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ALTERING THE FAMILY STRUCTURE TO INCREASE CHILD PHYSICAL ACTIVITY: METHODS AND DESIGN

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ABSTRACT: *The purpose of this paper is to provide an overview of a study protocol designed to elicit fitness effects in obese children through a family-based approach. Whereas, previous ecological interventions for physical activity have utilized school-based settings, this study targets the family unit, thereby having a potential effect on multiple mircosystems and mesosystems. Design: Families with at least one parent, that identified as sedentary and was willing to participate, and at least one child who was considered overweight or obese (85th percentile for BMI) were invited to participate. 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 session for 9 weeks. Methods: 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. Semi-structured interviews were conducted with the children and parents to explore the implementation of structure and learned strategies within the household.*

KEYWORDS: Family-Based Intervention, Social Ecological Model, Self-Determination Theory, Child Physical Activity.

INTRODUCTION

Research suggests that overweight or obese children are five times more likely to become obese adults [1], and obesity-related conditions (i.e. heart disease, type 2 diabetes, and certain types of cancers) are now the leading causes of preventable death [2]. Studies indicate higher rates of obesity occur in rural populations compared to urban populations [3]. A meta-analysis examining obesity in rural and urban areas found that children living in rural areas have a 26% greater chance of being obese [3]. Other studies have found an even greater prevalence of obesity in rural Southern children compared to other geographic areas [4,5]. Higher rates of obesity in these areas may be a result of inadequate resources to target childhood obesity.

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. Recent research has suggested that children with higher fitness levels had a 30-50% lower risk of all-cause mortality, non-fatal and fatal heart disease, cancer mortality and a 36% decreased risk of developing metabolic syndrome, independent of abdominal fat and overall weight status [6,7].

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

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primary gatekeeper; therefore, the child's behavior 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 [8]. 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 [9,10]. There are high expectations that interventions taking a more social ecological approach could yield more successful adherence by improving environments and policies that drive physical activity behavior; however, a weakness in current social ecological models is their lack of specificity about their hypothesized influences [10]. Targeting both an additional level of influence and individual determinants of child physical activity behavior could provide insight into more specific constructs that are suggested to be significant influences; thereby, providing applicable constructs for policies aimed at increasing childhood physical activity.

Although a large number of studies have focused on increasing physical activity and fitness in schools, a paucity of studies have examined family-based approaches. The primary objective of this study was to 1) elicit changes in fitness and physical activity through a family-based fitness program, 2) determine how the family structure (i.e. consistent rules and expectations and parental behavior) affected physical activity behavior 3) elicit changes in body composition and psychological determinants to encourage adherence 4) examine the relationship between parent and child physical activity and 5) examine the relationship between parental change and child in psychological determinants.

DESIGN AND METHODS

Families were recruited from a rural community via key stakeholders within the community including schools, recreation facilities, after school programs, churches and physicians. Free resources for physical activity are limited in this area. Per capita income is 24,356 for this county and approximately 34% of residence are in poverty. Recruitment targeted up to 35 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 in the study. The participating parent(s) identified as being sedentary (i.e. engaging in structured exercise no more than 1 day per week). All parents consented for their family and all children assented to be in the study. Families were asked to meet once per week for approximately 60-90 minutes. All procedures were approved by the Institutional Human Subjects Review Board prior to recruitment and data collection.

Measures

Dual-Energy X-ray Absorptiometry (DEXA)

Participants' 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 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.

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Physical Activity Data

Physical Activity data was collected using the *MOVABLE* MOVband3 activity tracker (*Dynamic Health Solutions, LLC,* Houston, Texas). 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, excluding the participants' session day each week, for all participants for data analysis.

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. 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), and muscular strength and endurance were assessed using the following: the curl-up (i.e. sit-up) test and the push-up test [11].

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.

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 [12]. 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 [13]. 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, Sherwood, Story, & Davis (2004) [14]. 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.

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Parental perceived competence was assessed using the modified Perceived Competence Scale developed by Southall, Okely, & Steele (2004) [15]. 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

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 [16]. 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.

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 [17]. 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.

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) [18]. 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).

Structure Implementation

A child's physical activity engagement can be largely dependent upon their immediate physical and social environment. Parents and caregivers can play a vital role in creating an environment for their children that is more conducive to physical activity behavior, and this can be done through the implementation of structure within the household. From a self-determination

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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 [19]. 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.

Procedures

This family-based fitness intervention consisted of once weekly sessions for 10 weeks (1 orientation session; 9 intervention sessions). The university is a central point in the county; therefore, 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 [20] and a PAR-Q adapted for children [21], collecting demographic 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. 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 one 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

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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 one week following the cessation of the intervention and consisted of 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.

IMPLICATIONS TO RESEARCH AND PRACTICE

With the continuing increase in childhood obesity and the associated health consequences, current intervention methodologies are not considered effective for long-term behavior change, especially in low resource areas. Research has suggested that increases in childhood fitness, regardless of weight change, can have a positive effect on health outcomes. Incorporating more physical activity into interventions to promote an increase in childhood physical fitness could encourage more health benefits, compared to a weight loss intervention alone. By integrating the self-determination theory and social ecological model we are targeting multiple levels of influence (i.e. parents and caregivers) while still targeting individual determinants. This approach enables us to provide a comprehensive intervention to target change in child physical activity levels and provide valuable insight into how the home environment can be structured to be more conducive of child physical activity behavior. Additionally, this study will expand upon the role parents' could play in their child's activity. These results could inform policy makers and stakeholders in developing applicable solutions and providing adequate resources to encourage life-long physical activity engagement. The findings of this study will provide

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valuable insight into significant mechanisms through which health promotion operatives can utilize for implementation.

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