessons focused on learning about different ways (running, quick step-ups, agility ladders, and jumping rope) to exercise their heart and lungs. Child-led lessons allowed children to design exercises that targeted different parts of the body and how they thought they could be more active throughout their day. Each 15-minute lesson was followed by approximately 25-30 minutes of free play.

For the final 15-20 minutes of each session, the family was brought back together for a group session. Group sessions consisted of going over weekly self-regulation logs and making individual and family-based goals, providing recommendations for exercise outside of the intervention, tips to help begin implementing lessons learned within the household. Take home material to promote parental confidence and implementation of structure and autonomy-supportive behavior was provided in the form of a family action plan. This action plan was in the form of a weekly calendar. Every week during group sessions, a researcher helped the family develop a plan of action for the upcoming week. The plan included daily goals, example exercise sessions that incorporated movements learned, and family physical activity ideas (i.e. walk to park, hiking, swimming, etc.). These family action plans were created using suggestions from both parents and their children. Nutrition education was primarily focused on offering healthy options (i.e. fresh fruits, vegetable; meat, low-processed carbohydrates and water) versus food restriction.

To promote self-monitoring and completion of self-regulation logs, research personnel reviewed the previous week's logs with each individual and helped set individual and family-based goals for the upcoming week. Individual goals were personalized and based on what that individual had done previously and what they hoped to accomplish. Family-based goals were created to promote accountability within the family. Recommendations for exercise and physical activity outside of the intervention were based on what had been learned in the exercise sessions and what resources the family had available. Post-testing began 1 week following the cessation of the intervention and consisted of height and weight assessments on both parent and children, DEXA scans for all participants, child FITNESSGRAM testing, and a final MOVband download.

Dual-Energy X-ray Absorptiometry

Anthropometric measures were collected prior to body composition scanning. Both parent's and children's weight were assessed with a calibrated electronic scale (Michelli Scales, Harahan, LA) to the nearest 0.1 kg and height measured to the nearest 0.25 in using a standiometer. Body composition assessment was performed prior to beginning the intervention and following the intervention employing the *GE* iDEXA scanner (*GE Healthcare Lunar,* Madison, Wisconsin). Variables for data analysis include change in overall fat mass, lean mass, segmental analysis (i.e. arms, legs, and trunk), and bone mineral content (BMC) for children and bone mineral density (BMD) for parents from the pre- and post-intervention assessments. BMC is reported for children because DEXA-derived BMD is an areal BMD (aBMD) rather than a true volumetric BMD (BMD= BMC/Bone Area); therefore, irregular bone growth and size of bones in children will be found to have a lower aBMD than larger bones even if their volumetric BMD is the same, resulting in possible error when reporting BMD as opposed to BMC

(Binkovitz and Henwood, 2007). Qualified research personnel carried out all iDEXA measurements.

Physical Activity Data

Physical Activity data was collected using the *MOVABLE* MOVband3 activity tracker (*Dynamic Health Solutions, LLC,* Houston, Texas). The MOVband3 utilizes tri- axial accelerometery and demographic information to estimate “moves” or physical activity during a 24-hour period. Each participant’s demographic information (height, weight, birth date, and sex) was used to calibrate the activity tracker. Participating parents and children were given a MOVband3 during the week prior to the intervention and were instructed to wear the activity tracker on their wrist during the day; taking the activity tracker off only for water-based activities. Participants were instructed to continue wearing the activity tracker throughout the duration of the 9-week intervention.

Fitness

Children were asked to complete the FITNESSGRAM pre- and post-intervention. The FITNESSGRAM is a series of health-related fitness activities to assess physical fitness in children. The three areas of assessment are cardiovascular endurance, muscular strength and endurance, and flexibility. Pre- and post-intervention scores on cardiovascular endurance and muscular strength and endurance were used for data analysis. Cardiovascular endurance was assessed using the Progressive Aerobic Cardiovascular Endurance Run (PACER), which is a multistage fitness test adapted from the 20-meter shuttle run test. Muscular strength and endurance was assessed using the following: the curl-up (i.e. sit-up) test, in which children were asked to do as many curl- ups as possible at a specified pace; the push-up test, in which the child did as many push- ups as possible in cadence of 20 push-ups per minute until they (a) must stop to rest (b) do not achieve a 90-degree angle with elbows each rep (c) do not maintain correct body position or (d) do not extend arms fully (Plowman and Meredith, 2013).

Statistical Analysis

All body composition and fitness measures were analyzed using paired t-tests in IBM SPSS Statistics 23 for Windows®, while changes in daily physical activity was a subset from a linear mixed-effect regression analysis using R and R Studio. Descriptive information for participants is provided in Table 1. All significance testing was set at p=0.05.

Results

Over the course of the intervention physical activity did not change significantly (p>.05) for parents or children. However, our results indicated some changes in child fitness as measured by the FITNESSGRAM. The children's sit-ups increased significantly (p=.04) by an average of 7.5 (9.5) sit-ups, while there were no significant differences in their PACER (p=.51) or push-ups (p=.77).

In examining body composition measures (Table 2), children (n=10) had significant differences in their lean mass (p=.000) and their BMC (p=.000), with no significant changes in overall fat mass (*p*=.08). In an effort to identify where in the body these lean mass changes occurred, we conducted a segmental analysis to examine differences in the lean mass (kgs) changes in their arms, legs, and trunks. As a group, their increases in arms [*M*=.19(±.21), *p*=.10], legs [*M*=.59(±1.0), *p*=.09], and trunks [*M*=.06(±.82), *p*=.83] were not found to be significant. When examining gender differences in lean mass, female children had a significant (*p*=.04) increase in overall lean mass (*M*=.85(±.48)). Their changes in arms [*M*= -.03(±.08), *p*=.60], legs [*M*=.83(±1.2), *p*=.26], and trunks [*M*=.05(±.75), *p*=.91] were not found to be significant. Male children also had significant changes in overall lean mass [*M*=.65(±.32), *p*=.004] and arm lean mass [*M*=.22(±.21), *p*=.05], with changes in legs [*M*=.43(±.93), *p*=.31] and trunks [*M*=.07(±.95), *p*=.87] not significant. Overall the children's BMC (kgs) increased [*M*=.04(±.02), *p*=.000], with both males [*M*=.04(±.02), *p*=.008] and females [*M*=.03(±.02), *p*=.04] increasing significantly. When examining body composition in parents (n=8), changes in lean mass [*M*=.40(±.77), *p*=.18], fat mass [*M*=-1.3(±2.5), *p*=.18], and BMD [*M*=.005(±.01), *p*=.19] were all found to be not significant.

Discussion

This study examined the effects of a family fitness intervention on physical activity, body composition, and child fitness. Our results suggested that there were no significant changes in physical activity over the duration of the intervention. However, it is important to note that the baseline physical activity suggested that all of the participants were meeting step recommendations at the onset of the intervention, despite meeting inclusion criteria. Although it cannot be assumed that parents not engaging in structured exercise sessions and children classified as obese are not physically active, it is important to note the possible novelty effect that the wrist-worn accelerometer had on their motivation for exercise. Reactivity to activity monitors has been documented for both adults and children (Foote et al., 2017; Scott et al., 2014; Clemes and Parker, 2009); however, such reactivity tends to be short-lived. It is possible that the activity monitor caused a reactive response; resulting in a baseline that was not representative of their habitual physical activity behavior.

Our body composition results suggested that parents did not experience any significant changes in fat mass, lean mass, or BMD; however, children experienced a significant increase in both lean mass (p=.000) and BMC (p=.000). This prompted further investigation by conducting a segment analysis to see if there was a significant area of the body (arms, legs, trunk) where these changes occurred. Our results suggested there were no significant differences between the children's arms, legs, and trunk lean mass changes, despite a significant increase (p=.04) in sit-up scores. Within the child weekly lessons, they learned about a variety of body weight exercises (i.e. squats, push-ups, planks, etc.). If children were engaging in more static muscular strength activities, this would not have been accurately represented in the accelerometer data and could account for the significant increase in lean mass and bone mineral content despite a lack of change in physical activity.

When examining differences in male and female children's lean mass changes, female children (n=4) had a slightly larger increase in lean mass (M=.85(±.48)) compared to their male (n=6) counterparts (M=.65(±.32)). The research surrounding body composition changes in children appear to be limited, with most authors citing significant changes in body composition (lean and fat mass) after a minimum of a 6- month intervention (Lazzer et al., 2005; Ning et al., 2014). Morris et al. (1997) reported a significant increase in females (aged 9-10) lean body mass after a 10-month strength- focused intervention, while McWhannell et al. (2008) reported only a significant increase in BMC and no changes in fat or lean mass after a 9-week structured exercise intervention. Within the children's muscular strength lessons, we focused on body weight exercises such as squats, lunges, planks, and push-ups. The muscular strength-oriented activity experienced during the intervention could have amplified their lean mass response during a short-duration intervention. Additionally, a study suggested that children who had lean mass increases during a 3-week intervention had the greatest reduction in fat mass at their 5-month follow-up (Schwingshandl and Borkenstein, 1995). This invention helped children develop a repertoire of physical activity and exercise skills and a rationale for why they are important. Their significant increases in lean mass and skill development could encourage a decrease in body fat and further engagement in physical activity post-intervention. Although we were unable to report significant changes in parents' fat and lean mass; it is important to note that parents' average fat mass (kgs) was 34.0(±8.9) at baseline and 32.6(±8.8) at post-test. Parents can play a significant role in their child's weight status (Golan and Crow, 2004; Lindsay, Sussner, Kim, and Gortmaker, 2006), as parents' change in weight status has been suggested to significantly predict their child's change in weight status (Wrotniak et al., 2004).

Limitations

The largest limitation that had the greatest impact on this intervention study was the small sample size. For this intervention we recruited for 5 weeks by a variety of methods and estimated to reach more than 8,000 people. We received interest from 12 families via email (two didn't meet inclusion criteria; two had time conflicts), which resulted in eight families that participated One of the major factors affecting our recruitment may have been the possibility that parents were unable to identify if their child met the BMI inclusion criteria (>85th percentile), as all participating children were at least 93rd percentile with the average being in the 97th percentile. This is not a recent phenomenon and has been well documented (Katz, 2015; De La O, Jordan, et. al, 2009; Doolen et. al, 2009; Eckstein et. al, 2006). Secondly, the short duration of the intervention could have played a role in the lack of significant body composition findings in both parents and children. Thirdly, we decided to incorporate food and beverage intake in the weekly self- regulation logs and nutrition education to promote healthy food choices within the family. We chose not to use the nutrition logs in data analysis due to the frequent variability in reporting. By not using nutrition data in the quantitative analysis, the results of this study are unable to expand on possible associations with body composition changes. Lastly, this family-based fitness study did not employ a control or active-control group; therefore, the findings of this study are limited by the possibility that observed findings could be due to confounding variables not examined.

Table 1 Descriptive Characteristics

Measure	Children (n=10) Mean (SD)	Parents (n=9) Mean (SD)
Age (yrs)	8.5 (1.78)	38.6 (6.54)
Gender, n		
Male, Female	6, 4	8, 1
Race/Ethnicity, n		
Caucasian, African American	8, 2	8, 1
Parental Education, n		
High School	-	2
Bachelor's	-	3
Master's	-	3
PhD	-	1
Parental Work Status, n		
Part-time	-	1
Full-time	-	8
Baseline BMI*	96.9 (1.87)	33.1 (6.70)
Baseline Moves	15794(609.8)	13137(109.7)

** Baseline BMI for children is provided as a BMI percentile as outlined by the Centers for Disease Control and Prevention classification's age- and sex-specific BMI cutoff points for 'normal weight' (84th percentile and below), 'overweight' (85th to 94th percentile) and 'obese' (95th and above).*

Table 2 Body Composition Measures

Measure (kgs)	Children (n=10) Mean (SD)		Parents (n=8) Mean (SD)	
	Pre	Post	Pre	Post
BMC/BMD[a]				
Total	0.92	0.95***	0.57	0.58
Male	0.82	0.86**		
Female	1.07	1.10*		
Lean Mass				
Total	21.5	22.3***	48.2	48.6
Male	19.9	20.5**		
Female	24.0	24.9*		
Fat Mass				
Total	17.8	17.4	34.0	32.6
Male	18.0	17.6		
Female	17.5	17.1		

[a] *Bone mineral content (BMC) given for children, bone mineral density (BMD) given for parents.*
**** $p=0.000$; ** $p \leq 0.01$; * $p \leq 0.05$*

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VI. ADDITIONAL FINDINGS

Overview

One of the goals of this dissertation study was to help parents find ways to enhance the amount of structure in their homes to create an environment that was more conducive of physical activity behavior. Within the study we targeted the enhancement of structure by providing parents with health education, a plan of action for the week, and weekly recommendations for implementing strategies that were learned. During the group sessions we also encouraged parents and children to create their individual goals and family-based goals for the week together. By promoting this provision of structure within the household, we hypothesized that this would have a positive effect on competence, self-efficacy and motivation in both parents and their children. We also sought to examine the relationship between parents' perceived competence of their child and their child's competence scores, parents' self-efficacy and their child's self-efficacy, and parental motivation and child motivation.

Results

Quantitative

All parent and child measures were analyzed using paired t-tests in IBM SPSS Statistics 23 for Windows® to estimate if there was a significant change from pre- to post-assessment. In examining how parents' perception of their child's competence changed, we found a significant increase [M=6.40(±6.77), p=.015]. However, when examining the children's perceived competence we did not find a significant difference (p=.833). Parent's reported self-efficacy also increased significantly [M=2.40(±3.06), p=.035] over the course of the intervention, yet when examining child self-efficacy and their proxy efficacy to influence parents to provide physical activity opportunities, both did not change significantly (p=0.57; p=0.13, respectively).

Our motivation scale was revised to assess motivation towards physical activity using a self-determination theory approach; therefore, we examined participants' intrinsic, integrated, identified, interjected, external, and amotivation for participating in physical activity and exercise (Table 6.1). Our results suggested that there were no significant changes in these motivation factors for children over the course of the intervention. However, as a group the children were considered to be intrinsically motivated for physical activity and exercise at the onset of the intervention. When examining the parent's changes in motivation, our results did suggest that they had a significant increase in their identified motivation [M=3.33(±4.18), p=.044] and a significant decrease in their amotivation scores [M=-4.78(±4.49),p=.013].

Table 6.1 Parent and Child Changes in Motivation Scores

Measure	Children (n=10) Mean (SD)		Parents (n=9) Mean (SD)	
	Pre	Post	Pre	Post
Intrinsic	17.8 (2.6)	16.3 (4.0)	14.2 (3.8)	16.7 (2.9)
Integrated	14.8 (4.7)	16.5 (5.1)	10.8 (5.6)	12.3 (4.2)
Identified	17.3 (2.7)	18.1 (2.9)	13.3 (4.0)	16.6 (2.7)*
Introjected	14.9 (4.0)	15.9 (4.9)	13.3 (3.6)	15.1 (3.4)
Extrinsic	10.5 (5.7)	11.2 (6.5)	9.2 (5.2)	9.7 (5.3)
Amotivated	8.9 (6.5)	6.7 (5.2)	8.8 (4.9)	4.0 (1.4)*

*p<0.05

Qualitative

Table 6.2 Themes Identified in Qualitative Assessment with Corresponding Subordinate Themes

Child Pre-Intervention Interviews	Parent Post-Intervention Interview	Comparing Parent and Child Post-Intervention Interviews
Lack of Structure *Competence-supportive behaviors* *Autonomy-supportive behaviors*	Nutrition *"What's Healthy"* Awareness *Making Physical Activity a Priority* Child-Driven Activity *Making Physical Activity a Family Affair* Environmental Influences	Family-by-Family *Have they been more active* *Rules about playing games/watching TV* *Rules about being physically active or exercising*

Table 6.2 provides the primary and subordinate themes for the children's pre-intervention interviews, the parent's post-intervention interviews, and the comparison of parent and child post-intervention interviews. When examining the pre-intervention interviews with the children, the most salient theme that arose was an overall lack of structure within the home. As a reminder, structure can be defined as the degree to which the environment is organized to facilitate competence. Competence can be supported thorough clear and consistent rules and expectations so children can learn how to orient their behavior for certain outcomes. Children's autonomy can be supported through context that take in their perspectives, encourage self-initiation, and promote joint problem solving. However, more simply autonomy can be supported in children by providing explanations as to why a rule or expectation is important and giving specific positive alternatives to sedentary activities to help them learn what is a "positive alternative".

Upon closer inspection, we found that the children that we deemed to have the least amount of structure also tended to have the highest BMIs (>96th percentile). Based on the overlying theme of the absence of structure bring more prevalent amongst the children with higher BMIs, two subordinate themes were created utilizing the self- determination theory as a "theoretical lens": autonomy and competence supportive behaviors.

Competence: clear and consistent rules and expectations

Within the interviews there were few to no rules regarding sedentary activities (i.e. TV viewing, playing video games, iPad games); if the family did have rules they were often vague and inconsistent. There seemed to be no expectations for physical activity except "play outside". There did appear to be some consequences for rules or not meeting expectations, while others were minimal and relatively inconsistent. The following are answers to questions asking if the children thought they had rules/expectations and consequences, and what these rules/expectations and consequences were:

<u>Rules about TV and video games</u>

> *"No not at all"*
>
> *"Yeah, my momma lets me watch TV for an extra 30 minutes at bedtime"*
>
> *"Umm we have to go outside on the weekends and play more than watch TV because TV is after school and like for relaxing and that kind of thing."*
>
> *"So we read about every night before we watch TV."*

"Well, our parents they sometimes, they will let us watch TV, but sometimes they don't let us watch it all day."

"Not allowed to play video games until every room is cleaned up"

"Can't watch TV if I'm grounded, and I also get my phone taken away. But I lost my phone, so I don't have a phone right now"

Rules about physical activity, outside play, and exercising

"Umm not really"

"They tell us just go outside and roam and stuff"

"Not really"

"I mostly stay inside and watch a little TV and then if I feel like I want to go outside I'll go and play with my neighbors"

"They tell, every time me and my brother goes outside, they tell us that we have to stay in the yard."

"No rules"

Consequences for not following a rule or meeting expectations

"Like uh, lose TV for a couple of minutes or a game"

"Our mom will be mad at us and send us to our rooms"

"Nothing"

"I get grounded and if I still had my phone, I'd get my phone taken away for a week"

Autonomy: the "why", parental encouragement for active alternatives

For the rules and expectations that they did have, some of the children did have a rationale as to why they had a particular rule or expectation. However, other children appeared to experience very little discussion. Alternatives for sedentary behaviors were given for a few children, but were often vague and gave little direction. The following are answers to questions that asked the children about discussions surrounding certain rules and expectations, and about alternatives to sedentary behaviors:

<u>Did your parents ever talk to you about why you have the rules?</u>

> *"No not really, they will just tell us to not go over and see what they [neighborhood children] are doing."*
>
> *"I don't know…so we don't watch too much of it [TV]"*
>
> *"Yes, because she tells us that, she thinks that every time other kids get in front of the TV it messes up their brain"*
>
> *"Those are the rules because they don't want me sitting around doing all that [watching TV, playing video games]."*
>
> *"Because they don't want me just sitting around"*

<u>Does your mom and/or dad help you find other things to do besides watch TV/play games? Things to be active?</u>

> *"Like if we're bored, they tell us to go outside and do something out there"*
>
> *"She tries to let me go outside, but I kind of refuse"*
>
> *"Yes, my mom will tell me like… tell us to go outside or go find something else to do in the house."*

"Half the time"

In examining the parents' post-intervention interviews, four major themes were developed: Nutrition, Awareness, Child-Driven Activity, and Environmental Influences. First, the parents' interviews suggested that the largest and most consistent changes within the household seemed to be with nutrition. Out of the 8 participating families, 7 parents mentioned making nutrition changes during the intervention. When asked if there have been any changes within the household during the intervention, the following are a few example responses:

> "*Yes, nutrition stuff. So you know with late night snacking, especially with 01C2, so late night snacking... If he does want something after dinner, it has to be like an apple… it has to be either fruit or veggie and that's it. Umm and then also with milk, like because he was just drinking so much milk*"

> "*Yeah like used to he would get 10 nuggets, pizza rolls… now we are down to 7 and 8, and then also after like 7o'clock at night he doesn't get anything else*"

> "*And one thing that I was doing and now I see that it really was a mistake...I would reward them like 'you do good, we will go to McDonalds' and now we don't do that...so its like 'y'all do good, you can stay up an extra hour and watch TV' or you know we will….its not food so…yeah*"

> "*I think I've mentioned before in one of our sessions, that we went to dinner and yeah when we went to Panama City for my birthday, and he (referring to son) ordered grilled chicken and broccoli."*

A subordinate theme of nutrition also emerged within the intervention regarding a large increase in the amount of parent-child discussions about nutrition, specifically about "what's healthy". In the interview if parents mentioned changes in nutrition we followed up with question(s) asking if they discussed with their children why they are making these nutrition changes, or if their child asked questions regarding the changes. The following are parental responses:

> *"Oh it's always like 'why do I have to drink more water?', because it's better for your body and it replenishes… 'Why do I have to eat vegetables?', because there's nutrients in it that you don't find in potato chips"*
>
> *"And they are drinking more water and they realize that they are, 'Oh I need to drink more water today'"*
>
> *"And especially 01C2 he'll say 'Wait is that healthy?'… He'll ask if things are healthy, you know or he'll ask for a snack and then be like 'Wait, is that healthy?', 'You know, I'll have water because that's healthy.'"*
>
> *"It's like today, I said something about cheesecake, and he (referring to child) was like 'I can not have cheesecake, I'm trying to slim up'"*

The second theme that arose from these interviews was an overall increase in awareness. In reviewing the transcripts, we found that all 8 families mentioned an increase in awareness of their food intake, daily sedentary behavior, or daily physical activity behavior. The following are responses when asked about general changes in the home since the onset of the intervention:

> *"He is a lot more aware of being more active, I mean he has always been a more active kid anyways but he talks about it a lot more."*
>
> *"You know, more noticeably, like 'O.K. hey lets park further back at the store' that kind of thing."*
>
> *"I think, you know, 02C1 is more cognizant about you know, watching what she eats, like if she does want a roll not getting two."*
>
> *"I think its umm made us more aware, I guess, and so you know we've kind of made a focused effort to try to be more active I guess outside of school and in the evenings"*
>
> *"I think we think about it now. Where I think before, we never thought about it."*

"It wasn't something that we put a whole lot of thought into. Like I think about goals now and I think about movements. I think about how many movements am I making everyday"

"I think setting goals, and as hard as it was to keep up with everything, I think the fact that I had to, even though I wasn't great at it…Umm I think that that made me think about it…all that stuff it made me think about my day and what I was really doing."

"I think it was making me aware and it was making it to where I was realizing what my habits were."

"It kind of made me open up my awareness to something and it makes it hard for something to not impact how you live"

"The MOVband, you know, that kind of kept me accountable because like when I didn't do so well I was like 'ugh' you know, and then as you will see some days I was like 'yeah I did it, she got it'."

A subordinate theme of increasing awareness was developed in regards to parents beginning to make physical activity a priority. We asked parents if and how their "after- school routine" and their weekends have changed since the beginning of the intervention, the following were parents' responses:

"I read a blog about speed cleaning and how you can make it exercise out of speed cleaning. I have to do that mess anyways so why not do it fast, you know"

"But we do try to schedule things on our off days and weekends that consist of walking. Like next Tuesday we are going to (name of park) park and a Christmas light show over in Columbus so that will all be walking so.."

"I used to, I used to not plan anything or they'd umm… after school, I didn't think a lot about after school. It was really homework…the things that I thought about were things like homework, dinner, that kind of stuff. I never thought about, I never really thought about activity….but now I do, yes"

"We look for activities that involved some sort of exercise, like we went downtown Auburn on Sunday to the see Santa at the corner and then we just played around in the courtyard of Samford"

Our third theme was the idea that the families' daily physical activity was more child-driven, opposed to parent-driven. Previous literature has suggested that when parents are more active, their children tend to be more active (VanAllen et. al, 2015; Erkelenz et al., 2014; Holm et al., 2012). However, this qualitative analysis suggested that for this particular cohort, it is possible that the child can be a driving factor in the parent's level of physical activity.

> *"He (child) really seems like he is trying and it makes us want to try more because he wants to try more so we're game for whatever he wants to do."*
>
> ***"**Yeah, we (parents) want to set that good example"*
>
> ***"**Saturdays I'm more active with the kids, more than I was before. Umm getting more involved with the things that they do, go outside a little bit more, trying to do more fun things with them as opposed to spending all the time cleaning or doing something else at the house."*
>
> ***"**Like 06C1 was doing burpees in the house the other day and lunges and so we were all just trying to see who could do the most"*
>
> *"He (child) has probably made us more aware I think of what we need to do to do better"*
>
> *"And we both want to be a little bit healthier, especially for our kids"*
>
> *"There were times when he was really close to his goal and we were like 'ok, we've got to go run, or lets dance'. We'd dance around the living room until he reached his goal. Or we'd dance around upstairs in the bedroom until he reached his goal. We'd do something until he reached it, and he thought that was fun"*
>
> *"Um, I see her trying to be more active which is really cool. Um, in fact everybody, pretty much in the family, we're all trying"*
>
> *"I mean sometimes he uses a guilt thing, you know if he wants to go do something that I don't want to do, he'll say 'But mom its active' you know so he sometimes turns the tables"*

A subordinate theme of child-driven physical activity was developed in regards to parents trying to make physical activity into more of a family affair. In addition to engaging in more activity with their participating child, parents also appeared to be trying to find more active alternatives for the whole family.

> *"We've tried to make sure that the TV is off more and try to do more active things"*
>
> *"Yeah, we try to go to the park more and walk to the park by our house because it's a good 2 mile walk there and back"*
>
> *"You know especially on the weekends, doing family things. You know we are trying to find family things to do, we I guess try to think of more…you know"*
>
> *"Right, that are active instead of saying 'oh lets go to a movie together', as a family we've tried to find…umm go hiking or try new things like that."*
>
> *"We usually try to make things we do all as a family more. We will do more activity now as a family"*
>
> *"But my husband and I would make a point…used to they would go outside and my husband and I…sometimes my husband would go out with them but I never did, but I made a point now to go out there and I didn't do nearly as much as my husband did but…still"*

Our fourth and final theme was the impact of environmental influences on engaging in physical activity. Throughout the duration of this intervention, there were various weather conditions, daylight savings time change, and the holiday season. The majority of the families' (6 out of 8) responses suggested that they were very sensitive to changes in the environment, and their family's physical activity was largely dependent on outside, environmental conditions.

> *"This last week has been cold, but the week before that we were outside a lot because the weather was nice"*

"I hated the time change. I think that really impacted his (son) a lot. I mean you see his before the time change and that kid was getting 25-30,000 moves, he was going crazy and then after the time change it was like 13-18,000."

"We've struggled since the day light savings, we've struggled more. So when, you know, earlier in the program and before daylight savings it did change some where you know 01C2 and I would try to go play outside or sometimes we would stay with 01C1 at swim and do activities there, but the recent is in my mind and over the last you know weeks with the holidays"

"When it started raining we didn't do nearly as much has we have been."

"The cold, the drop in temperature, and the rain has really thrown me off and daylight savings, yeah, that wasn't as bad but when the temperature dropped…because now we can't just say "lets go, we are going to go outside"

"Not so much…as much since it's been kind of cold, rainy and stuff…because prior to Thanksgiving we were doing our regular"

Unfortunately in examining the child post-intervention interviews, we were unable to develop a consensus between the two qualitative-trained research personnel regarding predominant themes. During the post-interview process, the children were having difficulties when asked to elaborate on their responses and this led to short and vague answers. For the majority of children, the interview was the last measure completed during the post-testing session. It is our opinion that in asking them to sit down for an interview after all of their other retesting that this could have resulted in their non-compliance. After transcription, research personnel attempted to separately derive themes and were unable to develop any predominate themes. During our meeting discussing the lack of consensus amongst the interviews, we decided that the best way to utilize the children's post-interviews would be to compare them to their parents' post- interviews. In reexamining the child's interviews, we came to the conclusion that the majority of their responses were to the first three questions asked. Therefore, we decided to compare the children's responses to their parents' responses on three different questions. The following are parent and child responses to three questions on a family- by-family basis:

When asked if their routine has changed, if they are more active

Family 1:

Parent: *"Umm, not really. I wish I could say that we become… we're not real good at structure.. so you know it's very… especially you know I need to think back….We've struggled since the day light savings, we've struggled more."*

Child: *"Umm well one time we went up and down stairs"; "oh we went hiking at…what's it called"*

Family 2:

Parent: *"Um, I see her trying to be more active which is really cool. Um, in fact everybody, pretty much in the family, we're all trying."*

Child: *"Well like (sibling), like rides on his scooter and I'll play on my bike"*

Family 3:

Parent: *"We go to the park more"*

Child: *"No, it has changed a lot. Since we've done this, I've been able to get out a lot"; "Like getting outside instead of staying in and reading, but instead of 20 minutes my parents changed it to 15 minutes so I had time to play outside."*

Family 4:

Parent: "*Sometimes we'll go for a walk. Him (04C1) and his granddad will sometimes go for a walk";"Ee have gotten out a little more. We've done some things.. a lot of things with our cub scouts, you know, out walking and doing different things"*

Child: *"it's about the same"; "Sometimes me and PawPaw walk"*

Family 5:

Parent: *"We look for activities that involved some sort of exercise"; "Umm I mean I've always tried to, but this was more accountability, especially with the MOVbands, like that you know… doing something that you know, trying to fill those bubbles and monitor that so….it's a very visual thing like 'oh goodness we need to get out and do something, we've only got 2 bubbles this morning so we need to get out and move'"*

Child: *"yeah"*

Family 6:

Parent: *"Umm he is a lot more aware of being more active, I mean he has always been a more active kid anyways but he talks about it a lot more"; "Saturdays I'm more active with the kids, more than I was before. Umm getting more involved with the things that they do, go outside a little bit more, trying to do more fun things with them as opposed to* *spending all the time cleaning or doing something else at the house. Just being more active with them, that has changed for us."*

Child: *"Umm more than I used to"; "When it didn't get so dark earlier, I usually go home, it depends on my grades whether I go outside. Luckily, I make As and Bs and so I'm able to go outside. Umm I ride my bike, but now that it's gotten darker earlier, I can't go outside and do that for as long"*

Family 7:

Parent: *"Umm, only thing that…is that Thursday added on an activity for us coming here, but other than that our normal is what we had been doing prior to coming"*

Child: *"I play….I don't really know"*

Family 8:

Parent: *"Umm but we would always go outside, we were good about going outside and we went for lots of walks and we did lots of activities and games [referring to time during the intervention]"*

Child: *"Umm sometimes"*

When asked if they have rules about playing games/watching TV

Family 1:

Parent: *"really with gaming we really don't… no more than… it's really like a filler while I'm cooking dinner so its only like 15-30 minutes. So there's really no gaming during the week." ; "yeah, and then with TV… I say we have rules.. I mean we… they can watch TV once we get done with our [unable to decipher], but it ends up being you know probably I don't know 30 minutes to an hour each night."*

Child: *"Umm well if we be bad, I think she told us, umm you can only do like electronics on the weekends" ; "well since its Christmas time… the rules are we can't watch our show on like nights that we have to watch a Christmas movie or don't watch anything at all"*

Family 2:

Parent: *"Umm, I mean we limit video games even on the weekend to no more than about forty-five minutes."; "Umm, and then with T.V. they're not really allowed any during the week. Other than like, we might watch… we watch like the Goldberg's on Wednesday night and they watch Super Girl. But other than that we really don't, um watch a lot of T.V. with them during the week. "*

Child: *"Umm, not really.. Umm well, on the weekdays with T.V. we only get to watch a little bit."; "But usually we get finished with homework so that way we could watch a little bit more T.V. if it's already dark out."*

Family 3:

Parent: *"no not really"; "The iPads go away, those only come out maybe Saturday and Sunday. We don't do those Monday through Friday"*

Child: *"Yes, we can only watch TV unless we've done everything, like take a shower and all that, and all the homework, which is only required for me, is done."*

Family 4:

Parent: *"not really"*

Child: *"no rules"*

Family 5:

Parent: *"Umm I think I've just more tried to...if it's been a certain amount of time I try to say "ok its time to do something and get out"*

Child: *"yeah…umm, actually I don't know"*

Family 6:

Parent: *"We really don't"; "We never really had to set any"; "if he does [play on playstation], he only has a few…probably 30 minutes of play time. Umm TV time, we really don't have a lot of TV time. If we do it's probably a max of maybe 30 or 45 minutes"*

Child: *"They have lots of rules about video games and watching TV. You can only do that about once an hour or two, and then you have to let another person have a turn."; "and video games, you can't play them for very long… because it makes you lazy"*

Family 7:

Parent: *"Well they don't have TVs in their room. We only have a TV in the living room, and then of course there is one in my bedroom, but for the most part they're usually in the living room with us watching TV. And typically that's what Daddy does, so on Saturdays if we don't have anything going on, we get movies and watch movies…well when football season was in, we were watching football or they would be in our bedroom watching TV so…"*

Child: *"We only can't...there's only 1. We can't play video games during the weekdays"*

Family 8:

Parent: *"I used to not think a whole lot about it, but now we just don't make it available"; "we have about 3 iPads in our house…Umm and they just aren't allowed on them now unless they ask"*

Child: *"nope"*

When asked if they have rules or expectations about being physically active or exercising

Family 1:

Parent: *"no, I guess we haven't as far as umm any rules about it"*

Child: *"umm I don't know"*

Family 2:

Parent: *"Not really because they were already, 02C1 especially and (sibling) too. Because I mean they're both in P.E. at school and they are so active during the day and by the time we get home, it's a lot harder"*

Child: *"Um, It's about the same."*

Family 3:

Parent: *"not really"*

Child: *"My parents said umm…I can go outside for a little bit… and then shower and bath."*

Family 4:

Parent: *"We do try to make him try to go for a walk at least 3 times per week."*

Child: *"That I have to…umm like get…do some exercises every time I get off the bus on Mondays Tuesdays Wednesdays Thursdays and Fridays, and I have to do the same on the weekends. Just to do a little workout"*

Family 5:

Parent: *"Yeah, I'd say just find something to do"*

Child: *"Well I go outside on my own"*

Family 6:

Parent: *"Not really…he just kind of goes, yeah"*

Child: *"Umm they made a rule for me. I have to exercise at least 5 times per week"*

Family 7:

Parent: *"Like I said, early on when we were actually able and Momma was out do her thing, yeah because I was like 'yall coming', 'you can start out with me, I know you're going to fall off, and that's ok, but you're going to be out doing something'. Because like I said usually, even if I'm walking, one has grabbed the scooter, the other is on his bicycle…as long as they were doing something, I really didn't necessarily have a rule as long as they were doing something."*

Child: *"no" ; "sometimes Mom, she will walk, and then we will walk with her for a few minutes and then play football with our neighbors"*

Family 8:

Parent: *"We made rules like we had to do so much. We had to do so many movements, and we would make a goal. And if we made the goal we would go do something fun."*

Child: *"I don't really know"*

Discussion

Quantitative

In examining the change in psychological variables for both parents and children, our results suggested some significant differences. Parents' perception of their child's competence for physical activity did increase significantly (p=.02) over the course of the intervention. From our initial discussions with parents, the majority of child physical activity and exercise was occurring during physical education classes at their child's school. This intervention encouraged physical activity engagement within the home by providing both parents and children with physical activity lessons and exercise sessions, and developing a family "action plan" for physical activity and exercise outside of school. By encouraging an increase in engagement and parental involvement in physical activity with their children, this could have had a positive impact on parents' perception of their child's physical capabilities. However, in examining the children's perception of their own perceived competence we did not see a significant change.

Parents' self-efficacy for providing their children with physical activity support increased significantly (p=.04) during the intervention. Previous research has suggested that initial parental confidence can be a strong predictor of their child's success within an intervention (Gunnarsdottir et. al, 2011); therefore, in designing this intervention we wanted to promote parental confidence early and effectively by spending an adequate amount of time discussing and developing their family's "action plan" for the upcoming week. The design of the "action plan" was intentionally made into a weekly calendar to ensure that parents' felt confident about their family's "plan" on a day-to-day basis for that particular week. In addition, parental support for physical activity has been suggested to have a significant impact on their child's level of physical activity (Erkelenz et.al, 2014; Edwardson and Gorely, 2010; Lorinzi and Trost, 2009); therefore, we wanted to create hard-copies of their action plans to give parents a resource to fall back on in the event of a relapse post-intervention. In examining child self-efficacy, we also wanted to investigate their perception of their parents' ability to provide physical activity support. Our results suggested that child self-efficacy did not change significantly over the study. Although our results also indicated no significant change in the children's perception of their parents' ability to provide physical activity support, it is important to note that the baseline scores were M=13.6(±0.73) and the post-test scores were M=16.3(±1.7). The max score for this questionnaire was 18, suggesting that although not found to be significant, the children's post-test scores indicate a high perception of proxy-efficacy.

Our motivation scale was revised to assess motivation towards physical activity using a self-determination theory approach; therefore, we examined participants' intrinsic, integrated, identified, interjected, external, and amotivation for participating in physical activity and exercise. Our results suggested no significant changes in child motivation; however, at baseline children averaged their highest score for intrinsic motivation (Table 6.1). In examining the parents' changes in motivation, our results indicated a significant increase (p=.04) in identified motivation (i.e. consciously valuing and deeming a behavior as personally important) and a significant decrease (p=.01) in amotivation (i.e. a lack of motivation). According to Ryan and Deci (2000), regulation through identification is a more autonomously driven form of extrinsic motivation because it involves consciously valuing a goal and deeming it as personally important; whereas amotivation would be considered having a lack of value and motivation for a particular behavior. By providing parents with weekly health education sessions and encouraging family discussion about the weekly topics, this could have had a positive impact on parents' valuing and perceived importance of physical activity, exercise, and the associated health implications.

Qualitative

Children's Pre-Intervention Interviews

A lack of structure within the household seemed to be the most prominent theme across the children's initial interviews. Additionally, the children that seemed to have the least amount of overall structure tended to have highest BMIs (>96th percentile) out of the cohort. When utilizing the Self-determination theory as a "theoretical lens", we developed two subordinate themes: autonomy- and competence supportive behaviors. In order to fulfill the need for competence, one must feel as though they can successfully navigate their environment to achieve desired outcomes. Within the household, parents can create an environment that is supportive of competence by providing their children with rules or expectations, and consequences for when those rules or expectations are not met. This allows children to learn how to orient their behavior to achieve a particular outcome. Although there were some known rules, expectations, and consequences, it appeared that on average these could be vague and inconsistent. This could make it difficult for the children to navigate expectations for sedentary or physical activity behaviors. When exploring the interviews, it did appear that the majority of the children had their own expectations for sedentary time, specifically with TV viewing. For example: "*Umm we have to go outside on the weekends and play more than watch TV because TV is after school and like for relaxing and that kind of thing."* TV viewing after school appeared to be a consistent routine in most of the children, opposed to physical activity engagement. When there are no expectations for physical activity behaviors then we cannot expect children to place value on engaging in these particular behaviors. A longitudinal study examining the associations between physical activity, screen time, and BMI, followed over 1,400 children from 6 to 14 years old. Their results suggested that increased screen time at 6 years of age predicted lower physical activity levels and higher BMIs at ages 8 and 10; at age 14, physical activity levels predicted BMI. These results suggested that time engaged in screen-based behaviors contributed to BMI at an early age (Hands et al., 2011). It has also been suggested that children, ages 4-8, viewing more than 1.5 hours of TV per day were 1.65 (95% confidence interval (CI): 1.15–2.38) times more often overweight compared to children, ages 4-8, viewing less than 1 hour per day. In addition, the study suggested that the most significant determinants of children viewing more than 1.5 hours of TV per day was the number of TVs in the household, a TV in the child's bedroom, and having no rules of TV viewing (De Jong et al., 2013). Parents and caregivers play an important role in the restriction of sedentary activities by creating and implementing rules and expectations and modeling the behavior that is expected from their children. Parents who limited their own TV-viewing time on weekend days to 2 hours or fewer per day are suggested to be almost 3 times more likely to set time restrictions for their children's TV-viewing time compared to parents who watched 2.5 hours or more per day (Kubik, Gurvich, & Fulkerson, 2017). Children's engagement in sedentary activities, such as TV viewing, can have a negative impact on their weight status and physical activity levels at a young age. Parents can promote a sense of competence by providing children with consistent rules and expectations for sedentary and physical activities to encourage the maintenance of a healthy weight throughout childhood and into adolescence.

The goal of creating an autonomy-supportive environment is to give children a sense that their behaviors are self-endorsed. Deci and Ryan (2008) suggested that it is important to remember that being autonomous does not mean to be independent. It means having a sense of free will when doing something or acting out of our own interests and values. Within a family context, this could present challenges for some parents and caregivers because you are trying to promote that your child engages in a particular behavior of their own volition, as opposed to them engaging because they "were told to do so". Although there appeared to be some discussions taking place concerning why there are particular rules and expectations, these discussions may not have been translated clearly to their children. Therefore, when the children were asked to convey these discussions or reasons, they appeared vague or nonexistent. Additionally, autonomy can be supported by encouraging self-initiation of behaviors. It is often the case when engaging in a new behavior that you may struggle to find ways to "get started". Newly engaging in physical activity is no exception. By offering active alternatives to sedentary behaviors, or giving specific ideas and encouragement for physical activity, parents can encourage autonomy. In these interviews, parents did seem to offer an alternative to sedentary behavior, but it was often a vague, blanket statement of "go outside". This can be difficult for children who are not normally physically active because they may be unable to develop ideas for physical activity on their own. For another perspective, this would be the equivalent of telling an inactive adult to "go to the gym". That adult can physically go to the gym; however, they would most likely be unsuccessful in being able to navigate the facility and exercise without more instruction. Moreover, that adult may feel overwhelmed and have a negative experience that could impact their further engagement.

Parent's Post-Intervention Interviews

Four main themes were derived from the parents' interviews, with the first being nutrition. Their interviews suggested that the largest and most consistent changes within the household seemed to be with nutrition. This theme was surprising due to the fact that this intervention targeted changes in physical activity, opposed to nutrition; however, out of the 8 participating families, 7 parents mentioned making nutrition changes during the intervention. Even more surprising was the specificity in which they did so; for example, "*Yeah like used to he would get 10 nuggets, pizza rolls… now we are down to 7 and 8…*". Parents appeared to have created specific rules or expectations about the content, the amount, and the time in which the food was ingested.

A subordinate theme of nutrition also emerged within the intervention regarding a large increase in the amount of parent-child discussions about nutrition, specifically about "what's healthy". For example, *"And especially 01C2 he'll say 'Wait is that healthy?'… He'll ask if things are healthy, you know or he'll ask for a snack and then be like 'Wait, is that healthy?', 'You know, I'll have water because that's healthy.'".* This study targeted change in physical activity and was designed to promote parent-child discussions about physical activity and exercise by creating family-based goals, encouraging the development of physical activity expectations within the household, and developing a "plan of action" for the week for both parents and their children. With 7 out of the 8 families mentioning making nutrition changes, we found that this seemed to be the largest and most consistent change made during the intervention. It is possible that this increase in discussion and reasoning for "what is healthy" played a role in helping children make healthier food choices. Additionally, when examining some of the responses, it appears that children began to pick healthier alternatives of their own volition: "*I think I've mentioned before in one of our sessions, that we went to dinner and yeah when we went to Panama City for my birthday, and he (referring to son) ordered grilled chicken and broccoli."* Although we did not see the increase in discussion regarding physical activity as we originally hypothesized, it is possible that the development of nutrition rules and expectations and the increase in discussion and rationales provided for "what's healthy" played a role in increasing the children's competence and autonomy for picking healthier food choices.

The second theme that arose from the parent interviews was an overall increase in their awareness. In reviewing the transcripts, we found that all 8 families mentioned an increase in awareness of their food intake, daily sedentary behavior, or daily physical activity behavior. The parents seemed to experience this increase in themselves, and several parents mentioned seeing an increase in awareness in their children. In this cohort, we had 8 full-time working parents and 1 part-time working parent (n=9), all with a minimum of 2 children and a maximum of 4 children. Parents are presented with a unique challenge in that they are not only having to manage their time, but also the time and commitments of their spouses and dependents. This is likely to result in a daily whirlwind of commitments and obligations, making it difficult to examine daily habits objectively. This intervention directly targeted physical activity self-regulation and indirectly targeted sedentary behavior regulation by incorporating the use of a self- monitoring tool (i.e. the MOVband), self-regulation skill education, goal-setting education, and providing recommendations and implementation strategies for outside of the intervention.

This gave parents and their children the opportunity to self-regulate throughout the day in a "real-time" fashion, and resulted in our subordinate theme of making physical activity a priority. The ability to self-regulate has been considered as essential to maintaining a physically active lifestyle (Bandura, 1997; Bandura, 2004). One of the goals of this intervention was to enhance parental self-efficacy for physical activity behavior and providing support for their child's physical activity, and child's self-efficacy for physical activity and their proxy-efficacy (i.e. perception of their parents' ability to provide support). It has been cited that self-efficacy is often mediated by the ability to self-regulate (Rovniak, Anderson, Winett, & Stephens, 2002). Moreover, self-regulation has been suggested as a consistent determinant for physical activity participation in both adults and children, and engaging in physical activity and exercise can help promote one's ability to self-regulate (Anderson, Wojcik, Winett, & Williams, 2006; Michie, Abraham, Whittington, McAteer, & Gupta, 2009; Nurmi et al., 2016; Oaten and Chang, 2006).

For this particular cohort, one of the largest challenges was creating an "after- school routine" that was more conducive to physical activity behavior for the whole family. Often times, as shown in the preceding responses, many parents were primarily concerned with homework, dinner, and hygiene; however, when examining the children's pre-intervention interviews, it was suggested that engagement in sedentary activities was also a consistent routine. When parents started to become more aware of their families daily habits, they reported that they started making physical activity a priority. For example, *"I used to, I used to not plan anything or they'd umm… after school, I didn't think a lot about after school. It was really homework…the things that I thought about were things like homework, dinner, that kind of stuff. I never thought about,* *I never really thought about activity….but now I do, yes".* It appeared that some families tried to incorporate physical activity into things they were already doing, while other families were choosing more active alternatives during their day. Although our quantitative analyses suggested that there were no significant changes in physical activity, our qualitative analyses suggested that out of the many priorities that a parent has on a daily basis (i.e. work, transportation, meals, etc.) they began to put physical activity on their list of daily priorities.

Our third theme was the idea that the families' daily physical activity was more child-driven, compared to parent-driven. Previous literature, along with our quantitative analysis, has suggested that when parents are more active, their children tend to be more active (Erkelenz et.al, 2014; Holm et. al, 2012; VanAllen et. al, 2015). However, this qualitative analysis suggested that for this particular cohort, it is possible that the child can be a driving factor in the parent's level of physical activity. For example, *"He (child) really seems like he is trying and it makes us want to try more because he wants to try more so we're game for whatever he wants to do."* It is important to note, that the development of this theme was not in disagreement with the existing literature that suggests that parent physical activity is a significant predictor of child physical activity. These findings offer a different perspective from parents, and potentially present a causality dilemma. It is of our opinion that these parents, who identified as sedentary at the beginning of the intervention, were more influenced by their children's motivation for physical activity for a variety of reasons. Some parents expressed the need to set a good example for their child, while others wanted to help their children reach their physical activity goals. This led to the development of our subordinate theme that parents were trying to make physical activity more of a family affair.

In addition to engaging in more physical activity with their participating child, it appeared as though parents were also trying to find ways to make physical activity a family affair. Their responses suggested that they were trying to get more involved themselves, and pick more active alternatives for spending time with their family. For example, *"Right, that are active instead of saying 'oh lets go to a movie together', as a family we've tried to find…umm go hiking or try new things like that."* Although we suggested that the families' physical activity appeared to be more child-driven, parents began taking a more active role in providing physical activity support for their children and families. Research suggests that active parents tend to provide more support and opportunities for their children's physical activity engagement (Erkelenz et.al, 2014; Edwardson and Gorely, 2010; Loprinzi and Trost, 2009). These parents were initially sedentary and seemed to be more motivated by their children to engage in physical activity. This led to parents seeking out more active opportunities for their participating children and family. It is our hope that this parental engagement and support can increase the likelihood of their children and families to continue to engage in physical activity as they age.

Our fourth and final theme was the impact of environmental influences on engaging in physical activity. Throughout the duration of this intervention, there were various weather conditions, daylight savings time change, and the holiday season. The majority of the families' (6 out of 8) responses suggested that they were very sensitive to changes in the environment, and their family's physical activity was largely dependent on outside, environmental conditions. For example, *“The cold, the drop in temperature, and the rain has really thrown me off and daylight savings, yeah, that wasn’t as bad but when the temperature dropped…because now we cant just say “lets go, we are going to go outside”.* In the creating of the family “action plans” every week, we worked with both the parents and the children to create a personalized plan for physical activity for the upcoming week based on their family-based goals, individual-based goals, and availability of space and equipment. The two researchers that conducted these family sessions, put emphasis on creating both indoor and outdoor options for activities, games, and exercises. However, it appeared that despite these recommendations, the main location for physical activity was outside. Environmental conditions appeared to be one of the largest barriers to physical activity in this particular cohort. This finding appears consistent with previous literature suggesting that levels of physical activity, particularly with children, vary with seasonality and weather conditions (Chan and Ryan, 2009; Tucker and Gilliland, 2007). Since parent physical activity seemed to be motivated by child physical activity, it is likely that these particular environmental barriers (i.e. weather, daylight savings) had a direct effect on child activity which indirectly affected parent activity. Although seasonal fluctuations in physical activity is commonly observed, research has suggested that the increase in activity in the warmer months typically do not compensate for the decrease in the colder months, resulting in an average decrease in physical activity of 7% yearly (Bélanger et al., 2009). Therefore, future research should place emphasis on overcoming environmental barriers to promote achieving adequate amounts of physical activity as children age.

Comparing Parent and Child Post Interview Responses

After analyzing all the interviews separately, we thought it would be informative to compare the responses given by parents and their children on a family-by-family basis. In exploring these comparisons, it was not expected that parents and children would have the same answers; however, we wanted to investigate what information was being translated to children. When comparing responses from our first question: "Can you tell me if your routine has changed, do you think you are more active?", we received a variety of answers, but felt that the majority of children were able to communicate similarly to the responses that their parents gave. Not surprisingly, most of the parents were able to recall changes made further back in time, compared to many of the responses from the children were from the previous few weeks.

When examining responses from our next question: "Do you have any rules about watching TV or playing video games?", the majority of parent responses suggested that they were employing some type of sedentary restriction. Parents also described time limits or days of the week that were utilized in restricting sedentary activities. However, it appeared that some children were able to articulate that they were aware of such restrictions but were unable to elaborate on the specifics of the restrictions. Interestingly, it seemed that parents who had vague rules (e.g. <u>Parent:</u> *"I used to not think a whole lot about it, but now we just don't make it available"; "we have about 3 iPads in our house…Umm and they just aren't allowed on them now unless they ask";* <u>Child:</u> *"nope" and* <u>*Parent:*</u> *"Umm I think I've just more tried to...if it's been a certain amount of time I try to say "ok its time to do something and get out";* <u>*Child:*</u>

"yeah…umm, actually I don't know"), their children were unable communicate any rules to the interviewer.

When asking our final question, "Do you have any rules or expectations about being physically active or exercising?" the majority of children were responding similar to their parents. One of the components of the intervention was to have families create a joint physical activity rule. We asked families to talk with their children and come up with a family physical activity rule, such as everyone in the family had to get at least a certain amount of moves per day or everyone had to exercise on a certain amount of days. We also recommended that families have a system to keep track (e.g. pebbles in a jar, score card on the refrigerator) of when they met their family goals and have a reward (e.g. laser tag, skate park, etc.) in place when they met their goals. However, it appears that this was not an effective method in getting the family to create physical activity rules or expectations long-term as the majority of the parents and children mentioned not having any rules or expectations for physical activity behavior.

VII. CONCLUSIONS

Overview

The primary goal of this intervention was to increase child physical activity levels by targeting psychological determinants, their parents' activity levels, and their parent's psychological determinants for engagement and support of physical activity. Although our linear-mixed effects regression suggested there was no significant change in physical activity levels in parents or children, it is important to also consider a few other findings. First, all parents claimed to meet inclusion criteria of being sedentary (i.e. engaging in structured exercise no more than 1 day per week) and the average BMI percentile for the participating children was 96.9 (±1.87). On average, children were getting 15,794(±609.8) *moves* and parents were getting 13,137(±109.7) *moves* at baseline. The participants' step equivalent would be approximately 13,161 steps for children and 10,947 steps for parents per day at baseline, suggesting that the participants were meeting step recommendations for both children and adults (Adams, Johnson, and Tudor-Locke, 2013; Tudor-Locke and Bassett, 2004) at the onset of the intervention. Although it cannot be assumed that parents not engaging in structured exercise sessions and children classified as obese are not physically active, it is important to note the possible novelty effect that the wrist-worn accelerometer had on their motivation for exercise as reactivity to activity monitors has been documented for both adults and children (Clemes and Parker, 2009; Foote et al., 2017; Scott et.al, 2014). Secondly, as referred to in our qualitative analyses, the parent's post-interviews suggested that environmental influences, such as weather, daylight savings time change, and the holiday season, had a significant impact on their family's engagement in physical activity. Parents also mentioned making physical activity a priority, attempting to engage the whole family, and becoming more aware of their sedentary and physical activity habits as a result of the intervention. This increase in valuing and importance placed on physical activity engagement is also evident is the parent's significant increase in their identified motivation and significant decrease in their amotivation.

In taking a closer look at the relationship between maternal physical activity and child physical activity, our analysis suggested a positive linear relationship. For this particular cohort, for every 1,000 *moves* a mother achieved, their child achieved an additional 191.8(±57.3) *moves* per day (p=.001). This finding reinforces the impact that parent physical activity behavior can have on their child's daily physical activity levels. Our qualitative analyses offered a different perspective than the current literature trends by suggesting that for the majority of families, physical activity seemed to be initially driven by the child, as opposed to parent-driven activity. With children being considered a large motivation factor for initial parental activity engagement, this could have also played a role in the significant increase in parents' perception of their child's competence. Our quantitative results are consistent with previous research reporting that parental activity, especially maternal, is a strong predictor of child activity levels (Cleland et. al, 2011; Holm et al., 2012; Edwardson and Gorely, 2010); however, our qualitative results offer a different perspective when examining the factors of motivation for previously sedentary parents.

Our body composition results suggested that parents did not experience any significant changes in fat mass, lean mass, or BMD; however, children experienced a significant increase in both lean mass (*p*=.000) and BMC (*p*=.000). All children's Tanner Scale scores reported from parents suggested that child were either prepubertal or in stage 2 (the onset of perberty); therefore, it is unlikely that puberty status was a significant confounding variable when examining body composition changes. This prompted further investigation by conducting a segment analysis to see if there was a significant area of the body (arms, legs, trunk) where these changes occurred. Our results suggested there were no significant differences between the children's arms, legs, and trunk lean mass changes, despite a significant increase (p=.04) in sit-up scores. Our qualitative results from the parents' post-interviews suggested that the largest and most consistent change made within the household during the intervention was changes with nutrition. Seven out of the 8 families mentioned making changes with the content, amount, and/or ingestion time of their children's food. In addition, they reported a noticeable increase in the amount of discussion and questions surrounding nutrition and "what's healthy?". Although we did not see the increase in discussion regarding physical activity as we originally hypothesized, it is possible that the development of nutrition rules and expectations and the increase in discussion and rationales provided for "what's healthy" played a role in increasing the children's competence and autonomy for picking healthier food choices.

Limitations

The largest limitation that had the greatest impact on this intervention study was the small sample size. For this intervention we recruited for 5 weeks by a variety of methods and estimated to reach more than 8,000 people. We received interest from 12 families via email (2 didn't meet inclusion criteria; 2 had time conflicts), which resulted in 8 families that participated. One of the major factors affecting our recruitment may have been the possibility that parents were unable to identify if their child met the BMI inclusion criteria (>85th percentile), as all participating children were at least 93rd percentile with the average being in the 97th percentile. This is not a recent phenomenon and has been well documented (Katz, 2015; De La O, Jordan, et. al, 2009; Doolen et. al, 2009; Eckstein et. al, 2006). Second, we decided to incorporate food and beverage intake in the weekly self-regulation logs and nutrition education to promote healthy food choices within the family. By not using nutrition data in the quantitative analysis, the results of this study are unable to expand on possible associations with body composition changes. Finally, this family-based fitness study did not employ a control or active-control group; therefore, the findings of this study are limited by the possibility that observed findings could be due to confounding variables not examined. Lastly, in attempting a more social ecological model approach we choose to only have the participants come in once per week. However, it could be that the overall dose of the intervention was not enough to elicit significant changes in physical activity.

Implications

Although there were fewer statistically significant findings than we originally hypothesized, this family-based fitness intervention was able to add to the current framework and literature surrounding the promotion of child physical activity. The most important and applicable finding is the role of parents and caregivers in their child's engagement in physical and sedentary activities. Parents can provide support for their child's physical activity by implementing a sense of structure, or clear and consistent rules and expectations for desired behaviors. Our qualitative analyses suggested that when parents began creating nutrition rules and expectations, their children began asking more questions. This led to an increase in discussion about “what is healthy” and possibly contributed to their children’s autonomy. This resulted in some of the children beginning to make healthier food choices of their own volition, and could continue to encourage this behavior long-term. From a theoretical perspective, this implementation of structure and autonomy-supportive behaviors would also have a similar effect on children’s physical and sedentary activity engagement.

Using a self-regulation tool (i.e. the MOVband), may have increased both parents and their children’s awareness of their daily physical and sedentary habits. As previously mentioned, self-efficacy is one of the most consistent predictors for physical activity engagement. Using a self-regulation tool, such as an activity tracker, could be an effective tool to mediate the development of self-efficacy; however, it is important to note that it may not be an effective tool to maintain physical activity long-term due to the extrinsic nature of the motivation.

Our qualitative analyses also suggested that families began making physical activity a priority and children were a large motivating factor for parents to engage in physical activity. After exploring the interviews and having discussions with parents, it is our opinion that the health education sessions (i.e. health implications of sedentary behavior, nutrition, goal setting, self-regulation techniques, time management, relapse prevention, social support, and reinforcements) had the largest impact on the parents’ sense of importance for physical activity and healthier food choices; this conclusion was also supported by parents’ increase in their identified motivation (i.e. consciously valuing a behavior). The implementation of the family action plans supported parents' self-efficacy in being able to provide support for their children's physical activity levels, and this could be increasingly important as children age. Lastly, future research and physical activity promotion programs need to place an emphasis on learning and being able to find alternative locations for physical activity and exercise as environmental factors appeared to play a large role in physical activity engagement.

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IX. APPENDICES

APPENDIX A: IRB PROTOCOL

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD for RESEARCH INVOLVING HUMAN SUBJECTS

RESEARCH PROTOCOL REVIEW FORM
FULL BOARD or EXPEDITED

For Information or help contact **THE OFFICE OF RESEARCH COMPLIANCE (ORC),** 115 Ramsay Hall, Auburn University
Phone: 334-844-5966 **e-mail:** IRBAdmin@auburn.edu **Web Address:** http://www.auburn.edu/research/vpr/ohs/index.htm

Revised 2.1.2014 **Submit completed form to IRBsubmit@auburn.edu or 115 Ramsay Hall, Auburn University 36849.**

Form must be populated using Adobe Acrobat / Pro 9 or greater standalone program (do not fill out in browser). Hand written forms will not be accepted.

1. PROPOSED START DATE of STUDY: September 7, 2016

PROPOSED REVIEW CATEGORY (Check one): ☑ **FULL BOARD** ☐ **EXPEDITED**

SUBMISSION STATUS (Check one): ☑ **NEW** ☐ **REVISIONS (to address IRB Review Comments)**

2. PROJECT TITLE: The Effect of the Family Structure on Child Physical Activity Within a Fitness Intervention: A Theoretical Approach

3. Danielle Wadsworth (**PRINCIPAL INVESTIGATOR**) | Assoc Professor (**TITLE**) | School of Kinesiology (**DEPT**) | wadswdd@auburn.edu (**AU E-MAIL**)

301 Wire Road, Auburn, AL 36849 (**MAILING ADDRESS**) | 844-1836 (**PHONE**) | ____ (**ALTERNATE E-MAIL**)

4. FUNDING SUPPORT: ☑ N/A ☐ Internal ☐ External Agency: ____________ ☐ Pending ☐ Received

For federal funding, list agency and grant number (if available). ____________

5a. List any contractors, sub-contractors, other entities associated with this project:

____

b. List any other IRBs associated with this project (including Reviewed, Deferred, Determination, etc.):

____

PROTOCOL PACKET CHECKLIST

All protocols must include the following items:

- ☑ **Research Protocol Review Form** (All signatures included and all sections completed)
  (Examples of appended documents are found on the OHSR website: http://www.auburn.edu/research/vpr/ohs/sample.htm)
- ☑ **CITI Training Certificates** for all Key Personnel.
- ☑ **Consent Form or Information Letter** and any Releases (audio, video or photo) that the participant will sign.
- ☑ **Appendix A**, "Reference List"
- ☑ **Appendix B** if e-mails, flyers, advertisements, generalized announcements or scripts, etc., are used to recruit participants.
- ☑ **Appendix C** if data collection sheets, surveys, tests, other recording instruments, interview scripts, etc. will be used for data collection. Be sure to attach them in the order in which they are listed in # 13c.
- ☑ **Appendix D** if you will be using a debriefing form or include emergency plans/procedures and medical referral lists (A referral list may be attached to the consent document).
- ☐ **Appendix E** if research is being conducted at sites other than Auburn University or in cooperation with other entities. A **permission letter** from the site / program director must be included indicating their cooperation or involvement in the project. NOTE: If the proposed research is a multi-site project, involving investigators or participants at other academic institutions, hospitals or private research organizations, a letter of **IRB approval** from each entity is required prior to initiating the project.
- ☐ **Appendix F** - Written evidence of acceptance by the host country if research is conducted outside the United States.

FOR ORC OFFICE USE ONLY

DATE RECEIVED IN ORC:________ **by**________ **PROTOCOL #**
DATE OF IRB REVIEW:________ **by**________ **APPROVAL CATEGO**
DATE OF IRB APPROVAL:________ **by**________ **INTERV**
COMMENTS:

The Auburn University Institutional Review Board has approved this Document for use from 08/24/2016 to 08/23/2017
Protocol # 16-306 MR 1608

6. **GENERAL RESEARCH PROJECT CHARACTERISTICS**

6A. Research Methodology

Please check all descriptors that best apply to the research methodology.

Data Source(s): ☑ New Data   Existing Data

Will recorded data directly or indirectly identify participants?
Yes   ☑ No

Data collection will involve the use of:

Educational Tests (cognitive diagnostic, aptitude, etc.)
✔ Interview
Observation
✔ Location or Tracking Measures
✔ Physical / Physiological Measures or Specimens (see Section 6E.)
✔ Surveys / Questionnaires

✔ Internet / Electronic
Audio
Video
Photos
Digital images
Private records or files

Other: ______________________________

6B. Participant Information

Please check all descriptors that apply to the target population.
☑ Males ☑ Females ☐ AU students

Vulnerable Populations
☐ Pregnant Women/Fetuses ☐ Prisoners ☐ Institutionalized
✔ Children and/or Adolescents (under age 19 in AL)

Persons with:

☐ Economic Disadvantages ☐ Physical Disabilities
☐ Educational Disadvantages ☐ Intellectual Disabilities

Do you plan to compensate your participants? ☐ Yes ☑ No

6C. Risks to Participants

lease identify all risks that participants might encounter in this search.

☑ Breach of Confidentiality*
☐ Deception
☐ Psychological
☐ None
Other:

☐ Coercion
☑ Physical
☐ Social

*Note that if the investigator is using or accessing confidential or identifiable data, breach of confidentiality is always a risk.

6D. Corresponding Approval/Oversight

- Do you need IBC Approval for this study?
  ☐ Yes ☑ No

  If yes, BUA #________________________Expiration date__________________________

- Do you need IACUC Approval for this study?
  ☐ Yes ☑ No

  If yes, PRN #________________________Expiration date __________________________

- Does this study involve the Auburn University MRI Center?
  ☐ Yes ☑ No

  Which MRI(s) will be used for this project? (Check all that apply)
  ☐ 3T ☐ 7T

  Does any portion of this project require review by the MRI Safety Advisory Council?
  ☐ Yes ☐ No

  Signature of MRI Center Representative: ______________________________
  Required for all projects involving the AU MRI Center

  Appropriate MRI Center Representatives:
  Dr. Thomas S. Denney, Director AU MRI Center
  Dr. Ron Beyers, MR Safety Officer

7. PROJECT ASSURANCES The Effect of the Family Structure on Child Physical Activity Within a Fitness Intervention: A Theoretical Approach

A. PRINCIPAL INVESTIGATOR'S ASSSURANCES

1. I certify that all information provided in this application is complete and correct.
2. I understand that, as Principal Investigator, I have ultimate responsibility for the conduct of this study, the ethical performance this project, the protection of the rights and welfare of human subjects, and strict adherence to any stipulations imposed by the Auburn University IRB.
3. I certify that all individuals involved with the conduct of this project are qualified to carry out their specified roles and responsibilities and are in compliance with Auburn University policies regarding the collection and analysis of the research data.
4. I agree to comply with all Auburn policies and procedures, as well as with all applicable federal, state, and local laws regarding the protection of human subjects, including, but not limited to the following:
    a. Conducting the project by qualified personnel according to the approved protocol
    b. Implementing no changes in the approved protocol or consent form without prior approval from the Office of Research Compliance
    c. Obtaining the legally effective informed consent from each participant or their legally responsible representative prior to their participation in this project using only the currently approved, stamped consent form
    d. Promptly reporting significant adverse events and/or effects to the Office of Research Compliance in writing within 5 working days of the occurrence.
5. If I will be unavailable to direct this research personally, I will arrange for a co-investigator to assume direct responsibility in my absence. This person has been named as co-investigator in this application, or I will advise ORC, by letter, in advance of such arrangements.
6. I agree to conduct this study only during the period approved by the Auburn University IRB.
7. I will prepare and submit a renewal request and supply all supporting documents to the Office of Research Compliance before the approval period has expired if it is necessary to continue the research project beyond the time period approved by the Auburn University IRB.
8. I will prepare and submit a final report upon completion of this research project.

My signature indicates that I have read, understand and agree to conduct this research project in accordance with the assurances listed above.

Danielle Wadsworth	Danielle Wadsworth Digitally signed by Danielle Wadsworth DN: cn=Danielle Wadsworth, o=Auburn University, ou=Kinesiology, email=wadswdd@auburn.edu, c=US Date: 2016.07.28 13:14:38 -05'00'	7-27-2016
Printed name of Principal Investigator	**Principal Investigator's Signature**	**Date**

B. FACULTY ADVISOR/SPONSOR'S ASSURANCES

1. I have read the protocol submitted for this project for content, clarity, and methodology.
2. By my signature as faculty advisor/sponsor on this research application, I certify that the student or guest investigator is knowledgeable about the regulations and policies governing research with human subjects and has sufficient training and experience to conduct this particular study in accord with the approved protocol.
3. I agree to meet with the investigator on a regular basis to monitor study progress. Should problems arise during the course of the study, I agree to be available, personally, to supervise the investigator in solving them.
4. I assure that the investigator will promptly report significant incidents and/or adverse events and/or effects to the ORC in writing within 5 working days of the occurrence.
5. If I will be unavailable, I will arrange for an alternate faculty sponsor to assume responsibility during my absence, and I will advise the ORC by letter of such arrangements. <u>If the investigator is unable to fulfill requirements for submission of renewals, modifications or the final report, I will assume that responsibility.</u>

Printed name of Faculty Advisor / Sponsor	**Faculty Advisor's Signature**	**Date**

C. DEPARTMENT HEAD'S ASSSURANCE

By my signature as department head, I certify that I will cooperate with the administration in the application and enforcement of all Auburn University policies and procedures, as well as all applicable federal, state, and local laws regarding the protection and ethical treatment of human participants by researchers in my department.

Mary Rudisill	Mary Rudisill Digitally signed by Mary Rudisill DN: cn=Mary Rudisill, o, ou=School of Kinesiology, email=rudisme@auburn.edu, c=US Date: 2016.07.28 13:50:21 -05'00'	7-27-2016
Printed name of Department Head	**Department Head's Signature**	**Date**

8. PROJECT OVERVIEW: Prepare an abstract that includes:
(350 word maximum, in language understandable to someone who is not familiar with your area of study)**:**

a) A summary of relevant research findings leading to this research proposal:
(*Cite sources; include a "Reference List" as* ***Appendix A.)***

b) A brief description of the methodology, including design, population, and variables of interest

Several studies have suggested that when parents are more physically active, their children tend to be more physically active (Jenson et al.,2015). When family-based interventions target increasing physical activity they result in greater health and fitness outcomes for the parents and the children (Erkelenz et al., 2014; VanAllen et al., 2015). This may be particularly true if parents implement autonomy-supportive structure (i.e. certain parenting practices and orientations) within the home to promote child's feelings of competence, autonomy, and self-efficacy and their physical activity behavior (Grolnick et al., 2014; Gunnarsdottir et al., 2011; Lloyd et al., 2014).

In this study, parents and children (ages 5-10) will be invited to participate in a 10-week fitness and health education intervention aimed at increasing health-related fitness in children and parents. At the beginning of the intervention, parents will complete a Physical Activity Readiness Questionnaire (PAR-Q) for themselves and the child version (PAR-Q C) on the behalf of their children to ensure they and their child are safe to participate in an exercise and physical activity program. At the beginning and end of the intervention, we will evaluate the parent and child using iDEXA (dual-energy X-ray absorptiometry), competence, self-efficacy, and motivation questionnaires. Additionally, children will also be evaluated using the FITNESSGRAM (physical fitness test specific to children) and a semi-structured interview. Participants will attend 60-90 minute, weekly sessions for the duration of the 10-week intervention (10 weekly sessions), 1 orientation session, 1 post-testing session and 1 retention session for a total of 13 visits to the School of Kinesiology. The sessions will consist of separate but concurrently run child and parent exercise sessions. Sessions will consist of child motor skill development and fitness education and parent cardiovascular and resistance training based on an exercise-needs assessment. These sessions will be followed by group health education and outside-intervention implementation strategies. Participants will return 3 months after the intervention has completed for a retention measure.

Our variables of interest include: change in physical activity levels (via MOVBAND activity monitors), change in child fitness (via FITNESSGRAM), change in body composition (via iDEXA), change in parental and child perceived competence, self-efficacy, and motivation (via questionnaires), and change in parental implementation of structure within the home (via semi-structured interviews with children). Change in physical activity levels will be measured using daily physical activity, while all other assessments will be measured pre and post-intervention as well as a retention measure 3 months after the intervention.

9. PURPOSE.

a. Clearly state the purpose of this project and all research questions, or aims.

The purpose of this intervention is to assess the effect of parental implementation of autonomy-supportive structure on children's feelings of competence, autonomy, and self-efficacy and its effect on child physical activity. The specific research questions include:
1) What is the effect of a family fitness intervention on physical activity behavior, fitness and body composition?
2) What the effect of a family fitness intervention on parental self-efficacy, perceived competence, motivation for physical activity, child perceived competence, autonomy, and self-efficacy, and family autonomy supportive structure.
3) To what extent does parental provision of structure in an autonomy-supportive manner and parental psychological factors predict child perceived competence, autonomy, and self-efficacy? Moreover, to what extent will parental structure provision and autonomy-supportive behavior and parental psychological factors predict child physical activity behavior and changes in fitness and fat mass?

b. How will the results of this project be used? (e.g., Presentation? Publication? Thesis? Dissertation?)

All data obtained from the parent and their child will be given study specific identifiers. These data will be analyzed with respect to the research questions above for doctoral dissertation, presentations at scientific conferences, and publication in scientific journals. Reports will be available upon request regarding pre/post intervention outcomes.

10. KEY PERSONNEL. Describe responsibilities. Include information on research training or certifications related to this project. CITI is required. Be as specific as possible. (Include additional personnel in an attachment.) *All key personnel must attach CITI certificates of completion.*

Principle Investigator Danielle Wadsworth Title: Assoc Professor E-mail address wadswdd@auburn.edu

Dept / Affiliation: School of Kinesiology

Roles / Responsibilities:

Dr. Wadworth will oversee all aspects of the research study, including: recruitment, training, testing, data analysis, and data reporting for publications and presentations.

Individual: Shelby Foote Title: Doc. Candidat E-mail address sjm0011@auburn.edu

Dept / Affiliation: School of Kinesiology

Roles / Responsibilities:

Shelby will be responsible for recruitment, training, testing, data collection and data analysis. She will present study results and assist in the preparation of manuscripts for publication.

Individual: James McDonald Title: Assoc Prof E-mail address jrm0013@auburn.edu

Dept / Affiliation: School of Kinesiology

Roles / Responsibilities:

Dr. McDonald will assist with iDEXA testing and data interpretation

Individual: ______ Title: ______ E-mail address ______

Dept / Affiliation: ______

Roles / Responsibilities:

Individual: ______ Title: ______ E-mail address ______

Dept / Affiliation: ______

Roles / Responsibilities:

Individual: ______ Title: ______ E-mail address ______

Dept / Affiliation: ______

Roles / Responsibilities:

11. LOCATION OF RESEARCH. List all locations where data collection will take place. (School systems, organizations, businesses, buildings and room numbers, servers for web surveys, etc.) Be as specific as possible. Attach permission letters in Appendix E. *(See sample letters at http://www.auburn.edu/research/vpr/ohs/sample.htm)*

Data collection will take place in the Exercise Adherence Lab (149 School of Kinesiology). Data will be stored on password protected computers located in the Exercise Adherence Lab. All consent forms will be stored in locked cabinets in Shelby Foote's office (126B School of Kinesiology).

12. PARTICIPANTS.

a. Describe the participant population you have chosen for this project including inclusion or exclusion criteria for participant selection.

☐ Check here if using existing data, describe the population from whom data was collected, & include the # of data files.

Interested families who specify they meet criteria by phone or e-mail will be asked to come to the Exercise Adherence and Motivation Lab, Kinesiology Department, to first fill out an informed consent on behalf of the parents and their children. After informed consent has been completed, the screening process will begin to determine eligibility. Drs. Wadsworth and McDonald and Shelby Foote will be completing the screening process.

Parents and children must meet the following inclusion criteria to participate: (1) Children must be between the ages of 5-10 (2) At least one child in the family must be considered overweight or obese (BMI > 85th percentile) (3) One parent must be willing to participate (4) Parent must identify as sedentary (defined as engaging in structured exercise no more than 1 day per week) (5) Healthy as determined by the Physical Activity Readiness Questionnaire (PAR-Q) for adults, and parents will be asked to fill out a PAR-Q for children on the behalf of their child and (6) Not currently taking any medications that would affect ability to exercise safely.

The PARQ and PARQ-C are designed to identified any underlying medical issues that could be a threat to the participant's safety in participating in an exercise program. Therefore, if they answer "YES" to any question, they will be unable to participate in the study.
Participants who do not meet all screening criteria will be given their consent form and Par-Q/C.

b. Describe, step-by-step, in layman's terms, all procedures you will use to recruit participants. *Include in Appendix B a copy of all e-mails, flyers, advertisements, recruiting scripts, invitations, etc., that will be used to invite people to participate. (See sample documents at http://www.auburn.edu/research/vpr/ohs/sample.htm.)*

Participants will be recruited by word of mouth, e-mail blasts, flyers, social network blasts, and flyers will be given to local schools. Flyers are given to schools to be distributed based of off the schools protocol. Typically, teachers place the flyer in the folders/binders that go home to the parents. The email list is from past outreach activities. We also send an email to healthy tigers and recreation centers if they would like to post the flyer. Posts will be made to local groups on facebook including: schools facebook page, kinesiology facebook page, lab facebook page. The flyer will be attached or a picture of the flyer will be posted for all recruitment purposes. The script will provide a brief overview of the study with all details provided with review of the informed consent. No deceptive language will be used in recruiting participants, and any potential questions regarding the study will be honestly answered to the best of our ability.

c. What is the minimum number of participants you need to validate the study? ____________

How many participants do you expect to recruit? 30 families

Is there a limit on the number of participants you will include in the study? ☑ No ☐ Yes – the # is __________

d. Describe the type, amount and method of compensation and/or incentives for participants.

(If no compensation will be given, check here: ☐)

Select the type of compensation: ☐ Monetary ☑ Incentives
☐ Raffle or Drawing incentive (Include the chances of winning.)
☐ Extra Credit (State the value)
☑ Other

Description:

All participants will recieve a health report based on body composition and current fitness levels. Their health report will include changes in child fitness scores from the FITNESSGRAM and child and parent body composition from DEXA.

13. PROJECT DESIGN & METHODS.

a. Describe, step-by-step, all procedures and methods that will be used to consent participants. If a waiver is being requested, check each waiver you are requesting, describe how the project meets the criteria for the waiver.

☐ Waiver of Consent (including using existing data)

☐ Waiver of Documentation of Consent (use of Information Letter)

☐ Waiver of Parental Permission (for college students)

When parent and child participants arrive in the laboratory, they will be given a physical copy of the consent form to read and sign. Either Dr. Wadsworth or Shelby Foote will orally explain the study and go over all aspects of participation. Participants will then be given time to read the consent form and decide on particiaption. Parents will sign a consent form for themselves, as well as each child in that is participating. Prior to participation, participants will be verbally reminded that they may discontinue participation at any time during the experiment without penalty. Please note that a consent form for each child in the family will be completed between the ages of 5-10. Consent forms for all participants will be completed prior to participant screening for participation.

b. Describe the research design and methods you will use to address your purpose. Include a clear description of when, where and how you will collect all data for this project. Include specific information about the participants' time and effort commitment. (*NOTE: Use language that would be understandable to someone who is not familiar with your area of study. Without a complete description of all procedures, the Auburn University IRB will not be able to review this protocol. If additional space is needed for this section, save the information as a .PDF file and insert after page 7 of this form.*)

All research procedures will be conducted at the Exercise Adherence and Motivation laboratory, School of Kinesiology, Auburn University. Parents will be asked to read and sign informed consent for themselves and on the behalf of their participating children. Those who decide to consent will partcipate and meet the study's criteria will complete an baseline data collection. Child's height and weight will be taken to interpret their BMI status. Children who meet the BMI criteria of > the 85th percentile (or have a sibling who meets this citeria) and parents who identify as sedentary (engaging in exercise less than 1 day per week) and identify as healthy based on the PAR-Q will be evaluated using the following assessments: DEXA (dual-energy X-ray absorptiometry) scans for all participants, parental perceived competence, self-efficacy, and motivation questionnaires, child perceived competence, motivation, and self-efficacy questionnaires, semi-structured interviews with participating children and parents and FITNESSGRAM (child-specific fitness test) testing with children. Participants will also be orientated on the MOVBAND. All standardized procedures will be followed for each test.

For the following 10 weeks, participants will participate in a face-to-face lab based intervention once per week for 60-90 minutes in duration. During the first 40-45 minutes of each session parents and children will partiicpate in seperate, concurrently run physical activity sessions. Child sessions will include motor skill development and fitness education, while parent session will consist of cardiovascular and resistance training exercise based on an exercise-needs assessment they provide during the baseline data collection session. The following 15-30 minutes, we will bring the families back together and have a group education session. These sessions include topics such as nutrition education, goal-setting, and time management. Qualified research personnel will then aid in creating a plan for exericse implementation for the families for the remainder of the week outside of the intervention (For more details see attached Week-by-Week schedule). Post-testing will be 1 week following the cessation of the intervention and will consist of height and weight assessments on both parent and children, DEXA scans for all participants, parental perceived competence and self-efficacy questionnaires, child perceived competence and self-efficacy questionnaires, semi-structured interviews with participating children and parents, FITNESSGRAM testing with children, and a final MOVBAND download. Retention measures will occur 3 months after the intervention and consist of: DEXA scans for all participants, parental perceived competence and self-efficacy questionnaires, child perceived competence and self-efficacy questionnaires, semi-structured interviews with participating children and parents and FITNESSGRAM testing with children.

13. PROJECT DESIGN & METHODS. *Continued*

c. List all data collection instruments used in this project, in the order they appear in Appendix C.
(e.g., surveys and questionnaires in the format that will be presented to participants, educational tests, data collection sheets, interview questions, audio/video taping methods etc.)

1. PAR-Q and PAR-Q C
2. Dual-Energy X-ray Absorptiometry (DEXA)
3. Physical activity levels measured by MOVBAND wrist-worn activity tracker
4. Child fitness levels assessed by FITNESSGRAM
5. Parental Self-Efficacy Questionnaire
6. Parental Modified Percieved Competence Scale
7. Parental Revised Sport Motivation Scale
8. Child Revised Motivation Scale
9. Child Percieved Competence Quesitonnaire
10. Child self-efficacy to be physically active (SEPA) and proxy efficacy to influence parents to provide physical activity opportunities (PEPA-P)
11. Structure Implementation Semi-structured interview questions

d. Data analysis: Explain how the data will be analyzed.

Changes in body composition, physical activity levels, fitness, psychological measures, and structure implementation will be examined pre/post intervention and retention. Differences in these changes between parents and children over time will also be assessed for interaction effects.

14. RISKS & DISCOMFORTS: List and describe all of the risks that participants might encounter in this research. ***If you are using deception in this study, please justify the use of deception and be sure to attach a copy of the debriefing form you plan to use in Appendix D.*** *(Examples of possible risks are in section #6D on page 2)*

1. Participants may experience physical fatigue (muscle fatigue and soreness) from the exercise and physical activities.

2. A small amount of radiation from the DEXA scan

3. Since we will be using human subjects and will not be collecting data anonymously, breach of confidentiality is always a risk.

15. PRECAUTIONS. Identify and describe all precautions you have taken to eliminate or reduce risks as listed in #14. If the participants can be classified as a "vulnerable" population, please describe additional safeguards that you will use to assure the ethical treatment of these individuals. ***Provide a copy of any emergency plans/procedures and medical referral lists in Appendix D.*** *(Samples can be found online at http://www.auburn.edu/research/vpr/ohs/sample.htm#precautions)*

1. To alleviate fatigue, participants are encouraged (and will be reminded) to take breaks during the in-person group sessions and while working at home. Participants are allowed to take breaks at any time or stop participating in the exercise session all together. However, the exercises and physical activities included in this program are similar to that of a physical education class, sport/recreational, or exercises sessions. In addition, during the study, information will be given to parents about exertion rates for children and adults. This information will help parents appropriately monitor and advise children on when to take breaks or when to decrease the intensity of the exercise. Breaks will be encouraged for parents and their child during the group sessions.
2. All procedures for the iDexa will be followed and have been approved by Auburn University and the State Board of radiation. Radiation from the iDexa full body scan is comparable to walking outside in the sun for approximately 10-15 minutes.
3. Participant confidentiality with respect to data collected during the study will be maintained via the use of study-specific identifiers. Data will be stored on password-protected computers in locked laboratory facilities (Exercise Adherence Lab KINE149) in the School of Kinesiology. The consent and recruitment information will be stored on password protected computers and/or physical copies will be locked in cabinets kept in Shelby Foote's office (126B School of Kinesiology).

If using the Internet or other electronic means to collect data, what confidentiality or security precautions are in place to protect (or not collect) identifiable data? Include protections used during both the collection and transfer of data.

All data collected will have study-specific identifiers and will be stored on password protected computers and spreadsheets in the Exercise Adherence Lab (149 School of Kinesiology building). Only key personnel will have access to these data and the passwords for the computers/spreadsheets. Recruitment information, consent forms, and spreadsheets linking study-specific identifiers and personal information will be kept separately (in Shelby Foote's office, room 126B) and not transferred.

16. BENEFITS.

a. List all realistic direct benefits participants can expect by participating in this specific study.
(Do not include "compensation" listed in #12d.) Check here if there are no direct benefits to participants. ☐

Parent's and their child's participation is completely voluntary. The study is designed to help increase participants' health-related fitness. In addition, the study may have substantial impact on understanding how parent participation in exercise and physical activity may lead to heath-related outcomes in their children.

b. List all realistic benefits for the general population that may be generated from this study.

The results of this study are broadly applicable to the general population of families with children who are considered overweight or obese. The results will help determine how to best promote physical activity and health in families.

The results will be made available through presentations and publications.

17. PROTECTION OF DATA.

a. Data are collected:

☐ Anonymously with no direct or indirect coding, link, or awareness of who participated in the study (Skip to e)

☐ Confidentially, but without a link of participant's data to any identifying information (collected as "confidential" but recorded and analyzed as "anonymous") (Skip to e)

☑ Confidentially with collection and protection of linkages to identifiable information

b. If data are collected with identifiers or as coded or linked to identifying information, describe the identifiers collected and how they are linked to the participant's data.

Participant confidentiality with respect to data collected during the study will be maintained via the use of study-specific identifiers. There will be one password-protected spreadsheet that links the study identifiers with the names/contact information used during recruitment (retained by Shelby Foote). For the purpose of the analysis, results, and eventual presentation/publication, all data will remain anonymous. Reports of the assessments, are available to participants upon request upon study completion.

c. Justify your need to code participants' data or link the data with identifying information.

Identify of participants is necessary to link data over time.

d. Describe how and where identifying data and/or code lists will be stored. (Building, room number?) Describe how the location where data is stored will be secured in your absence. For electronic data, describe security. If applicable, state specifically where any IRB-approved and participant-signed consent documents will be kept on campus for 3 years after the study ends.

All consent forms, recruitment information, and linking spreadsheet will be stored in Shelby Foote's office (126B School of Kinesiology Building) on either password-protected computers and password-protected spreadsheets or stored in locked cabinets. Upon study completion and for the 3 years following, all electronic information will be transferred onto a password-protected external hard drive, removed from the computers, and stored with the consent forms in this office. Only Dr. Wadsworth will have access to this office.

e. Describe how and where the data will be stored (e.g., hard copy, audio cassette, electronic data, etc.), and how the location where data is stored is separated from identifying data and will be secured in your absence. For electronic data, describe security

Data with study-specific identifiers will be stored in the Exercise Adherence Lab (149 School of Kinesiology). All electronic data will have study-specific identifiers and stored on password-protected computers and password-protected spreadsheets. Back-up copies of electronic data will be stored on an external hard drive locked in a filing cabinet in the lab. Hardcopies of questionnaires/surveys will be stored in a locked filing cabinet in the lab. Only key personnel will have access to the lab and/or computers.

f. Who will have access to participants' data?
(*The faculty advisor should have full access and be able to produce the data in the case of a federal or institutional audit*.)

All key personnel will have access to anonymous data. Dissemination of any anonymous data will need to be approved by Dr. Wadsworth.

g. When is the latest date that identifying information or links will be retained and how will that information or links be destroyed?
(Check here if only anonymous data will be retained ☐)

Dr. Wadsworth will keep the informed consent for three years. The master list will be destroyed once all data have been collected and collated.

AUBURN UNIVERSITY

COLLEGE OF EDUCATION

School of Kinesiology

PARENTAL PERMISSION for a Research Study entitled:

"The Effect of the Family Structure on Child Physical Activity Within a Fitness Intervention: A Theoretical Approach"

Project Overview/Purpose: Your child is invited to participate in a research study to examine the effect of the family structure on parent and child physical activity levels and changes in children's fitness. We are recruiting children and their families to complete a 12-week study with a follow-up three months later. Participants will participate in structured exercise sessions and education sessions. We will also be investigating the exercise adherence and behaviors related to participation in a family-based fitness intervention. The study is being conducted by Dr. Danielle Wadsworth and Shelby Foote of the Auburn University's School of Kinesiology. Since your child is age 18 or younger we must have your permission to include him/her in the study.

Requirements: (1) Children must be between the ages of 5-10 (2) At least one child in the family must be considered overweight or obese (BMI > 85th percentile) (3) One parent must be willing to participate (4) Parent must not be active (5) Healthy as determined by the Physical Activity Readiness Questionnaire for children on the behalf of their child and (6) Not currently taking any medications that would affect ability to exercise safely. Your child was selected as a possible participant because he/she is between the ages of 5-10, has a BMI over the 85th percentile or is a sibling of a child participating in the study.

Time commitment for participation in this study will be approximately 12-18 hours. Lab training time will last 12 weeks with follow-up 3 months later.

The Auburn University Institutional Review Board has approved this Document for use from
__08/24/2016__ to __08/23/2017__
Protocol # __16-306 MR 1608__

301 Wire Rd., Auburn, AL 36849-5323; Telephone: 334-844-4483; Fax: 334-844-1467

www.auburn.edu

What will be involved if your child participates?

Day 1: On the first visit to the lab, you will complete the PARQ C on the behalf of your child. Your child will complete the following: measured for height and weight, wear a *MOVBAND* activity tracker on the wrist, measured for body composition by scan (iDEXA), complete four questionnaires, complete the FITNESSGRAM Fitness Test, and complete a brief interview. An iDEXA (dual-energy x-ray absorptiometry) scan is similar to an x-ray, in which you will be asked to lie on a cushioned table while the scanner scans the length of your body. The MOVBAND activity tracker is worn on the wrist to measure physical activity throughout the day. The MOVBAND is a watch that tracks the physical activity your child accumulates throughout the day and displays this activity as “moves”. After that you and your child can view how many “moves” are accumulated each day. Your child will also complete a set of questionnaires that identifies how motivated your child is to participate in physical activity. Parents will be asked to identify their child’s current puberty status by looking at a pictorial scale. Your child will be interviewed to understand their views about physical activity. Finally, your child will complete the FITNESSGRAM Fitness test, which consists of short sprints, sit-ups and push-ups.

The estimated time for participation in this visit is approximately 60-90 minutes.

Week 1 – Sessions will take place on Thursdays during your scheduled time. This time is flexible and can be changed from week to week. Parents and children will be in separate sessions for the first 20-30 minutes of this weekly visit. The following 30-40 minutes, children and parents together will be introduced to self-regulation logs, the development of their first “action plan”, and a briefing on recommendations for the week. Movbands from all participants will be downloaded and charged.

- **Child exercise sessions (~20-30 minutes):** Children will participate in physical activity targeted at improving fundamental movement skills. All child sessions will be led and monitored by Auburn University graduate and undergraduate students in the Kinesiology building.

  Total estimated time commitment for first week is 60-90 minutes.

Weeks 2 – 11: Sessions will meet weekly on Thursdays during your scheduled time. Parents and children will be in separate, concurrently run exercise sessions for the first 40 minutes of each weekly visit. Details of this part of the session are below. The following 20-30 minutes, children and parents together will watch a brief presentation on various types of health education, review self-regulation logs and “action plans” from the previous week, and revise and create new goals with either Dr. Wadsworth or Shelby Foote. MOVbands from all participants will be taken for downloading and charging and returned at the end of the session. Throughout the remainder of the week, parents will be sent 2 reminder text messages on recommendations and principles talked about during the session.

- **Child exercise sessions (~40 minutes):** Children will participate in physical activity targeted at improving fundamental movement skills.

  Total estimated time commitment for each weekly visit is 60-90 minutes.

Post Testing – Week 12 – On this visit, children will be asked to complete iDEXA body composition scan; the self-efficacy, perceived competence, motivation questionnaires; and a semi-structured interview with either Dr. Wadsworth or Shelby Foote.

Total time commitment for lab participation = 12 weeks – between 12 and 18 hours

Retention measures – Week 24– There will be follow-up testing, where you will be asked to you to return to the lab and your child will complete the same measures completed in during week 12 testing. All participants will receive all of their results.

Total estimated time commitment for this visit is 60-90 minutes.

Potential Risks:

1. While performing any exercise there is a chance of muscle strains, sprains, pulls, and even death. The American College of Sports Medicine estimates the risk of sudden cardiac death 1 per 36.5 million hours of exertion.
2. There is a small amount of radiation from the iDexa (equal to walking outside in the sun for 10- 15 minutes).

"Note" It is important for you to realize that you are responsible for any costs incurred in the event of an injury.

Precautions:
1. We have employed the use of a PARQ and PARQ-C to assist in eliminating participants that have potential medical or orthopedic identified risks. During the trials you will always be accompanied by researchers who maintain current CPR Certifications.
2. After each exercise bout you will be monitored and be given a chance to cool-down.
3. Proper techniques, volume and intensity manipulation, and spotting will be employed to decrease the risk of injury during all exercise sessions.
4. Should an emergency arise, we will call 911 and follow our emergency action plan. You are responsible for any cost associated with medical treatment.
5. Standardized procedures will be followed for all testing, including the iDexa.

Benefits: If your child participates in this study, they will receive 10 weeks of organized and supervised exercise sessions and health education planning sessions, along with assessments including body composition, physical activity, and physical fitness information.

If you (or your child) change your mind about your child's participation, your child can be withdrawn from the study at any time. Your child's participation is completely voluntary. If you choose to withdraw your child, your child's data can also be withdrawn if it is identifiable. Your decision about whether or not to allow your child to participate or to stop participating will not jeopardize you or your child's future relations with Auburn University or the School of Kinesiology.

Your child's privacy will be protected. Any information obtained in connection with this study will remain confidential. The data collected will be protected by Shelby Foote and Dr. Wadsworth. Information obtained through your child's participation may be used to be published in a professional journal or presented at a professional meeting. However, all these data will be presented as aggregate and no individual scores will be used.

If you (or your child) have questions about this study, please ask them now or contact Shelby Foote (334-844-1836 or sjm0011@auburn.edu) or Dr. Wadsworth (wadswdd@auburn.edu). A copy of this document will be given to you to keep.

If you have questions about your child's rights as a research participant, you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH FOR YOUR SON OR DAUGHTER TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO ALLOW HIM OR HER TO PARTICIPATE.

______________________________	____________________________________
Parent/Guardian Signature Date	Investigator obtaining consent Date
______________________________	_Danielle D. Wadsworth_____________
Printed Name	Printed Name
__________________________	
Child's Name	

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Protocol # __16-306 MR 1608__

AUBURN UNIVERSITY

COLLEGE OF EDUCATION

School of Kinesiology

Informed Consent for a Research Study Entitled

"The Effect of the Family Structure on Child Physical Activity Within a Fitness Intervention: A Theoretical Approach"

Project Overview: You are invited to participate in a research study that will examine the effect of the family structure on parent and child physical activity levels and changes in children's fitness. We are recruiting participants to complete a 12-week study with a follow-up three months later. Participants will participate in structured exercise sessions and education sessions. We will also be investigating the exercise adherence and behaviors related to the participation in a family-based fitness intervention.

Purpose: The purpose of this intervention is to assess the effect of parental implementation of structure within the home on child's feelings of competence, autonomy, and self-efficacy and its effect on child physical activity behavior.

Participation Requirements: To be eligible, you must be:

1. A parent of a participating child
2. Must identify as sedentary (defined as engaging in structured exercise no more than 1 day per week)
3. Low risk for medical complications (as determined by physical activity readiness questionnaire (PARQ)).
4. Currently not taking any medications that will increase the risk of participation, or interfere with testing variables. Note that taking certain medications may cause you to be excluded from participation in this study including those that cause increases in heart rate, or other drugs that may increase the risk of participation

You must meet all of the requirements to be eligible for participation in this study.

Time commitment for participation in this study will be approximately 12-18 hours. Lab training time will last 12 weeks with follow-up 3 months later.

301 Wire Rd., Auburn, AL 36849-5323; Telephone: 334-844-4483; Fax: 334-844-1467
www.auburn.edu

Day 1: On the first visit to the lab, you will complete the PARQ Questionnaire and a PARQ C on the behalf of your child, complete the demographics information, self-efficacy, perceived competence, and motivation questionnaire, and read and sign the University-approved informed consent form. The PARQ and PARQ-C are designed to identify any underlying medical issues that could be a threat to your safety in participating in an exercise program. If you answer, "YES" to any question on the PARQ or PARQ-C, this indicates that you could have a medical condition that could affect your ability to safely participate in exercise. Therefore, if you answer "YES" to any question, you will be unable to participate in the study.

Dr. Danielle Wadsworth or Mrs. Shelby Foote will be present for all informed consent briefings. If ineligible for participation for any reason (participation requirements or PAR-Q) all forms will be returned to the subject and no record will be kept by the researchers.

Descriptive data will be obtained [age, height, weight, and iDEXA (body composition)]. You will then be familiarized with your activity tracker, or MOVband.

The estimated time for participation in this visit is approximately 60-90 minutes.

Week 1 – Sessions will take place on Thursdays during your scheduled time. This time is flexible and can be changed from week to week. Parents and children will be in separate sessions for the first 20-30 minutes of this weekly visit. Details of this part of the session are below. The following 30-40 minutes, children and parents together will be introduced to self-regulation logs, the development of their first "action plan", and a briefing on recommendations for the week. Movbands from all participants will be downloaded and charged.

- **Child exercise sessions (~20-30 minutes):** Children will participate in physical activity targeted at improving fundamental movement skills. All child sessions will be led and monitored by Auburn University graduate and undergraduate students in the Kinesiology building.
- **Parent exercise sessions (~20-30 minutes):** Parents will participate in an exercise session aimed at gradually improving fitness and introducing exercise that can be done at home. All sessions will be led and monitored by Auburn University graduate and undergraduate students in the Kinesiology building.
-

Total estimated time commitment for first week is 60-90 minutes.

Weeks 2 – 11: Sessions will meet weekly on Thursdays during your scheduled time. Parents and children will be in separate, concurrently run exercise sessions for the first 40 minutes of each weekly visit. Details of this part of the session are below. The following 20-30 minutes, children and parents together will watch a brief presentation on various types of health education, review self-regulation logs and "action plans" from the previous week, and revise and create new goals with either Dr. Wadsworth or Shelby Foote. MOVbands from all participants will be taken for downloading and charging and returned at the end of the session. Throughout the remainder of the week, parents will be sent 2 reminder text messages on recommendations and principles talked about during the session.

- **Child exercise sessions (~40 minutes)**: Children will participate in physical activity targeted at improving fundamental movement skills.
- **Parent exercise sessions (~40 minutes)**: Cardiovascular and resistance training exercises based on needs assessments and resources for implementation outside of the intervention.

Total estimated time commitment for each weekly visit is 60-90 minutes.

Post Testing –Week 12 – On this visit, Parents will be asked to complete DEXA body composition scan; the self-efficacy, perceived competence, motivation questionnaires; and a semi-structured interview with either Dr. Wadsworth or Shelby Foote.

Total time commitment for lab participation = 12 weeks – between 12 and 18 hours

Retention measures – Week 24– There will be follow-up testing, where you will be asked to you to return to the lab and complete the same measures completed in during week 12 testing. All participants will receive all of their results.

Total estimated time commitment for this visit is 60-90 minutes.

Potential Risks:

1. While performing any exercise there is a chance of muscle strains, sprains, pulls, and even death. The American College of Sports Medicine estimates the risk of sudden cardiac death 1 per 36.5 million hours of exertion.
2. There is a small amount of radiation from the iDexa (equal to walking outside in the sun for 10-15 minutes).

"Note" It is important for you to realize that you are responsible for any costs incurred in the event of an injury.

Precautions:

1. We have employed the use of a PARQ and PARQ-C to assist in eliminating participants that have potential medical or orthopedic identified risks. During the trials you will always be accompanied by researchers who maintain current CPR Certifications.
2. After each exercise bout you will be monitored and be given a chance to cool-down.
3. Proper techniques, volume and intensity manipulation, and spotting will be employed to decrease the risk of injury during all exercise sessions.
4. Should an emergency arise, we will call 911 and follow our emergency action plan. You are responsible for any cost associated with medical treatment.
5. Standardized procedures will be followed for all testing, including the iDexa.

Benefits: You will receive 10 weeks of organized and supervised exercise sessions and health education planning sessions, along with assessments including body composition, physical activity, and physical fitness information. Health education planning sessions will consist of information provided to you by Shelby Foote and/or Dr. Danielle Wadsworth about planning and goal-setting methods to help your family achieve more exercise outside of the study. At the conclusion of the study, Shelby Foote or Dr. Danielle Wadsworth will provide you with a health report that includes changes in child fitness scores from the FITNESSGRAM and child and parent body composition from DEXA. We will not provide medical referrals based on your information.

Your participation is completely voluntary. If you change your mind about participating, you can withdraw at any time during the study. If you choose to withdraw, you can request to have your data withdrawn if it is identifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, the Department of Kinesiology, or any of the researchers.

Your privacy will be protected. Any information obtained in connection with this study will remain anonymous.

If you have any questions, we invite you to ask us now. If you have questions later, you can contact Danielle D. Wadsworth (wadswdd@auburn.edu) or Shelby Foote (sjm0011@auburn.edu), or call 334- 844-1836. You will be provided with a copy of this document for your records. For more information regarding your rights as a research participant, you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board phone number (334) 844-5966 or email at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMTION PROVIDED, YOU MUST DECIDE WHETHER OR NOT
YOU WISH TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATED YOUR WILLINGNESS TO PARTICIPATE.

Participant's signature	Printed Name	Date
______________________________	____________________________	_______
Investigator obtaining consent	Printed Name	Date
______________________________	____________________________	_______
Co-Investigator	Printed Name	Date
______________________________	____________________________	_______

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APPENDIX B: FLYER

The Auburn University Institutional Review Board has approved this Document for use from 08/24/2016 to 08/23/2017
Protocol # 16-306 MR 1608

Fam-tastically FIT

Families who have at least one child with a BMI greater than the 85th percentile and at least one parent willing to participate are encouraged to join.

~ Program Criteria ~

...Children between the ages of 5-10, with at least one child with a BMI over the 85th percentile
...A least one parent willing to participate that does not exercise more than 1 day per week

Families will...

...come to lab one week night per week for 12 weeks

...participate in once weekly exercise and health education sessions

...be provided with an "action plan" to help your family be more physically active during the week

..be given a wrist worn activity tracker for the duration of the study

Fam-tastically FIT is a study to determine the effects of a Family Fitness intervention on children's physical activity

This project is being conducted by The Exericse Adherence and Motivation lab beginning August 2016

Please contact us!
Shelby Foote
sjm0011@auburn.edu

MOVEMENT. HEALTH. PERFORMANCE.

APPENDIX C: SURVEYS AND QUESTIONNAIRES

Appendix C

PRE-TEST QUESTIONNAIRE
(PAR-Q)

NAME ………………………………….   Ref. No. ……………

Date of Birth ……………………………   Age:…………

As you are to be a subject in this laboratory/project, would you please complete the following questionnaire. Your cooperation in this is greatly appreciated.

Please tick appropriate box

	YES	NO
Has the test procedure been fully explained to you?	☐	☐

Any information contained herein will be treated as confidential

		YES	NO
1.	Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?	☐	☐
2.	Do you feel pain in your chest when you do physical activity?	☐	☐
3.	In the past month, have you had chest pain when you were not doing physical activity?	☐	☐
4.	Do you lose your balance because of dizziness or do you ever lose consciousness?	☐	☐
5.	Do you have a bone or joint problem that could be made worse by a change in your physical activity?	☐	☐
6.	Is your doctor currently prescribing drugs for your blood pressure or heart condition?	☐	☐

7. Do you know of any other reasons why you should not undergo physical activity? This might include severe asthma, diabetes, a recent sports injury, or serious illness. ☐ ☐

8. Have you any blood disorders or infectious diseases that may prevent you from providing blood for experimental procedures? ☐ ☐

9. Are you currently pregnant? ☐ ☐

- If you have answered **NO** to <u>all</u> questions then you can be reasonably sure that you can take part in the physical activity requirement of the test procedure

I ………………………………. declare that the above information is correct at the time of completing this questionnaire Date ……/……/…….

Please Note: If your health changes so that you can then answer YES to any of the above questions, tell the experimenter/laboratory supervisor. Consult with your doctor regarding the level of physical activity you can conduct.

- If you have answered **YES** to one or more questions:
  Talk with your doctor in person discussing with him/her those questions you answered yes.
  Ask your doctor if you are able to conduct the physical activity requirements.

Doctor's signature …………………………….………… Date ……/……/…….

Signature of Experimenter……………………………….. Date ……/……/…….

PRE-TEST QUESTIONNAIRE

(PARQ-C)

Completed by a Parent/Guardian of Child

NAME OF CHILD ……………………………………………………………………………..

CHILD DATE OF BIRTH ……………………………   CHILD'S AGE: ………………..

As your child is to be a participant in this project, would you please complete the following physical activity readiness questionnaire for your child.

Please tick appropriate box

	YES	**NO**
Has the test procedure(s) that your child will participate in been fully explained to you?	☐	☐

Any information contained herein will be treated as confidential

		YES	**NO**
1.	Has your doctor ever said that your child has a heart condition and that your child should only do physical activity recommended by a doctor?	☐	☐
2.	Does your child ever experience chest pain during physical activity?	☐	☐
3.	Does your child ever lose balance because of dizziness or do they ever lose consciousness?	☐	☐
4.	Does your child have a bone or joint problem that could be made worse by a change in their physical activity participation?	☐	☐
5.	Does your child have uncontrolled asthma (i.e. asthma that is not easily controlled by an inhaler?	☐	☐
6.	Is your doctor currently prescribing any medication for your child's blood pressure or a heart condition?	☐	☐

7. Do you know of any other reasons why your child should not undergo physical activity? This might include diabetes, pregnancy, a recent injury, or serious illness. □ □

If you have answered **NO** to all questions then you can be reasonably sure that your child can take part in the physical activity requirement of this project.

I ………………………………. declare that the above information is correct at the time of completing this questionnaire on date ……/……/…….

Please note: If your child's health changes so that you can answer YES to any of the above questions, notify the investigators and consult with your doctor regarding the level of physical activity that your child can participate in.

If you answered YES to one or more questions:

Talk to your doctor in person discussing with him/her those questions you answered yes.

Ask your doctor if your child is able to participate in the physical activity requirements of the project.

Doctor's Name…. ……………………………. Date …………………………..

Doctor's Signature ……………………………..

Signature of Investigator ………………………… Date …………………………..

Demographic Information

Participant id________

Age________ Gender (circle one): M F Email Address_____________________

Cellphone number_________________ Cellphone service provider_____________

Marital Status (circle one): Single Married Divorced

Ethnicity__________________________

Number of Children_______________

Number of Children participating in study_____________

Highest educational degree completed_______________________________________

If married, highest educational degree your spouse has

completed____

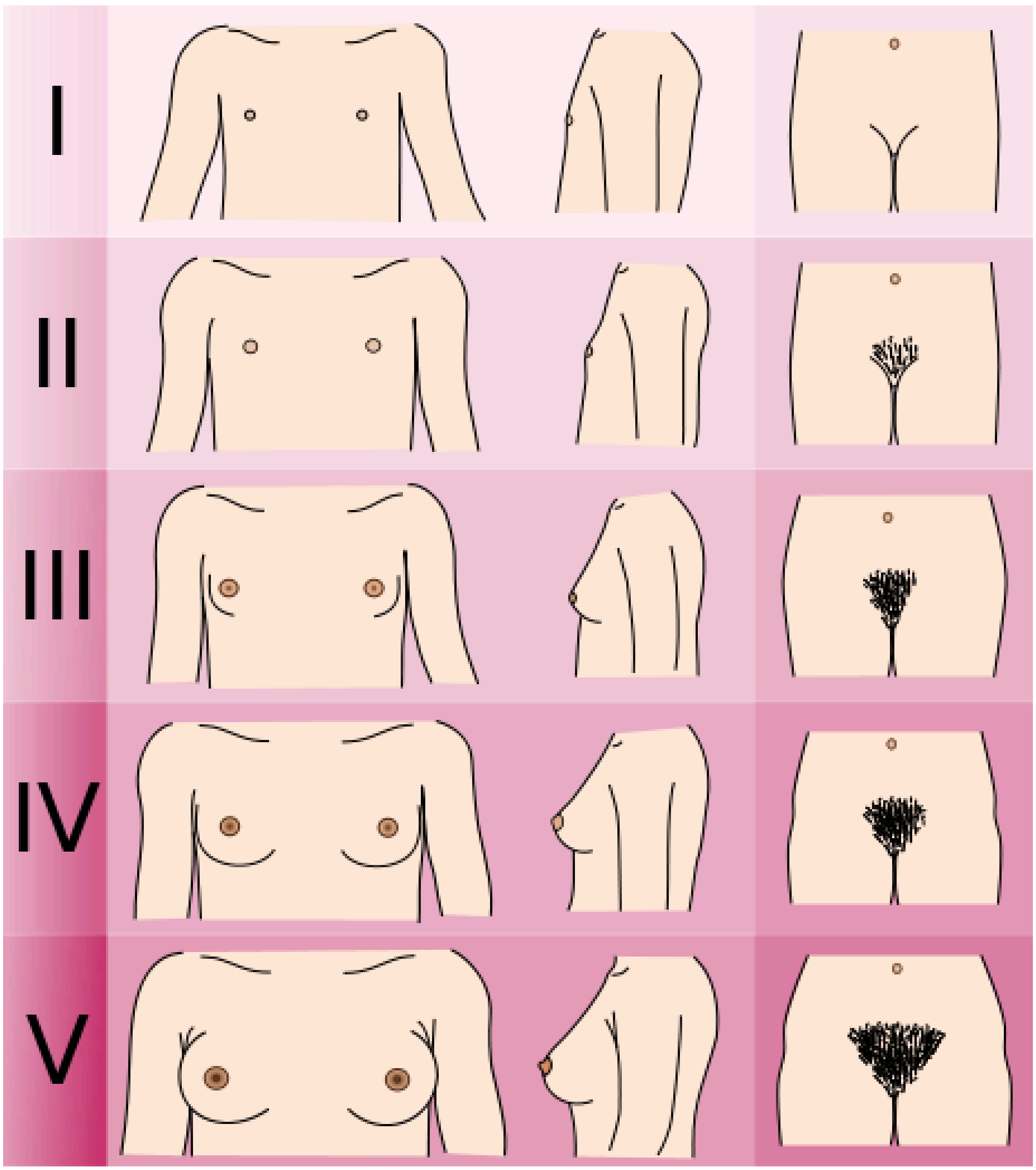
Employment Status (circle one): Unemployed Full-time Part-time

Other____________________

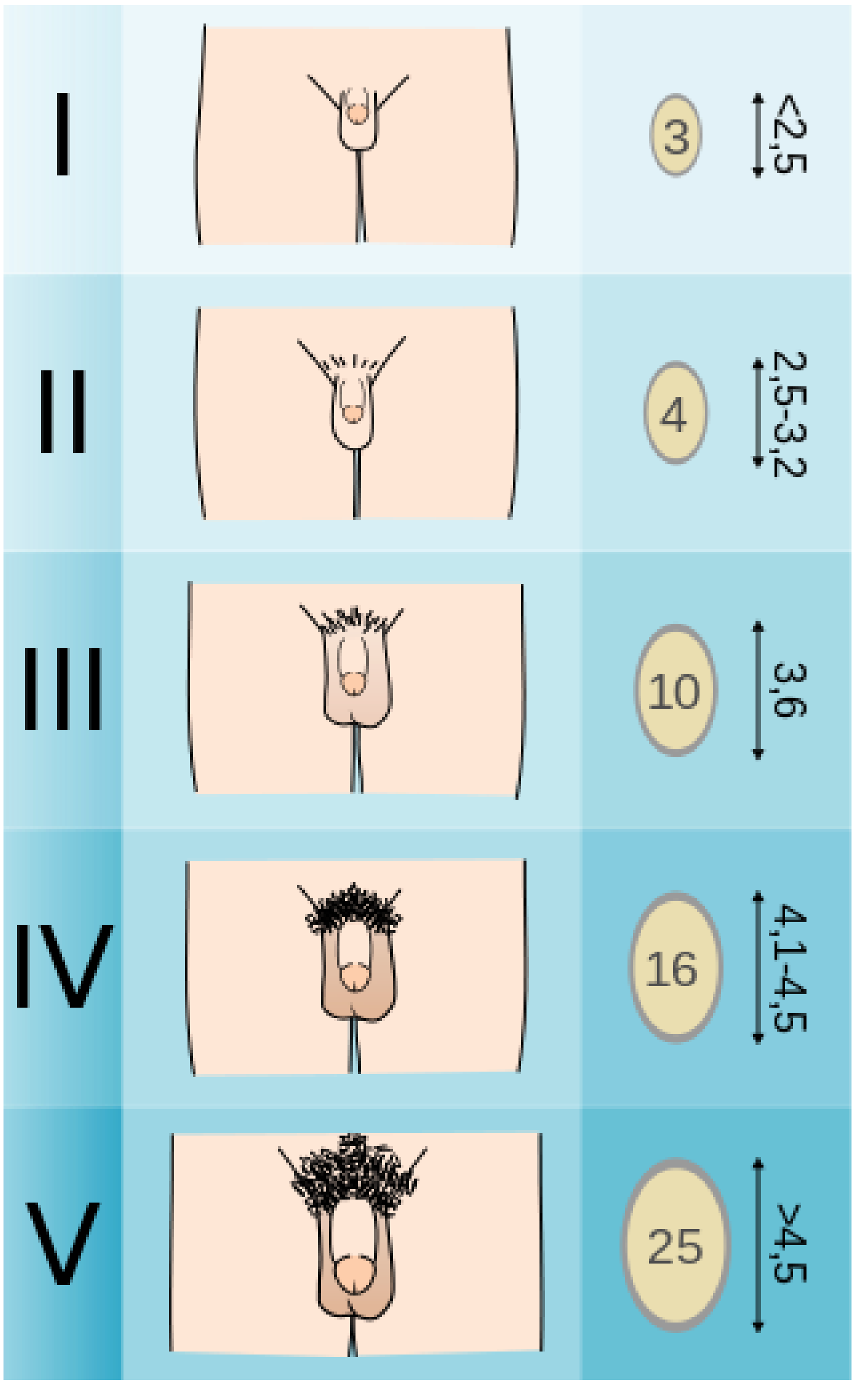
Hours you work per week__________________

Type of work that you do?____

Tanner Stage Scale
(Females)



Tanner Stage Scale
(males)



FITNESSGRAM Fitness test for children over the age of 5

Cardiovascular: Pacer Test

PACER

➩ *Recommended*

The PACER (Progressive Aerobic Cardiovascular Endurance Run) is the default aerobic capacity test in *FITNESSGRAM*. The PACER is a multistage fitness test adapted from the 20-meter shuttle run test published by Leger and Lambert (1982) and revised in 1988 (Leger et al.). The test is progressive in intensity—it is easy at the beginning and gets more difficult at the end. The progressive nature of the test provides a built-in warm-up and helps children to pace themselves. The test has also been set to music to create a valid, fun alternative to the customary distance run test for measuring aerobic capacity. Information on obtaining the music CD can be found in appendix A on page 85.

The PACER is recommended for all ages, but its use is strongly recommended for participants in grades K-3. The PACER is recommended for a number of reasons, including the following:

- All students are more likely to have a positive experience in performing the PACER.
- The PACER helps students learn the skill of pacing.
- Students who have a poorer performance will finish first and not be subjected to the embarrassment of being the last person to complete the test.

When you are administering the test to these younger children, the emphasis should be on allowing the children to have a good time while learning how to take this test and pace themselves. Allow children to continue to run as long as they wish and as long as they are still enjoying the activity. The main goal for young children is to allow them the opportunity to experience the assessment and to enjoy it.

Test Objective

The objective is to run as long as possible with continuous movement back and forth across a 20-meter space at a specified pace that gets faster each minute. A 15-meter version of the PACER test has been developed for teachers with smaller-sized facilities. To enter 15-meter scores into the 8.x software, a conversion chart is available on page 98. The music CD is now available.

Equipment and Facilities

Administering the PACER requires a flat, nonslip surface at least 20 meters long, CD or cassette player with adequate volume, CD or audiocassette, measuring tape, marker cones, pencil, and copies of score sheet A or B (found in appendix B). Students should wear shoes with nonslip soles. Plan for each student to have a 40- to 60-inch-wide space for running. An outdoor area can be used for this test if you do not have adequate indoor space. There should be a designated area for runners who have finished and for scorekeepers. You may want to paint lines or draw chalk lines to assist students in running in a straight line.

Note: Because many gyms are not 20 meters in length, an alternative 15-meter PACER test CD is now available. The procedures described as follows are the same for the 15-meter distance, but an alternative CD and scoring sheet are required for tracking the number of laps. To enter 15-meter scores into the 8.0 software, a conversion chart is available on page 98. The music CD is now available. The 15-meter PACER test is for use only in elementary schools.

Test Instructions

- Mark the 20-meter (21-yard, 32-inch) course with marker cones to divide lanes and use a tape or chalk line at each end.
- Make copies of score sheet A or B for each group of students to be tested.
- Before test day, allow students to listen to several minutes of the tape so that they know what to expect. Students should then be allowed at least two practice sessions.
- Allow students to select a partner. Have students who are being tested line up behind the start line.
- The individual PACER CDs have two music versions: one with only the beeps and one with the cadences for the push-up and curl-up tests. Each version of the test will give a 5-second countdown and tell the students when to start.
- Each student being tested should run across the 20-meter distance and touch the line with a foot by the time the beep sounds. The student should take full weight on the foot that is touching the line. At the sound of the beep, the student turns around and runs back to the other end. If some students get to the line before the beep, they must wait for the beep before running the other direction. Students continue in this manner until they fail to reach the line before the beep for the second time. A diagram of the PACER test is on page 31.

- A single beep will sound at the end of the time for each lap. A triple beep sounds at the end of each minute. The triple beep serves the same function as the single beep and also alerts the runners that the pace will get faster. Inform students that when the triple beep sounds, they should not stop but should continue the test by turning and running toward the other end of the area.
- Scoring the PACER will require the input of each student's height and weight. Calculation of aerobic capacity requires a score of at least 10 laps (20-meter version).

When to Stop

The first time a student does not reach the line by the time of the beep, the student stops where he or she is and reverses direction immediately, attempting to get back on pace. The test is completed for a student the next time (second time) he or she fails to reach the line by the time of the beep (the two misses do not have to be consecutive; the test is over after two total misses). Students just completing the test should continue to walk and stretch in the designated cool-down area. Figure 5.1 provides diagrams of testing procedures.

Note: A student who remains at one end of the testing area through two beeps (does not run to the other end and back) should be scored as having two misses and the test is over.

Scoring

In the PACER test, a lap is one 20-meter distance (from one end to the other). The scorer records the lap number (crossing off each lap number) on a PACER score sheet (samples provided in appendix B). The recorded score is the total number of laps completed by the student. For ease in administration, it is permissible to count the first miss (not making the line by the time of the beep). It is important to be consistent with all of the students and classes in the method used for counting.

An alternative scoring method is available. This method does not eliminate students when they miss their second beep (Schiemer, 1996). Using the PACER score sheet B, establish two different symbols to be used in recording, such as a star for making the line by the time of the beep and a triangle for not making the line. The scorer then draws a star in the circle when the runner makes the line by the time of the beep and a triangle when the runner fails to make the line by the time of the beep, simply making a record of what occurs. The runners can continue to participate until the leader stops the music or until they voluntarily stop running. To determine the score, find the second triangle (or whatever symbol was used). The number associated with the preceding star is the score. An example is provided in figure 5.2.

Regardless of the method, the scoring of the PACER test is based on the number of laps completed. Therefore, the laps have to be directly entered into the software. It is important to count each individual 15-meter or 20-meter distance as a lap (rather than based on a down-and-back count for the laps). The software will use the number of laps completed along with the child's age to estimate aerobic capacity, and this will be used to generate individualized feedback on the reports.

Criterion standards are not available for students in grades K-3. The object of the test for these younger students is simply to have them participate in the testing process and to complete as many laps as possible. The main goal is to provide the students with the opportunity to experience the PACER and to have a positive experience with the assessment. Nine-year-olds in grade 4 will receive a score, and it will be evaluated against a criterion standard. All 10-year-old students receive a score regardless of grade level.

Suggestions for Test Administration

- Both PACER CDs contain 21 levels (1 level per minute for 21 minutes). During the first minute, the 20-meter version allows 9 seconds to run the distance; the 15-meter version allows 6.75 seconds. The lap time decreases by approximately half a second at each successive level. Make certain that students have practiced and understand that the speed will increase each minute.
- A single beep indicates the end of a lap (one 20-meter distance). The students run from one end to the other between each beep. Caution students not to begin too fast. The beginning speed is very slow. Nine seconds is allowed for running each 20-meter lap during the first minute.

- Triple beeps at the end of each minute indicate the end of a level and an increase in speed. Students should be alerted that the speed will increase. When students hear the triple beeps they should turn around at the line and immediately continue running. Some students have a tendency to hesitate when they hear the triple beeps.
- A student who cannot reach the line when the beep sounds should be given one more chance to regain the pace. The second time a student cannot reach the line by the time of the beep, his or her test is completed.
- Groups of students may be tested at one time. Adult volunteers may be asked to help record scores. Students may record scores for each other or for younger students.
- Each runner must be allowed a path 40 to 60 inches wide. It may work best to mark the course.
- If using the audiotape, you may save time by using two tapes and two cassette players. Rewind the first tape while the second group is running the tests, and so forth. Using the CD is a much more efficient method for administering this test item.

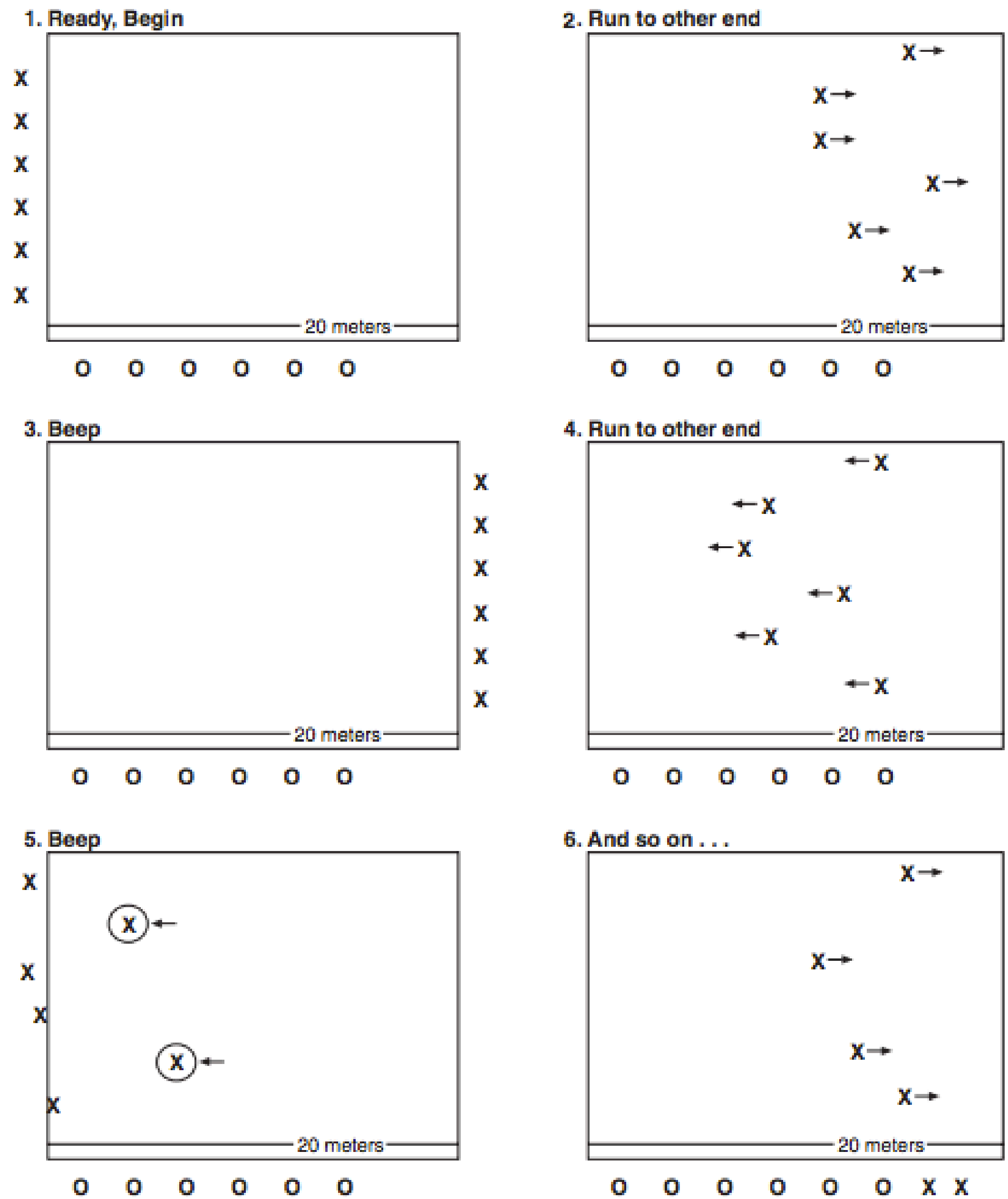


FIGURE 5.1 Schematic diagram of PACER test.

Muscle Strength and Endurance:

Curl-Up

➪ *Recommended*

This section provides information on the curl-up assessment used in *FITNESSGRAM*. The curl-up with knees flexed and feet unanchored has been selected because individually these elements have been shown to a) decrease movement of the fifth lumbar vertebra over the sacral vertebrae, b) minimize the activation of the hip flexors, c) increase the activation of the external and internal obliques and transverse abdominals, and d) maximize abdominal muscle activation of the lower and upper rectus abdominals relative to disc compression (load) when compared with a variety of sit-ups.

Few results are available on the consistency and accuracy of the curl-up. Reliability is higher for college students than for children but the values are acceptable for this type of assessment. Determination of validity has been hampered by the lack of an established criterion measure. Anatomical analysis and electromyographical documentation provide the primary support for the use of the curl-up test to determine abdominal strength and endurance.

Test Objective

To complete as many curl-ups as possible up to a maximum of 75 at a specified pace.

Equipment and Facilities

Gym mats and a measuring strip for every two students are needed. The measuring strip may be made of cardboard, rubber, smooth wood, or any similar thin, flat material and should be 30 to 35 inches long. Two widths of measuring strip may be needed. The narrower strip should be 3 inches wide and is used to test 5- to 9-year-olds; for older students the strip should be 4.5 inches wide. Other methods of measuring distance such as using tape strips and pencils are suggested in appendix A.

Test Instructions

Allow students to select a partner. Partner A will perform the curl-ups while partner B counts and watches for form errors.

Partner A lies in a supine position on the mat, knees bent at an angle of approximately 140°, feet flat on the floor, legs slightly apart, arms straight and parallel to the trunk with palms of hands resting on the mat. The fingers are stretched out and the head is in contact with the mat. Make sure students have extended their feet as far as possible from the buttocks while still allowing feet to remain flat on floor. The closer the feet are positioned in relation to the buttocks, the more difficult the movement.

After partner A has assumed the correct position on the mat, partner B places a measuring strip on the mat under partner A's legs so that partner A's fingertips are just resting on the nearest edge of the measuring strip (photo 7.1). Partner B then kneels down at partner A's head in a position to count curl-ups and watch for form breaks. Partner B places a piece of paper under partner A's head. The paper will assist partner B in judging if partner A's head touches down on each repetition (photo 7.2). The observer should watch for the paper to crinkle each time partner A touches it with his or her head.

Before beginning the curl-up, it is a good practice for partner B to pull on partner A's hands to ensure that the shoulders are relaxed and in a normal resting position. If partner A is allowed to hunch

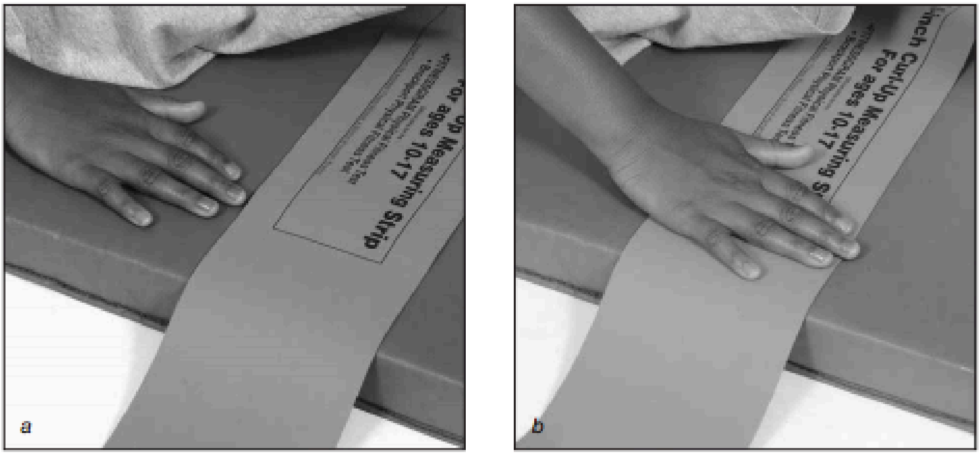


PHOTO 7.3 Close-up of the fingertips sliding: *(a)* starting position and *(b)* ending position.

the shoulders before beginning the test, he or she may be able to get the fingertips to the other side of the testing strip by merely moving the arms and shoulders up and down. Keeping heels in contact with the mat, partner A curls up slowly, sliding fingers across the measuring strip until fingertips reach the other side (photo 7.3, *a* and *b*); then partner A curls back down until his or her head touches the piece of paper on the mat. Movement should be slow and gauged to the specified cadence of about 20 curl-ups per minute (1 curl every 3 seconds). The teacher should call a cadence or use a prerecorded cadence. A recorded cadence may be found on the PACER music tape or CD. Partner A continues without pausing until he or she can no longer continue or has completed 75 curl-ups.

When to Stop

Students are stopped after completing 75 curl-ups, when the **second** form correction is made, or when they can no longer continue.

Form Corrections

- Heels must remain in contact with the mat.
- Head must return to the mat on each repetition.
- Pauses and rest periods are not allowed. The movement should be continuous and with the cadence.
- Fingertips must touch the far side of the measuring strip.

Scoring

The score is the number of curl-ups performed. Curl-ups should be counted when the student's head returns to the mat. For ease in administration, it is permissible to count the first incorrect curl-up. It is important to be consistent with all of the students and classes when determining whether or not you will count the first incorrect curl-up.

Suggestions for Test Administration

- The student being tested should reposition if the body moves so that the head does not contact the mat at the appropriate spot or if the measuring strip is out of position.
- Movement should start with a flattening of the lower back followed by a slow curling of the upper spine.
- The hands should slide across the measuring strip until the fingertips reach the opposite side (3 or 4.5 inches) and then return to the supine position. The movement is completed when the back of the head touches the paper placed on mat.
- The cadence will encourage a steady, continuous movement done in the correct form.
- Students should not forcibly "reach" with their arms and hands but simply let the arms passively move along the floor in response to the action of the trunk and shoulders. Any jerking, kipping, or reaching motion will cause the students to constantly move out of position. When students first begin to use this test item, many will want to "reach" with their arms and hands, especially if they have previously done a timed sit-up test.
- This curl-up protocol is quite different from the one-minute sit-up. **Students will need to learn how to correctly perform this curl-up movement and be allowed time to practice.**

90° Push-Up

⇨ *Recommended*

The 90° push-up to an elbow angle of 90° is the recommended test for upper body strength and endurance. Test administration requires little or no equipment; multiple students may be tested at one time; and few zero scores result. This test also teaches students an activity that can be used throughout life as a conditioning activity as well as in self-testing.

The 90° push-up has generally been shown to produce consistent scores but reliability depends on how it is administered. Lower values have been reported for elementary aged students using partners to count the repetitions. Objectivity, or the ability of different observers to attain the same results, is a factor in this item because of the necessity of judging the 90° angle. Scores from student partners are consistently higher than adult counts because students tend to simply count each attempted 90° push-up and not evaluate whether it was done correctly. As with several of the other neuromuscular fitness items, determining the accuracy of the 90° push-up as a test of upper body strength and endurance is made difficult by the lack of an agreed upon criterion measure. Specific validation data are available for the 90° push-up in only two studies conducted on college age students. Validity coefficients against a 1-RM bench press were the highest when the criterion test was the number of repetitions (endurance) at an absolute, but sex-specific, load.

Before test day, students should be allowed to practice doing 90° push-ups and watching their partner do them. Teachers should make a concerted effort during these practice sessions to correct students who are not achieving the 90° angle. In this manner all students will gain greater skill in knowing what 90° "feels like" and "looks like."

Test Objective

To complete as many 90° push-ups as possible at a rhythmic pace. This test item is used for males and females.

Equipment and Facilities

The only equipment necessary is an audiotape with the recorded cadence. The correct cadence is 20 90° push-ups per minute (1 90° push-up every 3 seconds). The PACER test CD or tape contains a recorded 90° push-up cadence. The 90° push-up may be performed on a mat. Squares of cardboard or anything else that has a 90° angle may assist students in judging 90°.

Test Instructions

The students should be paired; one will perform the test while the other counts 90° push-ups and watches to see that the student being tested bends the elbow to 90° with the upper arm parallel to the floor.

The student being tested assumes a prone position on the mat with hands placed under or slightly wider than the shoulders, fingers stretched out, legs straight and slightly apart, and toes tucked under. The student pushes up off the mat with the arms until arms are straight, keeping the legs and back straight. The back should be kept in a straight line from head to toes throughout the test (photo 7.7). The student then lowers the body using the arms until the elbows bend at a 90° angle and the upper arms are parallel to the floor (photo 7.8). This movement is repeated as many times as possible. The student should push up and continue the movement until the arms are straight on each repetition. The rhythm should be approximately 20 90° push-ups per minute or 1 90° push-up every 3 seconds.

When to Stop

Students are stopped when the second form correction (mistake) is made. Only one form correction is allowed.

Form Corrections

- Stopping to rest or not maintaining a rhythmic pace
- Not achieving a 90° angle with the elbow on each repetition
- Not maintaining correct body position with a straight back
- Not extending arms fully

Scoring

The score is the number of 90° push-ups performed. For ease in administration, it is permissible to count the first incorrect 90° push-up. It is important to be consistent with all of the students and classes

PHOTO 7.7 Starting position for the 90° push-up test.

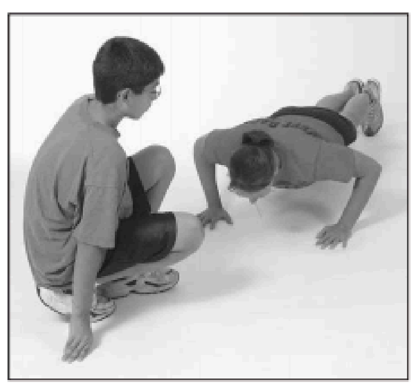


PHOTO 7.8 Student in the "down" position for the 90° push-up test.

when determining if you will count the first incorrect push-up.

Suggestions for Test Administration

- Test should be terminated if the student appears to be in extreme discomfort or pain.
- Cadence should be called or played on a prerecorded tape or CD.
- Males and females follow the same protocol.
- Find a short cone or other piece of pliable equipment that could be placed under the student's chest. The student must lower to the equipment in order for the 90° push-up to count. The size and height of the equipment that is used may vary depending on the age and size of your students.
- It may be helpful to make a recording with a voice-over that counts the number of 90° push-ups for the students (record the teacher counting over the cadence CD).

Participant id_________

Parental Self-Efficacy Questionnaire
(Adkins et al., 2004)

Please circle the answer you feel best reflects each question. Please only circle one answer per question.

The following questions are asking **How hard would it be to……**

1. Get your child/children to be physically active instead of watching TV?

Very hard *somewhat hard* *a little hard* *not hard at all*

2. Get your child/children to go on a walk with you?

Very hard *somewhat hard* *a little hard* *not hard at all*

3. Be physically active with your child/children each week?

Very hard *somewhat hard* *a little hard* *not hard at all*

4. Take your child/children to a park?

Very hard *somewhat hard* *a little hard* *not hard at all*

5. Go on a walk with your child/children?

Very hard *somewhat hard* *a little hard* *not hard at all*

Modified Parental Perceived Competence Scale
(Harter, 1985; Southall, 2004; modified adapted from Loprinzi et al., 2014)

Please circle the answer you feel best reflects each question. Please only circle one answer per question.

The following questions are asking, **"Compared to other children of the same age, my child…."**

1. **Does well at all kinds of sports and physical activities**

   strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

2. **Feels that they could be a lot better at sports**

   strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

3. **Does well at any new sports activity they haven't tried before**

   strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

4. **Does better than others at different sports and physical activities than others their age**

   strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

5. **Would rather watch other kids play games and sports instead of play**

   strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

6. **Does well at any new outdoor games**

   strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

7. **Does well at games or activities that involve kicking balls**

   strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

8. **Does well at games that involve catching balls**

   strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

9. **Is able to run fast, compared to others the same age**

   strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

10. Does well at games that involve overhand throwing

strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

11. Does well at games that involve underhand throwing

strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

12. Is able to jump far, compared to other the same age

strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

13. Is good at dribbling or bouncing balls

strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

14. Does well at games that involve striking (hitting) a ball

strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

15. Is able to gallop well, compared to others the same age

strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

16. Is able to leap far, compared to other the same age

strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

17. Is able to hop well, compared to other the same age

strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

18. Is able to side gallop well

strongly agree *somewhat agree* *somewhat disagree* *strongly disagree*

The Revised Sport Motivation Scale- Parents
(Pelletier et al., 2012)

Using the scale below, please indicate to what extent each of the following items corresponds to one of the reasons for which you are physically active.

Does not correspond at all		Corresponds a little		Corresponds moderately	Corresponds a lot	Corresponds exactly
1	**2**	**3**	**4**	**5**	**6**	**7**

WHY ARE YOU PHYSICALLY ACTIVE?

1. Because it gives me pleasure to learn more about being physically active and exercising	1	2	3	4	5	6	7
2. Because it is interesting to learn about how I can improve	1	2	3	4	5	6	7
3. Because I find it enjoyable to discover new ways to be physically active or exercise	1	2	3	4	5	6	7
4. Because being physically active or exercising is who I am	1	2	3	4	5	6	7
5. Because when being physically active, I am living in line with my deepest principles	1	2	3	4	5	6	7
6. Because being physically active is an integral part of my life	1	2	3	4	5	6	7
7. Because being physically active is one of the best ways I have chosen to develop other parts of myself	1	2	3	4	5	6	7
8. Because I have chosen to be physically active as a way to better develop myself	1	2	3	4	5	6	7

9. Because I have found that being physically active is a good way to develop other aspects of myself that I might value	1	2	3	4	5	6	7
10. Because I feel bad if I don't take the time to exercise or be physically active	1	2	3	4	5	6	7
11. Because I feel better about myself when I exercise or be physically active	1	2	3	4	5	6	7
12. Because I would not feel worthwhile if I did not exercise or be physically active	1	2	3	4	5	6	7
13. Because people I care about would be upset with me if I wasn't physically active	1	2	3	4	5	6	7
14. Because people around me reward me for exercising or being physically active	1	2	3	4	5	6	7
15. Because people around me would disapprove if I wasn't physically active	1	2	3	4	5	6	7
16. I used to have a good reason; now I'm asking myself if I should exercise or be physically active	1	2	3	4	5	6	7
17. I don't know anymore; I have the impression that I'm incapable of succeeding in being physically active or exercising	1	2	3	4	5	6	7
18. It's not clear to me anymore; I don't really think I have a place in exercising, sport, or being physically active	1	2	3	4	5	6	7

The Revised Sport Motivation Scale- Children
(Pelletier et al., 2012)

In this survey you have to read each sentence then decide which is the *most like you.* There are no wrong answers, so just take your time! If you have any questions, just ask!

Not like me at all		**A little like me**		**Somewhat like me**	**A lot like me**	**Exactly like me**
1	**2**	**3**	**4**	**5**	**6**	**7**

WHY ARE YOU PHYSICALLY ACTIVE?

	Not like me at all			Somewhat like me			Exactly like me
1. Because it makes me feel good to learn more about being physically active and exercising	1	2	3	4	5	6	7
2. Because it is interesting to learn about how I can get better	1	2	3	4	5	6	7
3. Because I have fun finding new ways to be physically active or exercise	1	2	3	4	5	6	7
4. Because being physically active or exercising is who I am	1	2	3	4	5	6	7
5. Because when being physically active, I am getting to do what I think is best	1	2	3	4	5	6	7
6. Because being physically active is an important part of my life	1	2	3	4	5	6	7
7. Because being physically active or exercising is the best way to get better at other things besides sports	1	2	3	4	5	6	7
8. Because I think when you exercise and are physically active you are making yourself better	1	2	3	4	5	6	7

9. Because when I exercise I get better at other things that are important to me	1	2	3	4	5	6	7
10. Because I feel bad if I don't exercise or be physically active	1	2	3	4	5	6	7
11. Because I feel better about myself when I exercise or be physically active	1	2	3	4	5	6	7
12. Because I would not feel good if I did not exercise or be physically active	1	2	3	4	5	6	7
13. Because people I care about would be upset with me if I wasn't physically active	1	2	3	4	5	6	7
14. Because people around me reward me for exercising or being physically active	1	2	3	4	5	6	7
15. Because people around me would not like it if I wasn't physically active	1	2	3	4	5	6	7
16. I used to exercise; now I don't know if I should exercise or not	1	2	3	4	5	6	7
17. I don't know if I want to exercise; I don't think I would be able to exercise or be physically active	1	2	3	4	5	6	7
18. I don't know if I should exercise; I don't feel like I fit in with the other kids who exercise or are physically active	1	2	3	4	5	6	7

Participant id_______

Revised Perceived Competence Scale for Children
Physical Subscale
(Harter, 1985)

In this survey you have to read each pair of sentence and then circle which answer is *the most like you*. For Example:

Some kids have one nose on their face   but   Other kids have three noses on their face

That shouldn't be too hard to decide! Once you have circled the sentence that is most like you, then you decide if its SORT OF TRUE or REALLY TRUE for you and put a checkmark ([ ] in the right box. Here is another example for you to try. Remember: first circle the sentence that is *most like you* than check off if it is SORT OF TRUE or REALLY TRUE for you.

Really True for me [ ]	Sort of True for Me [ ]	Some kids like to play with computers	But	Other kids don't like playing with computers	Sort of True for Me [ ]	Really True for me [ ]

Now you are ready to start filling in this form. Remember that there are no wrong answers; just what is *most like you*. Please put only 1 checkmark per question, and take your time! If you have questions, just ask!

Really True for me [ ]	Sort of True for Me [ ]	Some kids do very well at all kinds of sports	But	Other kids don't feel that they are very good when it comes to sports.	Sort of True for Me [ ]	Really True for me [ ]
Really True for me [ ]	Sort of True for Me [ ]	Some kids wish they could be a lot better at sports	But	Other kids feel they are good enough at sports	Sort of True for Me [ ]	Really True for me [ ]
Really True for me [ ]	Sort of True for Me [ ]	Some kids think they could do well at just about any new sports activity they haven't tried before	But	Other kids are afraid they might not do well in sports they've never tried	Sort of True for Me [ ]	Really True for me [ ]

Really True for me [ ]	Sort of True for Me [ ]	Some kids feel that they are better than others their age at sports	But	Other kids feel like they can’t play as well	Sort of True for Me [ ]	Really True for me [ ]
Really True for me [ ]	Sort of True for Me [ ]	In games and sports some kids usually watch instead of play	But	Other kids usually play rather than just watch.	Sort of True for Me [ ]	Really True for me [ ]
Really True for me [ ]	Sort of True for Me [ ]	Some kids don’t do well at new outdoor games	But	Other kids are good at new games right away.	Sort of True for Me [ ]	Really True for me [ ]

Child Self-Efficacy to be Physically Activity (SEPA) Scale
With subscale proxy efficacy to influence parents to provide physical activity opportunities (PEPA-P))
(Dzewaltowski et al., 2009)

In this survey you have to read each sentence and then circle the answer you are the *most sure of*. For Example:

I have three noses on my face

Not true at all *somewhat true* *very true*

That shouldn't be too hard to decide! Remember: circle the answer for each sentence that you are *the most sure of.* There are no wrong answers, just take your time! If you have any questions, just ask!

1. I can exercise or do physical activity for 1 hour each day

   Not true at all *somewhat true* *very true*

2. I can exercise or be physically active no matter how busy my family is

   Not true at all *somewhat true* *very true*

3. I can exercise or be physically active no matter how tired I am

   Not true at all *somewhat true* *very true*

4. I can exercise or be physically active even if its hot or cold outside

   Not true at all *somewhat true* *very true*

5. I can exercise or be physically active even if I have a lot of homework

   Not true at all *somewhat true* *very true*

6. I can get my mom/dad to help me plan my favorite physical activities

   Not true at all *somewhat true* *very true*

7. I can get mom/dad to give me a ride home after school

   Not true at all *somewhat true* *very true*

8. I can get mom/dad to find a place where I can exercise or be physically active

Not true at all *somewhat true* *very true*

9. I can get mom/dad to help me find different sports, games, or physical activities that I can do

   Not true at all *somewhat true* *very true*

10. I can get mom/dad to play outside with me or do physical activities/sports with me

    Not true at all *somewhat true* *very true*

11. I can get mom/dad to find time to be physically active or exercise with me

    Not true at all *somewhat true* *very true*

APPENDIX D: INTERVIEW QUESTIONS

Child Semi-Structured Interviews
Structure Provision

1. "I'd like to start by asking you to tell me about exercising or playing outside of what you do at school."
2. "What typically happens when you come home from school?"
3. "What typically happens on the weekends and your house?"
4. "What rules does your mom/dad have about watching tv/playing video games?"
5. "What rules does your mom/dad have about exercising or playing outside?"
6. "Can you tell me about what happens when you don't follow those rules."
7. "Can you tell me what your mom/dad told you why there are rules about watching tv/playing video games?"
8. "Can you tell me what your mom/dad told you why there are rules about exercising or playing outside?"

Autonomy-Supportive

9. "Why do you think your mom/dad has rules about watching tv/playing video games?"
10. "Why do you think your mom/dad has rules about exercising/playing outside?"
11. "Do you remember what you and your mom/dad talked about when they told you about this rule? What did you talk about?"
12. "Does your mom/dad encourage you to find things to be physically active?"
13. "Does your mom/dad encourage you to find alternatives to watching tv/ playing video games?"

14. “Did your mom/dad give you choices about playing games/ watching tv? Do you get to have a say-so? What are your other choices?”
15. “Did your mom/dad give you choices about exercising/ playing outside? Do you get to have a say-so? What are your other choices?”
16. “Can you tell me about what happens if you want a rule to be change or you don’t like the rule? What does mom/dad say?”

Parent Semi-Structured Interviews

Structure Provision

1. “I’d like to start by asking you to tell me about how exercising or playing outside, etc. changed over the intervention with your children.”
2. “What typically happens when your children come home from school? How did this change?”
3. “What typically happens with you and your children on the weekends and your house? How did this change?”
4. “Did you change any rules regarding watching tv/playing video games?”
5. “Did you change any rules regarding exercising or playing outside?”
6. “Can you tell me about what happens when your children don’t follow those rules.”

Autonomy-Supportive

7. ** If applicable, “Did you talk to your children about why you have these rules about watching tv/playing video games? Exercising/playing outside?”
8. “Do you remember what you talked about when this rule was made, if anything? "

9. “Did your encouraging of your children to find things to be physically active change, how so?”
10. “Did your encouraging of your children to find alternatives to watching tv/ playing video games change, how so?”
11. “Did you give your children choices about playing games/ watching tv, exercising/ playing outside? Did this change? Can you tell me a little bit about how this would happen?”
12. “Can you tell me about what happens if your child wants a rule to be change or they don’t like a rule? What is your general response? Has this changed at all?”

APPENDIX E: ACTION PLANS

Weekly "Action Plan"

Family id______

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					Sunday

GOALS FOR THIS WEEK

APPENDIX F: SELF-REGULATION LOGS

Self-Regulation Logs

Id _____

Day of the Week	Exercise and "MOVES" *Please fill out every day*	**Goals and Recommendations for this week**
Monday	Exercise: "MOVES":	
Tuesday	Exercise: "MOVES":	
Wednesday	Exercise: "MOVES":	
Thursday	Exercise: "MOVES":	
Friday	Exercise: "Moves":	
Saturday	Exercise: "MOVES":	
Sunday	Exercise: "MOVES":	

Self-Regulation Logs

Id _____

Nutrition (Food and Beverage Intake)

Please choose 2 weekdays and 1 weekend day

Day of the Week (circle): Monday Tuesday Wednesday Thursday Friday Saturday Sunday

Time	Food/Beverages	Method of Preparation *(baked, fried, boiled, canned, etc)*	Amount/ Serving Size	Goals and Recommendations for the Week

APPENDIX G

Child Weekly Lessons

<u>Week 1</u>

"How can you be more active throughout your day?"

--We can take the stairs

--Set-up blue plastic steps to simulated taking the stairs

--How many more *moves* do we get from using the stairs

--We can run in place

--Jog in place

--How many *moves* do we get from jogging in place

--We can play a game with friends

--What games can you think of?

--Soccer, kickball, tag, etc.

--Let's play duck-duck-goose (break into really small groups, students included)

--How many *moves* did we get from duck-duck-goose

--We can dance

--Let me see your dance moves (students can demonstrate and dance with them)

--How many *moves* did we get from dancing

<u>Week 2</u>

"What are we exercising when…" Muscular Strength

--When we are doing push-ups

--Lets practice

--How can we make pushups easier (wall pushups, knee pushups)

--How can we make pushups harder (partner pushups, elevate your feet)

--What are some other ways that you can think of to exercise your arms?

--When we are crawling like a Bear

--Lets practice

--Exercise with Friends

--What are we exercising when we are doing a wheelbarrow?

--Lets practice

--How can we make it harder/easier

--What are we exercising when we are doing hula-hoop planks

--Lets practice

--What are some other ways that you can think of to exercise your stomach?

<u>Week 3</u>

"What are we exercising when.." Muscular Strength

--When we are doing squats

--Lets practice

--How can we make them harder (jumping squats, hold an object)

--When we are doing lunges

--lets practice

--how can we make them easier/harder

--What are some other ways that you can think of to exercise your legs

--When we are doing crab walks

--Lets practice

--When we are doing situps

--Lets practice

--How can we make them harder?

--Lets practice with friends (situp with ball toss)

--Do you remember some other ways we can exercise our stomachs? (planks, hula-hoop planks, etc)

<u>Week 4</u>

"What are we exercising when.." Cardiovascular

--When we are running

--Lets practice running in place

--How can we make it easier/harder

--When we are doing "Fast Steps"

--Set up blue plastic steps to do fast steps on

--lets practice

--When we are doing ladders

--Set up ladders

--lets practice

--When we are jumping rope

--lets practice

--What are some other ways that you can think of to exercise our heart and lungs?

<u>Week 5</u>

Making Obstacles with Friends

--Break into small groups, with the help of students

--With the help of our friends lets make an obstacle that helps us exercise our arms, stomach and legs

--All the children and students get to practice on all the groups obstacles

<u>Week 6</u>

Child-led Muscular Strength

--Lets come up with some exercises that you can do at home that work your arms.

---How do you think you can make that easier or harder?
--Lets come up with some exercises that you can do at home that work your stomach.
---How do you think we can make this easier/harder?

Week 7
Child-led Muscular Strength
----Lets come up with some exercises that you can do at home that work your legs.
---How do you think you can make that easier or harder?
--Lets come up with some exercises that you can do at home that work your stomach.
---How do you think we can make this easier/harder?

Week 8
Child Led Cardiovascular
----Lets come up with some exercises that you can do at home that can help get your heart beating fast.
---How do you think you can make that easier or harder?

Week 9 (final intervention week)**
How can we get more PA?
--Lets come up with some ways that you think you can get more “moves” at home, at school, or at after-school.

APPENDIX H
Parent Weekly Workouts

<table>
<tr><th>Week</th><th>Workout</th></tr>
<tr><td>1</td><td>
<u>3 Rounds</u>
1:00 minute step-ups/ :30 secs rest
:30 secs racked thruster/ :30 secs rest
:30 secs plank hold/ :30 secs rest

<u>Orthopedic Alternative:</u>
3 mins of 0% grade/2.5 mph on treadmill
2 sets of 3 sprints on a treadmill (at predetermined speed)
Sprints consist of 40 secs on treadmill/ :20 secs of rest
2 mins of 0% grade/2.5 mph on treadmill
<table><tr><td>3min Warmup</td><td>HR:</td><td>HR:</td><td>HR:</td><td>Rest 1 min</td><td>HR:</td><td>HR:</td><td>HR:</td><td>Rest 1 min</td><td>2 min cool down</td></tr></table>
-followed by-
3 sets of
10 step-ups
10 squat to press
:30 secs plank hold variation
</td></tr>
<tr><td>2</td><td>
<u>3 Rounds</u>
1:00 minute kettlebell swings/ :30 secs rest
:30 secs kettlebell squats/ :30 secs rest
:30 secs mountain climbers/ :30 secs rest

<u>Orthopedic Alternative:</u>
3 mins of 0% grade/2.5 mph on treadmill
2 sets of 3 sprints on a treadmill (at predetermined speed)
Sprints consist of 40 secs on treadmill/ :20 secs of rest
2 mins of 0% grade/2.5 mph on treadmill
<table><tr><td>3min Warmup</td><td>HR:</td><td>HR:</td><td>HR:</td><td>Rest 1 min</td><td>HR:</td><td>HR:</td><td>HR:</td><td>Rest 1 min</td><td>2 min cool down</td></tr></table>
-followed by-
3 sets of
10 kettlebell swings
10 kettlebell or air squats
:30 secs mountain climber variation
</td></tr>
<tr><td>3</td><td>
<u>3 Rounds</u>
1:00 burpees/ :30 secs rest
:30 secs lunges/ :30 secs rest
:30 secs hollow holds/ :30 secs rest

<u>Orthopedic Alternative:</u>
3 mins of 0% grade/2.5 mph on treadmill
2 sets of 3 sprints on a treadmill (at predetermined speed)
</td></tr>
</table>

<table>
<tr><td></td><td>Sprints consist of 40 secs on treadmill/ :20 secs of rest
2 mins of 0% grade/2.5 mph on treadmill
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-followed by-
3 sets of
10 pushup to standup
10 lunges
:30 secs hollow hold variation</td></tr>
<tr><td>4</td><td><u>3 Rounds</u>
1:00 minute thrusters/ :30 secs rest
:30 secs sumo high pulls/ :30 secs rest
:30 secs flutter kicks/ :30 secs rest

<u>Orthopedic Alternative:</u>
3 mins of 0% grade/2.5 mph on treadmill
2 sets of 3 sprints on a treadmill (at predetermined speed)
Sprints consist of 40 secs on treadmill/ :20 secs of rest
2 mins of 0% grade/2.5 mph on treadmill
<table><tr><td>3min Warmup</td><td>HR:</td><td>HR:</td><td>HR:</td><td>Rest 1 min</td><td>HR:</td><td>HR:</td><td>HR:</td><td>Rest 1 min</td><td>2 min cool down</td></tr></table>
-followed by-
3 sets of
10 squat to press
10 sumo high pulls
:30 secs flutter kicks or leg raises</td></tr>
<tr><td>5</td><td><u>3 Rounds</u>
1:00 minute jumping jacks/ :30 secs rest
:30 secs single leg deadlift with kettlebell/ :30 secs rest
:30 secs bicycle crunches/ :30 secs rest

<u>Orthopedic Alternative:</u>
3 mins of 0% grade/2.5 mph on treadmill
6 sets of sprints on a treadmill (at predetermined speed)
Sprints consist of 40 secs on treadmill/ :20 secs of rest
3 mins of 0% grade/2.5 mph on treadmill
<table><tr><td>3min Warmup</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>3 min cool down</td></tr></table>
-followed by-
3 sets of
10 jumping jacks
10 single leg deadlift with kettlebell
:30 secs bicycle crunches</td></tr>
<tr><td>6</td><td><u>3 Rounds</u>
walk or jog stairwell to the 3rd floor/ walk back to lab</td></tr>
</table>

<table>
<tr><td></td><td>:30 secs lunges/ :30 secs rest
:30 secs moving planks/ :30 secs rest

Orthopedic Alternative:
3 mins of 0% grade/2.5 mph on treadmill
6 sets of sprints on a treadmill (at predetermined speed)
Sprints consist of 40 secs on treadmill/ :20 secs of rest
3 mins of 0% grade/2.5 mph on treadmill
<table><tr><td>3min Warmup</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>3 min cool down</td></tr></table>
-followed by-
3 sets of
walking up stairs to 3rd floor/ walk back to lab
10 lunges
:30 secs moving plank variation</td></tr>
<tr><td>7</td><td>3 Rounds
1:00 minute kettlebell swings/ :30 secs rest
:30 secs kettlebell squat/ :30 secs rest
:30 secs mountain climbers/ :30 secs rest

Orthopedic Alternative:
3 mins of 0% grade/2.5 mph on treadmill
6 sets of sprints on a treadmill (at predetermined speed)
Sprints consist of 40 secs on treadmill/ :20 secs of rest
3 mins of 0% grade/2.5 mph on treadmill
<table><tr><td>3min Warmup</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>3 min cool down</td></tr></table>
-followed by-
3 sets of
10 kettlebell swings
10 kettlebell squats
:30 secs mountain climbers</td></tr>
<tr><td>8</td><td>3 Rounds
1:00 burpees/ :30 secs rest
:30 secs sumo high pulls/ :30 secs rest
:30 secs hollow hold/ :30 secs rest

Orthopedic Alternative:
3 mins of 0% grade/2.5 mph on treadmill
6 sets of sprints on a treadmill (at predetermined speed)
Sprints consist of 40 secs on treadmill/ :20 secs of rest
3 mins of 0% grade/2.5 mph on treadmill
<table><tr><td>3min Warmup</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>3 min cool down</td></tr></table>
-followed by-
3 sets of</td></tr>
</table>

<table>
<tr><td></td><td>10 pushup to stand up
10 sumo high pulls
:30 secs hollow hold variation</td></tr>
<tr><td>9</td><td><u>3 Rounds</u>
1:00 thrusters/ :30 secs rest
:30 secs single leg deadlift with kettlebell/ :30 secs rest
:30 secs flutter kicks/ :30 secs rest

<u>Orthopedic Alternative:</u>
3 mins of 0% grade/2.5 mph on treadmill
6 sets of sprints on a treadmill (at predetermined speed)
Sprints consist of 40 secs on treadmill/ :20 secs of rest
3 mins of 0% grade/2.5 mph on treadmill
<table><tr><td>3min Warmup</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>HR:</td><td>3 min cool down</td></tr></table>
-followed by-
3 sets of
10 squat to press
10 single leg deadlift with kettlebell
:30 secs flutter kicks</td></tr>
</table>

APPENDIX I
Text Messaging Schedule

For text messaging, the "week" starts on Thursdays

Week	Theme	Friday	Tuesday	Wednesday
1	-	-	-	Just a reminder to bring all your paperwork tomorrow night! See you then!
2	Sedentary behavior	It's almost the weekend! Take time to be active with your family this weekend!	Exercise should play some role during your day. 30 minutes or 3 X 10 min bouts can improve your health and your day! Take time for you!	Just a reminder to bring all your paperwork tomorrow night! See you then!
3	Nutrition	Experiment in the kitchen this weekend! Try a new healthy meal! For meal ideas check out www.onceamonthmeals.com	Remember healthy eating doesn't have to be restrictive and overwhelming. Moderation is key!	Just a reminder to bring all your paperwork tomorrow night! See you then!
4	Goal-Setting	Have you made your SMART goal yet? Write it down somewhere you will see it every day!	Long-term goals are important, but achieving short-term goals will help keep you motivated & increase the chances of you reaching your long-term goals!	Just a reminder to bring all your paperwork tomorrow night! See you then!
5	Self-Regulation	Keeping a journal or log is a great way to record your exercise, food intake and progress! Positive reinforcement at your fingertips!	Can't find time to exercise? Take the time to plan out your week and schedule some "you" time!	Just a reminder to bring all your paperwork tomorrow night! See you then!
6	Time Management	There are 1440 minutes in a day, take 20-30 mins for yourself and your health!	There are many opportunities to be active throughout your day! Take the stairs, park your car a little bit further away. Every step counts!	Just a reminder to bring all your paperwork tomorrow night! See you then!
7	Relapse Prevention	With the holidays coming up, it's easy to get out of a routine. Before the holidays	Have you identified your triggers? This can help keep you on track!	Just a reminder to bring all your paperwork tomorrow night! See you then!

		start, make a plan with your family		
8	Social Support	Having others around you with similar goals will help keep you motivated and on track!	-	Just a reminder to bring all your paperwork tomorrow night! See you then!
9	Reinforcements	Don't forget to reward your efforts. Whenever you or your family reaches a short-term goal, do something fun!	-	Just a reminder to bring all your paperwork tomorrow night! See you then!