Comparison of Impairments, Activity Limitations,
Physical Activity, and Self-Efficacy among Healthy
Weight, Overweight and Obese Minority Middle
School Children

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COMPARISON OF IMPAIRMENTS, ACTIVITY LIMITATIONS, PHYSICAL ACTIVITY, AND SELF-EFFICACY AMONG HEALTHY WEIGHT, OVERWEIGHT AND OBESE MINORITY MIDDLE SCHOOL CHILDREN

By

Annabel Nuñez-Gaunaurd

A DISSERTATION

Submitted to the Faculty of the University of Miami in partial fulfillment of the requirements for the degree of Doctor of Philosophy

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The feasibility and outcomes of a 12-week extracurricular family-based intervention led by physical therapists that was designed to increase physical activity (PA) in three Hispanic male middle-school children was examined. This intervention has limited feasibility and may increase physical activity levels for overweight Hispanic middle school children. In a second study, differences in motor proficiency, strength, endurance, and PA among healthy weight, overweight and obese children were examined, and correlations between BMI and physical impairments were explored. Obese children demonstrated impairments in motor proficiency, strength, and endurance when compared to healthy weight children. Among overweight children, higher BMI was associated with more physical impairments. Overweight children were less physically active than healthy weight children. A high proportion of children were not meeting daily step recommendations to maintain a healthy weight. Girls were less active than boys at this crucial stage of development. The findings of this study have important clinical relevance for physical therapists, who are uniquely qualified to assess these identified impairments and activity limitations that may limit a child’s ability to engage in greater levels of physical activity. This information lends support to the role of the physical
therapist in addressing current public health recommendations related to the childhood obesity.
DEDICATION

This dissertation is dedicated to all the children that participated in our study and shared their thoughts and effort with much patience and enjoyment.

My Ph.D. degree is dedicated to my family: my two beautiful children, Aidan, my little fire who always lights up my heart and Grace, my little miracle who reminds me how blessed I am; my sister Cloris, who I could always count on even through uncertain times; my mother, whose unconditional love and never-ending support encouraged me to always move forward; my father, who continues to be my hero and for exemplifying that anything is possible and attainable if you have the will; and finally, to my husband and best friend Iggy, whose love and encouragement is unparalleled.
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CHAPTER 1. PHYSICAL IMPAIRMENTS AND ACTIVITY LIMITATIONS IN OVERWEIGHT AND OBESE CHILDREN

Diminishing levels of physical activity in children of all ages is thought to be one explanation for the astounding increase in childhood overweight and obesity in the last 20-25 years.\(^1\) Despite Center for Disease Control (CDC) and other national and international guidelines indicating that children should participate in at least 60 minutes of recreational activities daily, children who are overweight may have difficulty performing moderate physical activity due to impairments in strength, endurance, posture, and balance, and the presence of musculoskeletal pain brought on by high body mass index and adiposity.\(^2\)\(^-\)\(^7\) Children with obesity related musculoskeletal impairments and activity limitations may face challenges in participating in programs designed to increase physical activity. Physical therapists are in a position to identify barriers to physical activity such as physical impairments and activity limitations and to provide the essential elements of health promotion education for children who are overweight.

Magnitude of Obesity Problem

The alarming rate of pediatric obesity in both developed and developing countries has become a complex issue with many areas to address. The early emergence of the obesity-disease link can be traced back to 1921, when Joslin made the observation that a large proportion of diabetic patients were overweight.\(^8\) Today, poor diet and physical inactivity is the second leading cause of preventable death in the United States.\(^9\) Changes in the prevalence of these adverse behaviors in the recent past have led to an increase in adult obesity that contributes to numerous chronic diseases including hypertension, dyslipidemia, osteoarthritis, and adult onset diabetes mellitus (Type II DM).\(^10\)
According to the 2003-2006 National Health and Nutrition Examination Survey (NHANES), an estimated 16.3% of children ages 2-19 years in the United States were above the 95th percentile and 11.3% were above the 97th percentile of the BMI for-age growth chart. Children are at an increasing risk of becoming overweight or obese, with a prevalence that has tripled from 1980 to 2004 and held at a steady rate since. An estimated 80% of overweight children at age 10-15 are overweight or obese at age 25. Childhood weight may increase the likelihood of adult morbidity and mortality due to the development of cardiovascular disease and diabetes. Increased prevalence of cardiovascular risk factors have also been identified in overweight children even before they reach puberty. Furthermore, the economic burden of childhood obesity in the United States has been estimated to be about 125 million dollars in a 3 year period. These recent findings indicate a likely rise in adult obesity in the future with a concomitant rise in related chronic conditions and healthcare costs.

Health Disparities in Minority Populations

Disparities in the prevalence of obesity persist among different racial and ethnic groups. In general, minority children are at a greater risk of becoming overweight. According to data from the 2003-2004 National Survey of Children’s Health, it was estimated that 49.2% of the African-American children and 44.0% of Hispanic children were over the 85th percentile on the CDC’s body mass index (BMI) chart, compared to 32.2% of white children. In addition, the more recent 2003-2006 NHANES findings indicate that African-American girls are more likely than Hispanic or White Non-Hispanic girls to have a BMI above the 95th percentile, with a prevalence of 28% compared to 20% and 14.5% respectively. Among boys, Mexican-Americans were
more likely to have a high BMI for age than white non-Hispanic boys.\textsuperscript{11} This coincides with the rise of Type II diabetes mellitus among minority children.\textsuperscript{19-21} The Hispanic population is the largest minority group in the United States with a particularly high predisposition for type 2 diabetes due to the combination of genetic, social, cultural and lifestyle factors.\textsuperscript{22}

Physical activity and time spent in sedentary activities also appear to be disparate among children of different racial and ethnic groups. A large proportion (36.9\%) of overweight or obese Hispanic children do not perform the recommended levels of physical activity, and a higher proportion of their parents are not engaging in moderate physical activity when compared to non-Hispanic children.\textsuperscript{18} A higher percentage of overweight African-American children (36.4\%) report 3 or more hours of daily television viewing when compared with overweight Hispanic and white children (25.1\% and 19.9\%, respectively).\textsuperscript{18} In addition, higher proportions of overweight African-American children report non-school computer use three or more hours daily.\textsuperscript{18} Minority children are at a disadvantage when combating obesity.

Ethnic and racial disparities in obesity rates and physical inactivity levels have often been attributed to differences in social economic status. Some physical environments that serve racial and ethnic minorities lack parks and recreation centers or accessibility to these venues is limited. Fast-food restaurants and convenience stores are much more accessible in low income minority neighborhoods than chain supermarkets that offer a healthier selection of foods including fresh fruits and vegetables. Crime rates and perceptions of danger are higher in low-income neighborhoods,\textsuperscript{23} possibly discouraging parents from letting their kids play outside and instead encouraging
indoor play which perpetuates sedentary behaviors. Most importantly, a tendency towards lack of health insurance for people of racial minority groups limits access to health care providers who might provide education and counseling related to health-related behaviors which discourage obesity.\textsuperscript{23}

There are also differences in cultural perceptions of food, eating, physical activity and weight in racial and ethnic communities that may contribute to disparities in obesity.\textsuperscript{23} For example, traditional foods in African-American culture are high in fat and carbohydrates that may increase the risk of child obesity.\textsuperscript{24} Perceptions of ideal body size may differ among different cultures. For example, African American females prefer a significantly larger body size than that of white women. Latino mothers are also more likely to perceive their obese child as healthy and are less concerned about their child’s weight.\textsuperscript{24} Ethnicity and culture may contribute to the propensity of obesity, especially when acclimating to different customs and traditions such as with Caribbean, South and Central American immigrants that move to the United States. For example, first generation Hispanic children in the United States may prefer to eat fast food American cuisine such as pizza or burgers instead of the home cooked ethnic meal. This preference seems to worsen with generations, especially among the Hispanic culture.\textsuperscript{24} Ethnicity and cultural background of participants should be taken into consideration when tailoring any health promotion intervention.

**Obesity: ICF-Health Conditions, Functional Impairments and Activity Limitations**

Obesity in children leads to other types of physiological, psychological and physical disorders. Early menstruation in girls,\textsuperscript{25} increased risk of low self-esteem or
social stigmatization, and sleep apnea are more common in children who are obese. The latter has been associated with learning and memory impairments that limit success in school. Obese children and adolescents account for two thirds of the cases of slipped capital femoral epiphyses and tibia varum. Recent studies have suggested that at least three or more metabolic syndrome risk factors are significantly increased among the overweight 8 to 14 year old age group, consequently putting them at a greater risk to develop adult onset cardiovascular disease or Type 2 DM in their early teen age years. Following a review of impairments and activity limitations related to obesity in children, a summary of published findings related to childhood obesity is described below.

**Body Composition and Body Mass Index**

Traditionally, body composition refers to the relative amount of fat mass versus fat-free mass. Since body composition changes with age, an accurate assessment of body fat in children may not be determined with body mass alone. However, direct measurement of this construct remains difficult to assess requiring expensive equipment that may expose patients to risks. The current gold standard for body composition measurement is under water weighing, however the difficulties in performing this measurement makes it unsuitable for field studies. A more sophisticated approach for body composition analysis that has gained support in the research community is the dual-energy x-ray absorptiometry due to its accuracy and accessibility. This method of body fat assessment is not feasible for field studies such as that described here. Instead, anthropometric measurements such as the body mass index is commonly used as a clinical
tool to estimate body composition in both adults and children. In 2005, The American Medical Association in collaboration with the Health Resources and Service Administrations and Center for Disease Control and Prevention (CDC) assembled an expert committee to develop recommendations on evaluation and treatment of child and youth obesity.\textsuperscript{32} Body Mass Index (BMI) for age percentile is the recommended clinical screen for body fat assessment in children.\textsuperscript{32} An absolute BMI (kg/m\textsuperscript{2}) is calculated by dividing a child’s body mass (kg) by height (m) squared and then plotted on a current growth chart provided by the CDC for BMI for age percentile. Children are categorized as healthy if BMI age percentile is greater than 5\% and less than or equal to 85\%, overweight if BMI for age percentile was greater than or equal to 85\% and less than 95\%, and obese if BMI for age percentile is greater than or equal to 95\%.\textsuperscript{32}

Pediatric growth charts have been used by pediatricians, nurses, and parents to track the growth of infants, children, and adolescents in the United States since 1977.\textsuperscript{33} Current growth charts are based on data collected from NHANES in the 1970’s.\textsuperscript{34} The CDC provides an online BMI for age percentile calculator for parents and an excel spread sheet for schools, healthcare and child care providers to compute BMI for school-aged children.\textsuperscript{35}

High levels of body fat are associated with higher health risks. It must be noted that BMI for age percentile has its limitations since it does not distinguish between fat-free mass and fat mass. Therefore, an adolescent boy with a high degree of lean mass may be categorized as overweight or obese because of his increased body mass. However, no single body fat value, whether measured as fat mass or as percentage of body weight, clearly distinguishes health from disease or risk of disease.\textsuperscript{36}
Motor Proficiency

As early as 1968, a military study on factors that affect equilibrium function found that body shape and mass were significant factors in postural stability due to the displacement of the center of gravity in overweight adult men. Although a longitudinal study would best elucidate the direction of causation for BMI, motor proficiency and physical activity, there is a general consensus of weak to fair positive associations among motor skills, gross motor development, self-reported athletic coordination and physical activity in children. A more recent study with non-obese children by Wrotniak et al. found that physical activity had a fair association with motor proficiency scores ($r = 0.33; \ p = .008$) among eight to ten year old children. Furthermore, there were also fair negative correlations between BMI percentile and percentage of time in moderate physical activity ($r = -0.36; \ p = .003$), percentage of time in moderate to vigorous physical activity (MVPA) ($r = -0.30; \ p = .014$), and motor proficiency ($r = -0.30; \ p = .015$). In another study with nine to twelve year old boys, a weaker correlation was found between motor skills and moderate to vigorous physical activity as measured by an accelerometer ($r = .25, \ p \leq .01$).

Overweight and obese children are more likely to have poorer static and dynamic balance and impaired lower extremity strength than healthy weight children. In a postural balance study by Goulding et al, overweight boys had significantly poorer composite Bruininks-Oseretsky balance test scores than non-overweight boys, (24.5 versus 26.2, $p < .005$). These differences were particularly greatest in items that required single leg stance and standing on a balance beam. In another pediatric postural study by Mcgraw et al, obese boys were more likely to experience medial-lateral postural
instability when compared to non-overweight boys. Although the direction of the relationship between motor competence and physical activity in obese children has not yet been established, it is plausible that obese children may experience greater difficulty engaging in physical activity due to poor motor competence. Conversely, poor motor competence may be due to decreased engagement in physical activities which can lead to or exacerbate the condition of obesity.

Muscle Strength-Endurance (Lower extremity and trunk)

Decreased lower extremity musculoskeletal strength and power may negatively affect a child’s ability to successfully learn and perform activities of daily living and recreational activities. Riddiford et al examined the effects of obesity on upper and lower extremity strength and power among obese and non-obese children using basketball throws, vertical jumps (VJ) and standing long jumps (SLJ). Although there were no differences in upper extremity performance between the two groups, obese children had shorter VJ and SLJ than non-obese children, VJ (22.1 vs 24.7 cm; SLJ (94.6 vs 101.7 cm, p≤.05). In another study by Almuzaini, a fair but significant inverse relationship was found between knee extensor endurance and BMI (r = -0.34) among children. This may exacerbate the progression of obesity by encouraging sedentary behaviors such as remaining seated for prolonged periods. In a review by Tsiros et al, overweight and obese children performed significantly poorer in weight bearing tasks when compared to non-overweight children. Abdominal strength and stamina has also been found to be compromised among obese children. These strength deficiencies in obese children may further exacerbate musculoskeletal pain and increase risk of injury.
Endurance

Cardiovascular endurance is defined as the ability of the cardiovascular and pulmonary systems to deliver oxygen to tissues at levels appropriate for the level of activity.\(^4^7\) Poor cardiovascular fitness and obesity are well documented risk factors for cardiovascular disease in adults.\(^4^8\) Lower VO2 max values, the criterion measurement for cardio-respiratory fitness, has been associated with reduced capacity for weight –bearing physical activity and exercise, and increased health risk in older adults.\(^4^9\) Obesity is energy taxing on an obese child since they must perform at a higher percentage of their maximal oxygen uptake. Generally, their maximal uptake values are lower than those of lean children.\(^5^0\) This gives obese children less reserve capacity and causes them to perceive higher exertion when performing a task.\(^5^0\) Therefore, an endurance task such as walking or running for exercise may be more difficult for an obese child to complete.

Musculoskeletal Pain

In adults, plantar fasciitis is a common soft-tissue disorder of the foot. Obesity is a risk factor for developing unilateral plantar fasciitis (OR 5.6 compared to normal BMI).\(^5^1\) Obesity is also associated with chronic plantar heel pain.\(^5^2\) In overweight children, skeletal fractures and reports of musculoskeletal pain and difficulties with mobility are significantly higher than in non-overweight children.\(^5\) Specifically, overweight children are 4.04 times more likely than non-overweight children to report back and lower extremity pain (OR: 4.04; 95\% CI: 1.5–10.6; \(p=.007\)).\(^5\) In a study by Taylor et al., knee pain was the most common documented musculoskeletal joint
complaint, which was noted in the medical charts of 6.6% of overweight versus 2.3% of non-overweight children (OR: 2.95; 95% CI: 0.8 –10.4; \( p=0.079 \)).\(^5\) Another potential challenge for the overweight child is carrying excess body weight over the long term resulting in an abnormal posture and gait pattern.\(^7\) Musculoskeletal pain may further exacerbate sedentary behaviors in obese children that already have low levels of physical activity and contribute to further weight gain.

Important activities of daily living such as walking, transferring from sit to stand, and climbing stairs for school or recreational purposes and musculoskeletal pain, lower body strength and postural balance can potentially be important factors that need to be addressed in order to implement a successful intervention strategy. Children with obesity related musculoskeletal impairments and activity limitations will face increased challenges in participating in school-based programs designed to increase physical activity.

**Physical Activity and Sedentary Time**

A review of cross-sectional studies identified that BMI-referenced standard cut points recommendations for maintaining a healthy weight range for 6- to 12-year-old girls and boys are 12,000 and 15,000 steps a day, respectively.\(^53\) Cross-sectional and longitudinal studies have suggested that when children of both sexes engage in high levels of physical activity they tend to demonstrate relatively less adiposity.\(^54\) However, an overweight child’s perception of moderate physical activity may be altered due to increased lower extremity pain, cardiopulmonary and biomechanical strains and premature fatigue brought on by their high body mass. This may decrease adherence to
physical activity programs. Physical activity also decreases with age among children. In a cohort study that followed a group of children from the 1991-2007 National Institute of Child Health and Human Development Study of Early Child Care and Youth Development, it was determined that children decrease their level of moderate to vigorous physical activity (MVPA) as measured by an accelerometer from age 9 to 15 years of age, with girls demonstrating MVPA levels below the recommended 60 minutes by age 13.1 and boys by age 14.7. In a study that observed physical activity levels of Hispanic children using accelerometers, minutes in moderate to vigorous activity were lower (88 vs 96 and 74 vs 79 min., p= 0.002) and sedentary activity counts were higher (40.7 vs 34.2 and 39.5 vs 35.2 min., p= 0.001) in overweight than in non-overweight boys and girls.

Although it may be reasonable to suggest that overweight and obese children perform less physical activity, the literature on this topic remains inconsistent. A study by Wrotniak et al, found no significant associations between children’s percentage overweight and physical activity. Previous analysis of the Third National Health and Nutrition Examination Survey (NHANES III), found no clear trends in the relationship between obesity and participation in vigorous physical activity for both boys and girls. Time spent in sedentary activity may be equally as important as physical activity, since this is a period that is often associated with TV watching and may cue eating when a child is not even hungry. In another study from the NHANES III database, boys and girls who watched four or more hours of television each day had greater body fat (p<.001) and had a greater body mass index (p<.001) than those who watched less than 2
hours per day. Previous studies have indicated that decreasing sedentary behaviors is a key ingredient to the successful treatment of childhood obesity.

**Physical Activity Self-Efficacy**

Self-efficacy is defined as the belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations. Efficacy beliefs can influence goals and aspirations that people set for themselves. People with high self-efficacy expect higher outcomes than those with low self-efficacy. For example, children will be motivated to adopt a behavior if they believe that there is a benefit from this behavior and if they believe they can accomplish this behavior. Self-efficacy is an important correlate of physical activity, and it has also been found to be associated with motor proficiency scores among children, ($r=0.39; P=.001$). In a study by Cairney et al., that examined self-efficacy and performance in a 20 meter shuttle run among children, after adjusting for age, gender, and BMI, higher perceived adequacy regarding physical activity ($r^2= 0.09, P < 0.001$) and greater predilection to select physical over sedentary activities ($r^2= 0.09, P < 0.001$), were independently weakly associated with better test performance. Furthermore, overweight children tend to demonstrate lower actual and perceived physical competence when compared to non-overweight children.

**Family Support**

Family and parental support is positively associated with increased physical activity levels. Furthermore, parental support may be an important correlate of children’s physical activity level accounting for 4% of the variance in children’s physical
Specific parental supportive behaviors that assist in increasing a child’s self-efficacy level include transporting the child to an activity, observing activity, and encouraging the child. In addition, family-based obesity treatment programs are among the most effective for combating pediatric obesity. To improve the success rate for a children’s physical activity intervention, parents are encouraged to be positive role models for their children and to provide the resources to support a desired healthy-lifestyle behavior.

Role of Physical Therapy in the Theoretical Framework to Address Childhood Obesity

Physical therapy can play a significant role in prevention and treatment of childhood obesity. According to the American Physical Therapy Association’s Vision Statement 2020; physical therapist will be recognized as healthcare professionals with direct access by consumers and the leading experts for the diagnosis, intervention, and prevention of impairments, functional limitations, and disabilities related to movement, function, and health. The Guide to Physical Therapist Practice elucidates the role of the physical therapist in the prevention and the promotion of health, wellness and fitness in the context of the disablement model. Obesity is identified as one of the risk factors for cardiovascular, pulmonary and integumentary disorders. Primary prevention strategies prevent disease in a susceptible or potentially susceptible population through specific measures such as general health promotion efforts. Physical therapists must identify risk factors and behaviors that may impede optimal functioning. The pediatric physical therapist must be proficient in identifying related measurements such as the child’s BMI.
for-age percentile on the CDC growth chart along with possible balance, posture or strength deficits in order to fulfill the goal of health promotion in at-risk groups.

In response to the global obesity problem, in May 2004, the World Health Organization adopted the Global Strategy on Diet, Physical Activity and Health. The Global Strategy has 4 main objectives: 1. Reduce risk factors for chronic diseases that stem from unhealthy diets and physical inactivity through public health actions. 2. Increase awareness and understanding of the influences of diet and physical activity on health and the positive impact of preventive interventions. 3. Develop, strengthen and implement global, regional and national policies and action plans to improve diets and increase physical activity that are sustainable, comprehensive and actively engage all sectors, and 4. Monitor science and promote research on diet and physical activity. Physical therapists have the potential to address all four objectives from the WHO. Physical therapists may implement strategies to increase physical activity and to reduce risk factors and potential barriers for physical activity such as musculoskeletal impairments and activity limitations for children who are overweight.

Obesity in children is a complex chronic condition that is influenced by multiple factors including biological, behavioral and environmental. The World Health Organization (WHO) sponsored the *International Classification of Functioning, Disability, and Health (ICF)* as a universal standardized disablement language and framework that looks beyond mortality and disease to focus on how people live with their conditions. The ICF is beneficial when describing the continuity of care of chronic diseases such as child obesity because it provides a bio-psychosocial view of health states from a biological, personal, and social perspective. The ICF utilizes multidirectional
relationships among health conditions, body function/body structures/impairments, activity/activity limitations, and participation/participation restrictions. It also takes into account contextual factors such as environmental and personal barriers and facilitators. For example, a physical therapist may identify a child’s strength and balance impairments, long distance walking limitations and decreased adherence to moderate physical activity. In addition, the physical therapist may identify environmental contextual factors such as a child with two working parents that are unable to take him or her to weekly recreational activities. Ultimately, personal and social aspects of health affect the behavior changes required to make physiological changes associated with improved health.

**Social Cognitive Theory and Health Promotion**

A desired health outcome from an obesity prevention or intervention program is to change a sedentary child’s behavior by having him become more physically active. Bandura’s Social Cognitive Theory (SCT) has been studied extensively to facilitate such desired health behavior changes. The SCT proposes that behavior change is affected by three components: environmental influence, personal factors or attributes of the behavior itself. Each component may affect or be affected by the other two. The core determinants in the SCT include knowledge of health risks and benefits of different health practices, perceived self-efficacy that one can exercise control over one’s health habits, outcome expectations about the expected costs and benefits for different health habits, the health goals people set for themselves and the concrete plans and strategies for realizing them, and the perceived facilitators and social and structural impediments to the changes they
At the focal point of the SCT is self-efficacy, because it has a direct effect on behavior and it influences the other determinants. Children with poor self-efficacy will be easily derailed in the face of obstacles or impediments while a child with high self-efficacy is more likely to stay the course. Efforts to prevent child obesity will also require that parental physical activity behaviors coincide with national recommendations. Chronic disease treatment intervention programs for children may be enhanced through the application of the SCT. Poor lifestyle choices such eating fast-food and engaging in sedentary activities such as watching TV and playing video games can be altered by changes in health behavior patterns. The social cognition model provides a framework to account for variations in health behavior. There is a general consensus that treating such chronic diseases like pediatric obesity is made more difficult by the inconsistencies and lack of motivation to seek treatment in this population. Behavioral techniques and strategies attempt to interpret and apply the health behavior theories for the treatment and prevention of pediatric obesity. They are often applied to modify lifestyle behavioral choices for children and their families.

**Self-regulation through Goal Setting**

Self-regulation systems mediate the effects of most external influences on behavior and provide the basis for purposeful action. These systems involve three elements: 1. monitoring of one’s behavior, 2. judgment of one’s behavior in relation to personal standards and environmental circumstances and 3. affective self-reaction. Self-regulation through goal setting is based on the idea that conscious human behavior is
Goal-directed action is defined by three attributes: 1. Self-generation, meaning that the source of energy is integral to the organism, 2. Value-significance, where the actions not only make possible but are necessary for an organism’s survival and 3. Goal-causation, where the resulting action is caused by a goal.

In relation to performance, two goal attributes have been studied; content and intensity. Content may vary on a spectrum from vague to specific. For example, “increase your physical activity” is less specific than “increase your weekly step counts by 1000 steps for next 2 weeks.” The other aspect of content includes level of difficulty such as from easy “try to increase average daily step counts by 500 steps,” moderate “try to increase your average daily step counts by 1000” to difficult “try to increase your weekly step counts by 2000 steps.” However, difficulty will depend on the relationship between the task at hand and the person. A task may be easy or difficult depending on the person’s ability and experience. More specific goals lead to higher success in attaining them. With vague goals, too many possible outcomes are possible. The ambiguity of “Do your best” allows for people to give themselves the benefit of the doubt and thus a maximum effort is not stimulated. Therefore, goal specificity will allow for a more controlled performance with less variability.

The second attribute of performance goals is that of intensity which refers to the scope, clarity and mental effort. Those who think most intensely and comprehensively about how to attain a personal goal are most likely to stay committed and to take action insolving it. Goal intensity has often been studied as commitment. Commitment refers to the degree to which an individual is attached to their goal regardless of setbacks and obstacles. Attainment of higher goals requires high commitment. Two factors that
enhance one’s commitment to a goal are: 1. the possibility of achieving the goal and 2. the importance or appropriateness of achieving the goal. The former factor pertains to one’s expectancy of success or self-efficacy.

Self-efficacy has been found to have a powerful, direct effect on performance. Therefore, both goals and self-efficacy have direct, independent effects on performance of health related behaviors. In addition, self-efficacy can indirectly affect personal goal choice and commitment to assigned goals. For example, someone with low self-efficacy will be unlikely to pursue goals that are beyond their perceived capability. Striving for high goals has costs with respect to effort, time, and other values. Goal choices are a combination of selecting what may be possible and what is attainable.

**Preliminary Studies Evaluating Physical Activity Interventions for Children who are Overweight.**

Due to the increase in obesity and its related health complications, there is a likelihood that the life expectancy in the United States will decline for the first time in two centuries. As previously stated, there has been a steady rise in sedentary behaviors and poor eating habits among both adults and children. Children are dependent on their parent’s health habits and their support for the development of their own physical and eating habits. Therefore, behavioral interventions that target both children and their parents have longer lasting effects.

Obesity prevention and management programs for children have had both mixed and modest results. In general, programs that target parent and child demonstrate superior health outcomes when compared to child only or parent only. The impact of
family health behaviors is substantial to both adults and children, often guiding health habit development in children. Epstein examined 10-year treatment outcomes for obese children in four randomized treatment groups which differed by presence of parental involvement. Significant effects were observed at 10 years for parents and children that were targeted for weight loss when compared to controls resulting in 30% of the children in the intervention group no longer being classified as obese. A more recent study by Berry et al. that targeted both children and parents of multiethnic backgrounds found that greater physical activity levels led to lower BMI in parents and this relationship coincided with their children’s physical activity and BMI after six months when compared to controls. Although requiring greater effort and intensity, findings from these studies reinforce that family-based treatment programs are more likely to demonstrate long term behavior maintenance in children than treatment programs which do not involve the family.

Further evidence of the importance of parental involvement comes from the Child and Adolescent Trial for Cardiovascular Health (CATCH) program. CATCH is a school-based health intervention that was applied to ethnically diverse children in the 3rd and 5th grades from four states. This study randomly assigned schools to either a control group, or an intervention group that included school food service modification, a CATCH school-based curriculum and physical education interventions. Intervention schools were further randomized equally to either school based programs and school based programs plus family interventions. Health outcomes which improved in both groups included increased self-reported vigorous activity (p<.003) as well as significantly decreased consumption of fat (from 39% to 32%) in school meals (p<.01). In addition, the
family group had greater improvement (p<.002) than the curriculum-only group for dietary knowledge after 4 semesters.89

The CATCH Kids Club, a pilot after-school adaptation of the CATCH program provided another avenue for reaching kids in an already crowded school day.91 Students in the schools implementing the CATCH Kids Club demonstrated greater increases in moderate to vigorous physical activity as compared to children in reference schools who did not receive the intervention.91 Further study is needed to more clearly identify what aspects of these programs are the most effective and how physical therapists can best contribute.

Another successful community-based program that emphasized healthy eating and physical activity for older adults is “Eat Better & Move More.” This program integrated nutrition and physical activity as facilitators of successful aging.94 The Eat Better Move More Guidebook included 12 weekly sessions incorporating “mini-talks,” a series of 10-15 minute lectures on specific topics followed by experiential activities related to nutrition and physical activity sessions.95 The physical activity portion emphasized the benefits of walking and participants used a pedometer to set goals and track progress. This model program served as a template for the development and implementation for the preliminary study in this dissertation.

**Preliminary Studies Evaluating Impairments and Activity Limitation in Children who are Overweight**

A pilot study was performed by the researcher in one Miami-Dade County K-8 Center in October-December 2008. The purpose of this research study was to: 1) examine differences in musculoskeletal pain and balance impairments, activity
limitations, level of physical activity, and physical activity self-efficacy among minority non-overweight, overweight and obese children and adolescents, and 2) to examine relationships between BMI for age percentile and physical activity and physical performance measures.

Thirty-six elementary and middle school children volunteered for participation in a physical activity and fitness screening at their school. Inclusion criteria were children between the ages of 8-15, regardless of weight and fitness level, who attended the target school and were enrolled in the after school program at the participating school. Exclusion criteria included the presence of learning and or physical disabilities, congenital cardiovascular pathology, respiratory disorders, and eating disorders. Identification of the exclusion criteria was accomplished through self-report by the parent.

The child and parent completed surveys related to health habits, physical activity self-efficacy, and musculoskeletal pain. Height and weight measurements were taken to calculate BMI-for-age percentile. The children's outcome measures included: Timed Up and Down Stairs (TUDS) Test, the Six-Minute Walk (6MWT), Sit-to-stand, FITNESSGRAM items, Bruininsk-Oseretsky Balance Test (BOT-2), the Children’s Self-Perception of Adequacy in and Predilection for Physical Activity (CSAPPA) scale and a pedometer and log to track their daily steps for seven days.

The pedometers used to track daily step activity were given to the child as compensation for his/her participation in the study. Data was analyzed using ANOVA to examine differences among healthy weight, overweight and obese children and adolescents, and Pearson correlations were calculated to test the relationship between
BMI-for-age percentile, musculoskeletal pain, balance impairments, activity limitations, physical activity (steps/day), and physical activity self-efficacy in children who were overweight or obese.

Children were an average of 10 years old, 62% female, 86% Hispanic, and had an average BMI-for-age percentile of 71%. Eighteen children were at a healthy weight (BMI for age percentile between 5% and 84%), eight were overweight (BMI for age percentile between 85 and 94%), and ten were obese (BMI for age percentile ≥ 95%). For all children combined, 21% watched TV or video more than 3 hours/day, 47% performed 60 minutes of physical activity more than 3 days per week. In the previous 12 months, 47% had not participated in organized sports, and 30% had been without health insurance coverage. Compared to healthy weight and overweight children, obese children took significantly less steps per day and covered less distance in the six minute walking test and completed less repetitions in the 60 second sit to stand test. Descriptive and analytical data on the outcome variables are presented in Tables 1.1 through 1.3.

In overweight and obese children, BMI-for-age showed a moderate correlation to the BOT2 balance total score, timed up and down stairs test, six minute walk distance, and self-efficacy. Overweight and obese children were also more likely to report musculoskeletal pain than healthy weight children (50% vs 30%, p = .03) and less likely to have health insurance in the previous 12 months (50% vs 93%, p = .04). Correlational statistics are presented below in Table 1.4.

We concluded that children who are overweight or obese may have impairments which limit their ability to participate in the recommended levels of physical activity.
Lower self-efficacy and lack of regular medical care may also lead to poor health habits. These children may have special needs as it relates to meeting CDC recommendations.

The results from the pilot study assisted in the design and implementation of the primary study presented in chapter three. The outcome measures used were appropriate to identify impairments in this population. However, a more objective measurement of physical activity and a greater sample of children would further clarify the associations between the BMI for age percentiles and physical activity. This study also led to further examination of gross motor abilities of overweight and obese children with a more comprehensive motor proficiency evaluation. It was also necessary to reduce the age range for participants in the study to only middle school aged children. This would decrease the variation in children who take physical education and to limit to children who were in a smaller range of maturation.

**Overview of Dissertation Study**

Physical therapists are uniquely qualified to assess the need for modifications in activity and exercise for children with musculoskeletal impairments and mobility limitations such as those found in children who are obese. Although physical therapists have the potential to positively contribute to obesity intervention in children, there is a paucity of research in this area. Given this lack of evidence, and the pressing need for effective obesity interventions for minority children, the purpose of the preliminary study was to test the feasibility and examine outcomes of a 12-week extracurricular family-based physical therapy–led intervention for obesity with minority children. This intervention is described in Chapter two.
The primary study of this dissertation examined impairments in strength, balance, motor proficiency and endurance in children who are overweight and obese compared to healthy weight children and it is described in Chapter three. The relationships between BMI for age percentile and motor proficiency, strength, musculoskeletal pain, self-efficacy and physical activity levels are also examined.

Finally, chapter four will discuss global conclusions, study limitations, recommendations for future work and Therapeutic/Public Health Implications of the Middle School Screening by Physical Therapists.

**Study Aims and Hypothesis**

Specific Aim 1: To describe the feasibility and outcomes of a 12-week extracurricular family-based intervention led by physical therapists that was designed to increase physical activity in three Hispanic male children in middle-school.

Specific Aim 2: To examine differences in motor proficiency, strength, musculoskeletal pain, activity limitations, and level of physical activity among children who are obese (BMI >85th percentile), overweight (BMI between 85th and 94th percentile) and children who are at a healthy weight (BMI between 5th and 84th percentile).

i. Hypothesis 2a: Impairments in motor proficiency (BOTS), strength (push-ups, sit-ups, timed sit to stand), endurance (6MWT), musculoskeletal pain, and activity limitations (Timed Up-Down Stairs) will be greater among overweight children than in children who are at a healthy weight.
ii. Hypothesis 2b: Higher BMI will be associated with lower motor proficiency (BOT-2 percentile scores), abdominal and LE strength (curl-ups, timed sit to stand test), endurance (6MWT), and more reported pain in children who are overweight.

iii. Hypothesis 2c: Level of physical activity as measured by a step activity monitor will be lower among overweight children than in healthy weight children.

Specific Aim 3: To examine differences in self-efficacy and parental health behaviors and attitudes in children who are at a healthy weight versus children who are overweight.

i. Hypothesis 3a: Self-Efficacy scores (CSAPPA) will be lower among children who are overweight than in children who at a healthy weight.

ii. Hypothesis 3b: Parental health behaviors and attitudes to exercise will be different in children who are at a healthy weight than in children who are overweight.

Methods -Preliminary Study

i. Design

To test the feasibility and outcomes of 12-week extracurricular family-based intervention led by physical therapists designed to increase physical activity in Hispanic children in middle-school, the investigator conducted a pre postdesign pilot study. This study is presented as a case series. The intervention, designed for this study, was entitled Kids Eat Better & Move More (KEBMM). This study was approved by the Institutional Review Boards at the University of Miami and Miami-Dade County Public School
Systems. One school from Miami-Dade County Public Schools was selected to participate in this study.

ii. Participants and Recruitment

A sample of convenience was utilized. Students and their parents from a K-8 school in the Miami-Dade County Public School System were invited to participate. This school was chosen for convenience, mix of social economic status in the school and their willingness to participate. The principal and teachers at this school received an IRB-certified information letter that summarized the purpose of the study, the time requirements and contact information. The parents of all students participating in after-school care received an informational letter distributed by the after-school program coordinator, which described the program and requested volunteers. Flyers were also placed on school announcement boards. Inclusion criteria were children between the ages of 10-15, regardless of weight and fitness level, who attended the target school, and whose parents were available and willing to participate in the after-school activity. Exclusion criteria included the presence of learning and or physical disabilities, congenital cardiovascular pathology, respiratory pathology, and eating disorders. Identification of the exclusion criteria was accomplished through self-report by the parent.

Children that met the inclusion criteria and were not eliminated because of exclusion criteria, along with at least one parent or guardian, were enrolled into the intervention. Parents signed the informed consent and their children signed the informed
assent. Parents indicated that they would be available to attend 12 weekly sessions focusing on healthy behavior change.

iii. Intervention

The evidence-based intervention, KEBMM, was designed to improve healthy lifestyle behaviors in Hispanic children. It was based on a successful community-based program for older adults, “Eat Better & Move More,” that integrated nutrition and physical activity over 12 weekly sessions. The physical therapist-led KEBMM intervention targeted both children and their parents and focused on lifestyle modification related to children’s food choices and physical activity. Two bilingual physical therapists interacted with participants in both Spanish and English. This interaction included presenting didactic information, instructing participants in physical activity and answering questions. KEBMM sessions were implemented in the school cafeteria. Pre-testing was conducted during Week 1 of the program and post-testing during Week 13. Session duration was one hour and the meeting time was in the evening for parent convenience.

A KEBMM Guidebook, which is a modified version of the Eat Better Move More Guidebook was developed specifically for children and young adolescents. This task intervention guide was completed by following Center for Disease Control and Prevention Guidelines for youth physical activity and nutrition topics. In addition, The President’s Challenge for youth physical fitness was also incorporated into the modules for exercise and physical activity suggestions. The President’s Challenge website provides thorough information about key aspects of physical activity and getting started such as: motivation suggestions, goal planning and fitness standards for adults and
Illustrations of children performing new strength and flexibility exercises along with simple instructions were also incorporated into the modules. A description of each of the twelve modules is presented in Table 1.5. The intervention consisted of 12 weekly sessions incorporating 10-15 minute lectures and group parent-and student-targeted activities related to nutrition and physical activity behaviors. Each session presented a new module of the KEBMM guidebook. See Appendix A and B for weekly session sample from the KEBMM guidebook.

Parents attended and participated in the same lectures and activities as their child. Behavioral modification, goal-setting, use of existing social and family support structures, and changing the home environment were strategies used to facilitate healthy behavior changes related to physical activity and nutrition. Determinants from the SCT for behavior change were addressed such as knowledge of recommended levels of daily physical activity and better nutritional food choices. The physical activity portion of the program taught children and their parents how to use pedometers to track physical activity. Outcome expectations were addressed by discussing the personal and physical benefits of better nutrition and increased physical activity. In addition, expected monetary costs of healthier food choices and possible time requirements to increase their physical activity levels were also discussed. Perceived self-efficacy for exercise was discussed on an individual basis with the therapist and directed weekly physical activity goals. Health goals were set for increasing physical activity by increasing exercise, increasing physical activity in lifestyle behaviors, and decreasing sedentary behaviors such as TV, computer, and video gaming on a weekly basis and goals were reviewed weekly for compliance or possible barriers to achieving these goals.
The KEBMM nutrition content was based on the 2005-2011 U.S. Department of Agriculture’s *My Pyramid* Food Guide recommendations, which was recently replaced by *My Plate*. A variety of fresh fruit and vegetables were brought in to specific lessons for tasting. Participants were instructed to check off their nutrition intake and the number of steps taken daily on “Tips and Task” sheets. These take-home task sheets were specific to each week’s nutrition and physical activity lesson. A summary of the weekly topics is presented in Table 1.1

**iv. Procedure/Protocol**

Subjects completed pre-testing, in a one hour testing session. Each participating parent provided demographic information including child and parent age, gender, occupation, ethnic background, past medical history and current medical conditions. Each participating child completed the After-School Student Questionnaire (ASSQ). A licensed physical therapist completed all anthropometric and performance assessments on the children. Anthropometric assessment included: weight, height, waist and hip circumference in each child. Each child was tested for physical fitness assessment using the FITNESSGRAM, which included tests for aerobic capacity, muscle strength, muscle flexibility and muscle endurance.

Following initial testing, all subjects received a pedometer with simple instructions along with a one week tracking log. Subjects were instructed to turn in the step tracking log to investigators one week later. Subjects then participated in the 12 weekly sessions. All subjects returned at 13 weeks for post-test and completed all testing procedures completed during week one.
Outcome Measures-Preliminary Study

Health Knowledge

Health knowledge and behaviors, and self-efficacy were collected using the After-School Student Questionnaire (ASSQ),\textsuperscript{91} which is a modified version of the Health Behavior Questionnaire (HBQ)\textsuperscript{88, 89, 100} and the School-Based Nutrition Monitoring Student Questionnaire.\textsuperscript{101} The ASSQ consists of 58 items, mostly in three to seven point Likert scale format that evaluate self-efficacy in nutrition and physical activity, usual behavior in nutrition and physical activity, and knowledge in nutrition. The questionnaire takes about 30 minutes to complete. No reliability or validity studies on the ASSQ have been published to date, however reliability on the HBQ and the School-Based Nutrition Monitoring Student Questionnaire appear to be adequate. The internal consistency of the HBQ has been reported to be $\alpha = .75$ for diet knowledge $\alpha = .78$ for diet intentions.\textsuperscript{89} The child dietary self-efficacy construct from the HBQ was found to have moderate test-rest reliability ($r = .63$), with the food scale showing slightly lower reliability at $r = .58$.\textsuperscript{100} The School-Based Nutrition Monitoring Student Questionnaire has a moderate correlation ($r = .66$) with same day test-retesting.\textsuperscript{101} Children completed this questionnaire individually with a physical therapist nearby to answer questions that may not have been clear to the subject.

Health Behavior

To assess physical activity behavior, the one-button Accusplit Xpedometers\textsuperscript{102} were given to all participants. In general, pedometers are small, inexpensive, battery-operated movement monitors that may be attached to the waistband.\textsuperscript{103} They are specifically designed to measure the number of steps taken by an
individual during ambulation.\textsuperscript{103} Intra-class correlation analyses by Tudor-Locke found that three consecutive days of data collection with a pedometer were necessary to achieve a moderately high correlation of .80 for estimating steps per day.\textsuperscript{104} Both children and their parents were given a pedometer and tracking log in order to document their daily steps and set weekly step goals. Tracking logs were collected weekly, and children were assisted in setting new step goals. Through a review of cross-sectional studies, the following BMI-referenced standard cut points recommendations for maintaining a healthy weight range for 6- to 12-year-old girls and boys are 12,000 and 15,000 steps a day.\textsuperscript{53}

**Anthropometric Testing**

For the preliminary study height and weight measurements were assessed individually with a physical therapist in a private setting. Height was taken in a standing position using a static tape measurement in cm and weight was measured in standing using a Health o Meter digital scale to the nearest kilogram. These measurements were then converted to meters and kilograms for BMI for age percentile calculations by the investigators using the online calculator provided by the CDC.\textsuperscript{35}

**Physical Fitness**

The children’s fitness level, including aerobic capacity, muscle strength, flexibility and endurance, was evaluated using FITNESSGRAM Items.\textsuperscript{105} The FITNESSGRAM is administered to all physical education students in the Miami-Dade County Public School Systems. It is a health related assessment tool that helps identify individual fitness level of students through five components of health-related fitness:
aerobic capacity, muscle strength, muscle flexibility and muscle endurance and body composition.

a. Aerobic capacity was measured with a timed one mile walk or run. Resting and post-exercise blood pressure (BP) and heart rate (HR) were recorded immediately following the one-mile walk/run; a five-minute recovery HR was also recorded.

b. Abdominal strength was measured as the number of times a student could lift his/her head and shoulders off the floor with knees bent and feet unanchored in a supine position to a maximum of 75 repetitions.

c. Upper body strength and endurance were measured as the number of completed 90 degree push-ups. Students begin in a prone plank position with knees and hands on the floor then lower their body to a 90-degree elbow angle and push up while maintaining their spine straight.

d. The recommended test for lower body flexibility is the Back Saver Sit-and-Reach measurement in centimeters. This test is similar to the traditional “sit-and-reach” but it is intended to be safer by evaluating one leg at a time. Each leg is measured individually to identify asymmetrical restrictions and to reduce “posterior ligamentous strain, erector spinae strain and excessive disc compression.” The test re-test reliability coefficients for the back saver sit-and-reach for children of ages six through 12 and 11 through 15 were high, for both right and left lower extremities (r=.96-.98) and (r=.99).
A summary of the outcomes measures and the constructs examined are provided in Table 1.6.

a. Data Analysis

As this information is presented as a case series, no statistical analysis was performed. Rather demographic information and pre and post test scores were described. Results and conclusion of this study can be found in Chapter 2.

Methods - Primary Study

a. Subjects

Children were recruited for voluntary participation in the screening from Coral Way K-8 Center and West Miami Middle School. Both are part of the Miami-Dade County Public School System. Previous research had been conducted at one of the two sites by the investigators, and the results were presented previously in this chapter. Eighty-six middle school children participated in the screening. Inclusion criteria were the following: (1) middle school children, (2) males and females, (3) children with a chronological age between 10 and 15 and (4) enrollment at the participating school. Exclusion criteria included the following: (1) Children with learning and/or physical disabilities that would inhibit participation in physical activity and (2) children with congenital cardiovascular pathology, respiratory, or neurological pathology, or an eating disorder. The selected schools’ principal, teachers, community school faculty and staff, and parents received an IRB-certified information letter that summarized the purpose of the study, the time requirements and contact information. Informed consent and assent forms were signed by both the parent and child onsite. Informed consents were translated to Spanish and certified for this community. Investigators in communication with
participating students were bilingual. To assist with recruitment and return of step activity monitors, parents were given monetary compensation with gift cards at a value of $10.00 when returning their child’s step activity monitor.

Subjects participated in the screening activity between October of 2010 and June of 2011 during extracurricular hours. Participating children and parents in this screening were given a summary of findings related to physical fitness and physical performance testing and were given the opportunity to discuss these findings with a licensed physical therapist. Participants were informed through an individualized summary report on their physical fitness, motor proficiency, and BMI for-age percentile results. View a sample report in Appendix C.

Outcome Measures- Primary Study

Anthropometric Measurements

Anthropometric measurements were taken for all participants. These included height and weight measurements and waist and hip circumference. Height was measured using a standing height scale where a rater measured to the nearest .25 inch. Weight was measured in standing using a portable digital weight scale to the nearest pound. Waist circumference was taken in standing position at the level between the last rib and the iliac crest; hip circumference was taken at the level of the greatest protrusion of the gluteal muscles. These measurements were then converted to meters and kilograms to calculate body mass index.

Children’s BMI for-age-percentiles were calculated using standard procedures and standardized tables from the Center for Disease Control. Children were categorized
as normal if BMI for age is greater than 5% and less than or equal to 85%, overweight if BMI for age was greater than or equal to 85% and less than 95%, and obese if BMI for age was greater than or equal to 95%. High levels of body fat are associated with increasing health risks. However, no single body fat value, whether measured as fat mass or as percentage of body weight, clearly distinguishes health from disease or risk of disease. The sensitivity of BMI of 85th percentile for identifying the fattest children is good, and, in contrast to more-precise measures of body fat (such as dual-energy x-ray absorptiometry or underwater weighing), health care providers can assess weight and height routinely in a clinical or community setting.

**Resting BP and HR**

As per National Institute of Health guidelines, blood pressure in children was measured with a standard clinical sphygmomanometer, using a stethoscope placed over the brachial artery pulse, proximal and medial to the cubital fossa, and below the bottom edge of the cuff (about 2 cm above the cubital fossa). The child was seated for at least five minutes on a chair with feet on the floor prior to BP assessment. The child’s back was supported and right arm (cubital fossa) was held supported at the heart level. Children’s BP standards are based on sex, age, and height for a more accurate classification. Regardless of age and height, a BP reading of 120/80 mmHg is considered pre-hypertensive and a reassessment may be required. Furthermore, the recommendation is to test BP on at least three separate occasions if the child’s BP exceeds the 95th percentile (hypertensive classification). For the purpose of this one time screening only one BP measurement was completed.
The Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) Short Form

As stated previously, overweight children may demonstrate poorer dynamic balance during play, walking and running activities. The BOT-2 is an individually administered performance assessment that measures fine and gross motor skills. This instrument is intended to be used by clinicians and researchers to screen children and youth of ages four through 21 years of age to identify motor impairments, assist in making placement or program adjustments decisions and to evaluate motor interventions. Eight fine and gross motor subtests are evaluated in this battery including: fine motor precision, fine motor integration, manual dexterity, bilateral coordination, balance, running speed and agility, upper limb coordination and strength. In previous literature, the inter-rater reliability has been examined using two examiners and 47 children. Pearson product moment correlation coefficients were good for the short form and all the Complete Form subtests and composites ($r > .90$). Pearson product moment correlation coefficients were $\geq .80$ for the Total Motor Composites and for the Short Form. However, for three out of the four composites (Fine Manual Control, Manual Coordination and Body Coordination) and their related subtests, the results were highly variable, $<.80$. A small practice effect was noted specifically for the Manual Coordination and Body Coordination Motor Area composites.

For the purpose of this field study, all 14 items from the BOT-2 Short Form version, which is taken proportionally from the complete version, were evaluated. These 14 items included measurements of fine motor precision, fine motor integration, manual dexterity, bilateral coordination, upper extremity coordination, standing and walking
balance ability, running speed and agility, trunk and upper extremity strength. The items were divided into 3 testing stations where the child moved along from one testing item to the next, until all fourteen items were completed.

Number of Curl-Ups performed is one of items in the BOT-2 short form battery that was analyzed individually as a measurement of trunk (abdominal) strength. The examiner instructed the child to complete as many curl-ups as possible in thirty seconds. The Curl-Up test has a high degree of test-retest reliability ($r=.97$) among college students. Among younger children (ages 6-10), the reliability is lower ($r=.70$).

Number of Push-ups performed is another item in the BOT-2 battery that was analyzed individually as an upper body strength and endurance measurement. The examiner gave the child the choice to complete as many 90 degree Push-ups with or without knees support in thirty seconds. Specific muscles tested in Push-Ups were the pectoralis major, triceps and anterior deltoid. The intraclass test-retest reliability coefficients for the 90 degree push-up among three separate samples of elementary and high school students ranged from $.50$ to $.86$.

The BOT-2 evaluation tool took approximately 15 minutes to complete. This assessment was completed inside an air conditioned library in the school. View Table 1.7 for a complete list of the 14 testing items in the BOT-2 Short Form. A raw score is obtained for each if the fourteen testing items and then converted to a point score, which allows each item to be evaluated on a graded scale. Point scores from each individual item are then added to obtain the total Short Form point score. Based on this total point score, a standard score and a percentile rank can then be obtained in age and sex specific tables provided in the BOT-2 manual. The type of push up (full or knee) is also identified.
in the table when obtaining these final two scores. The standard scores range from 20 to 80 with a higher score indicating better motor proficiency performance. A standard score of 60 and above indicates above average motor proficiency ability.

**Timed Sit to Stand Test**

The timed Sit to Stand (STS) is a functional performance measure that evaluates lower extremity strength and endurance. Similar to walking, this is a repeated activity that is done throughout one’s activities of daily living. STS can be measured as the number of repetitions performed over a given amount of time (10 or 30 seconds). Our study involved overweight and obese children who may have weak lower extremity strength and impaired lower extremity endurance due to increased body mass. A 60 second STS test was chosen for our study. The starting position of each child was standardized with hip flexion at 90°, knee flexion at 90° (full extension was defined as 0°), feet parallel and flat on the floor, trunk erect, and hands on waist or crossing the chest. The child was asked to stand up and repeat as many cycles of STS as possible at a comfortable speed to the defined standing position, which required the child’s trunk and lower extremities be fully extended. To date there is no published data on the reliability and validity of the 60-Second Sit to stand test in the pediatric population.

**6-Minute Walk Test (6MWT)**

Overweight children may face musculoskeletal discomforts and deficiencies such as lower extremity pain and decreased trunk and lower extremity strength that consequently impair their mobility. The 6MWT is a functional
performance measurement that evaluates endurance and can easily be administered on school grounds. The object of the 6MWT is to have the child walk as much distance as they can back and forth along a 100ft (30.5 meter) designated area for a total of 6 minutes. The 6MWT was originally adapted from Cooper’s (1968) 12 minute walk test (12MWT), where he found a strong correlation between the distance ambulated and maximum VO2 among males in the military. Butland et al. found that the 6MWT was highly correlated to the 12MWT (r=0.95). Concurrent validity was examined among a group of children and adolescents between the ages of 12 and 16 by demonstrating a good correlation between the 6MWT and maximum oxygen uptake determined on the exercise treadmill. The test–retest reliability within a subgroup found the ICC coefficient to be 0.94 (0.89–0.96).

For this study, the 6MWT was administered on a flat covered corridor with a walking course that measured 100ft. The course was outlined by bright colored cones. Students were instructed to walk as many laps as they can around the course in six minutes. Students were informed how much time was left to their course at one minute intervals. In addition, resting heart rate and blood pressure was recorded before and post 6MWT using standard procedures as described previously.

Pain Assessment

Children were given a pain drawing to determine if they were experiencing any musculoskeletal pain during standing, walking, or running activities and if so, the child was asked to quantify their pain on a visual analog scale. The body outline used was adapted from the body outline format of the McGill Pain Questionnaire. Body outlines
are valuable because children are often more able to communicate through drawings than through verbal responses. View Pain VAS Questionnaire in Appendix D.

**Timed Up and Down Stairs Test (TUDS)**

The Timed Up and Down Stairs Test (TUDS) test is a functional mobility outcome measurement that can also be administered on school grounds. The TUDS requires the child to ascend a flight of stairs (12-14 steps) and descend to the starting point as quickly as possible while being timed with a stopwatch. The final score is the time required to climb and descend a flight of stairs. Adequate reliability and validity has been found with the TUDS test, and scores correlated with functional mobility and balance in the pediatric population. Intrarater and interrater reliability is good, ICC (2,1)=0.99. The test-retest reliability of the TUDS is good, ICC =0.94. Concurrent validity was measured by examining the relationship between TUDS and the Timed up and Go, Functional Reach Test and Timed One Legged Stance. The relationships were moderate to strong among children with cerebral palsy (CP) diagnosis ($r_s=0.78, -0.57, -0.77: p<0.001$), but were weak to fair with typically developing children ($r_s=0.33, 0.046, -0.32: p<0.053$). Construct validity was measured by examining the relationship between TUDS and age and a moderate and significant relationship was found among children with CP and typically developing children ($r_s=-0.61, -0.41, p< 0.001$ and $0.018$).

In this study, the TUDS was performed by the child in a school stairwell. One flight of stairs with a landing was chosen in both schools. Since number of steps per flight of stairs was different for each school, steps per second was calculated instead of
the TUDS score. View Appendix E for all performance measurement instructions (excluding BOT-2 Short Form).

**Physical Activity Level-StepWatch Step Activity Monitor**

As previously mentioned, cross-sectional and longitudinal studies report mixed results when interpreting the relationship between levels of physical activity and BMI among children.\textsuperscript{54, 57, 58} This may be due to methodological issues related to previous physical activity assessments. For example, self-report recall of physical activity has its limitations especially with children, due to their limited concept of time and memory capacity.\textsuperscript{124} An objective measure of physical activity may be assessed with an accelerometer, a small electronic motion sensor, which has been found to be reliable and valid among children.\textsuperscript{125} An accelerometer is attached on an elastic belt and worn over the hip.\textsuperscript{125} However, accelerometry testing may have its drawbacks in clinical studies because it may be difficult to delineate the type of activity performed, such as slow or fast paced walking.\textsuperscript{126}

Alternatively, the StepWatch Step Activity Monitor (SAM), provides an objective measurement of a child’s physical activity frequency, intensity and duration.\textsuperscript{126-128} The SAM is a lightweight instrument, worn around the ankle that uses a custom accelerometer linked to a microprocessor to detect and store step counts in user-definable time intervals and it can record data continuously at 1-minute intervals for up to 41 days.\textsuperscript{126} The investigator programs the monitor with child’s height using a computer software supplied by the manufacturer and uploaded along with the time of day to the SAM through a docking station.\textsuperscript{126} The SAM is programmed prior to sending the subject home. The only
task the subject has is to attach the SAM correctly to the appropriate ankle and remember to wear it daily for the specified number of days as per the investigation.\textsuperscript{126} Once the SAM is returned and uploaded unto the computer, data is provided regarding total steps per day and minutes per day at investigator-defined step activity levels and intensities of step activity.\textsuperscript{126} Intensity activity levels include low, medium and high.\textsuperscript{126} Based on StepWatch monitor data for adults who maintained daily diaries, zero step rate was defined as 0 steps, low step activity rate is defined as 1-15 steps per minute, medium step activity rate is defined as greater than 16 steps per minute, and high walking activity is defined as greater than 40 steps per minute.\textsuperscript{128} A child running would be considered at a high walking activity level, whereas a child walking slowly would be classified as moderate walking activity level.\textsuperscript{128} Reliability of SAM step measurements compared with observer counted steps in walking has been documented at ($r = .91$ to $0.99$).\textsuperscript{126, 127} The SAM has been reviewed and validated in children in previous studies.\textsuperscript{126, 127}

Trost et al reported that a seven-day monitoring protocol produced reliable estimates of daily participation in moderate to vigorous physical activity in children, ($r = 0.76$ to 0.87).\textsuperscript{129} For the primary study, children were fitted with a SAM to wear for a seven day monitoring period in order to capture both week and weekend days. The days on which the monitor was initially donned and removed were not analyzed due to incomplete monitoring data. Days with incomplete data were also not included for analysis. Incomplete data was defined as data obtained on days with greater than 3 hours of poor activity monitoring during daytime hours. Children were instructed to remove the SAM only during bathing/showering, and to wear it on their ankle until they go to bed,
then to place it back on in the morning. At least two to five complete days from the seven day sampling period were used to estimate average daily physical activity levels. Investigators also piloted a strategy to increase compliance with SAM wear and return by sending a daily text message to participating students to remind them to wear their SAM. SAMs were collected by investigators after seven days.

**Children’s Self-Perception of Adequacy in and Predilection for Physical Activity Scale (CSAPPA)**

The CSAPPA is a 20 item written questionnaire that evaluates a child’s self-perception of adequacy in performing and desiring to participate in physical activities. The questions are equally divided between active and inactive statements. Eight of the statements address adequacy while the remainder addresses predilection. For each item, the child must decide between two phrases that best describes them, and select if that description is *sort of* or *really* true for them. The most inactive or inadequate response is scored as 1 while the most active or adequate response receives a 4. The CSAPPA was found to have strong reliability and validity where low scores correlated with less participation in organized and free time activities and being more clumsy. Total test score test-retest reliability among grades 4th, 5th and 6th was $r=.84$, among 7th, 8th and 9th graders $r=.90$. See Appendix F for CSAPPA questionnaire example.

**Demographics and Parent Reported Physical Activity Survey**

Each child’s parent completed a demographic, medical, and physical activity inventory that included child and parent’s age, gender, ethnic background, child’s past medical history and current medical conditions. They also completed questions related to
parent physical activity, child physical activity, child TV viewing and information about physician visits and whether the child was insured. A bilingual interviewer conducted the preliminary screenings and attainment of consents. Medical and physical activity questions were taken using the 2007 National Survey of Children’s Health which is also available in the Spanish version.\textsuperscript{131} View physical activity questions (English & Spanish) in Appendix G&H. A summary of the Outcome Measures and their related constructs as per (ICF) are available in Table 1.8.

**Blinding:**

All subjects were familiarized with the different surveys and performance measurements in which they participated, however the purpose of study and test results were not provided until study completion at their participating school. There were a total of four physical therapists and a number of physical therapy students involved with data collection. Each survey and performance measure was completed by the subject individually and privately to prevent competition among the children. A specific physical therapy student or physical therapist was assigned to each outcome measure for all participating subjects. For example one physical therapist was assigned to the 6MWT and a physical therapy student was assigned to the TUDS and the sit-to-stand for all subjects. Survey and performance testing was done in a circuit format and every effort was made to ensure that the same person administered a specific testing item. All personnel involved with data collection were instructed to avoid discussion of results between themselves and participants.
Procedure/Protocol:

Subjects that were interested in participating in the study and that met the inclusion/exclusion criteria completed the consent process. The informed consent was provided in their first language. The principal investigator or the co-principal investigator, who were both bilingual, were present during the informed consent process to address any questions that the parent and/or child may have, including risk and compliance issues. Parents were reminded that they could choose to or not to participate in the study. If both parent and child chose to participate in the study then they were asked to sign the consent form at that time. Subjects completed demographic, musculoskeletal pain and self-efficacy in physical activity questionnaires. Anthropometric assessments including weight, height, waist and hip circumference were completed by a research assistant. Subjects were then guided to each testing station to complete the 6MWT, followed by the TUDS, Sit to Stand Test, and the BOT2 short form assessment. After careful review by the last rater that all outcome measures were completed by the subject including surveys and the physical assessments, subjects were fitted with a step activity monitor for seven days. SAM instructions were provided at this time by a physical therapist. Seven days after the distribution of the accelerometers, subjects returned their device to a study team member who downloaded the SAM input and reviewed the SAM output for possible incomplete data. If the study member found that the input was incomplete due to donning error by the subject or if the subject forgot to wear the SAM daily, then the SAM was re-administered for another week.
**Data analysis**

Hypothesis 2a: Impairments in motor proficiency (BOTS), strength (push-ups, sit-ups, timed sit to stand), endurance (6MWT), musculoskeletal pain, and activity limitations (Timed Up-Down Stairs) will be greater among overweight children than in children who are at a healthy weight.

a. Analysis of variance was calculated to compare differences in motor proficiency (BOTS 2), strength (push-ups, sit-ups, timed sit to stand), endurance (6MWT), musculoskeletal pain, and activity limitations (Timed Up-Down Stairs).

Hypothesis 2b: Higher BMI will be associated with lower motor proficiency (BOT-2 percentile scores), abdominal and LE strength (curl-ups, timed sit to stand test) endurance (6MWT), and more reported pain in children who are overweight.

i. Pearson correlations were calculated to test the relationships between motor proficiency (BOT-2 percentile score), abdominal and lower LE strength (curl-ups, timed chair test), and endurance (6MWT) and reported pain in and BMI for age percentile in overweight children.

Hypothesis 2c: Level of physical activity as measured by a step activity monitor will be lower among overweight children than in healthy weight children.

b. Analysis of variance was calculated to compare differences in moderate to vigorous physical activity levels (steps and minutes in Moderate to High activity as per SAM data) among children who were at a healthy weight, overweight, and obese.
c. Analysis of variance was calculated to compare differences in sedentary time (minutes in zero step rate as per SAM data) among children who were at a healthy weight, overweight, and obese.

Hypothesis 3a: Self-Efficacy scores (CSAPPA) will be greater among children who are at a healthy weight than in children who are overweight.

d. Analysis of variance was calculated to compare differences in physical activity self-efficacy (CSAPPA score) among children who were at a healthy weight, overweight, and obese.

Hypothesis 3b: Parental and child reported health behaviors will be different in children who are at a healthy weight than in children who are overweight.

e. Chi square tests were calculated to examine differences in parent physical activity, child physical activity, child TV viewing and information about physician visit and whether the child was insured.

Power Analysis

A power analysis was calculated to estimate the necessary sample size to detect differences between groups for an analysis of variance test. Estimates from an analysis from the pilot data estimated an effect size of .46-.48 for the variables of interest. A sample size of 40 subjects in each group (healthy weight, overweight, and obese) given a 75% attrition rate will result in 30 subjects per group. Considering this large effect size, a sample of 30 per group will achieve high power (87-97%) when calculating a one-way analysis of variance.
Table 1.1 Descriptive Characteristics of Children

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, male/female</td>
<td>14/22</td>
</tr>
<tr>
<td>Age, mean ± SD</td>
<td>10.14 (±1.15)</td>
</tr>
<tr>
<td>Grade Level (3rd, 4th, 5th, 6th, 7th)</td>
<td>6,5,17,4,3</td>
</tr>
<tr>
<td>Ethnicity (Hispanics/Non-Hispanics)</td>
<td>29/5</td>
</tr>
<tr>
<td>Race (White, Asian, African American)</td>
<td>1. = 29, 2. = 4, 3. = 1</td>
</tr>
<tr>
<td>BMI Percentile, mean ± SD</td>
<td>71 (±28.6)</td>
</tr>
</tbody>
</table>

Table 1.2 – Parent Reported PA levels and Health Care Coverage (All Children)

<table>
<thead>
<tr>
<th>Question</th>
<th>Total</th>
<th>Non-Overweight</th>
<th>Overweight</th>
<th>Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child watches ≥ 3 hours/day of TV, videos, video games, etc.</td>
<td>16.67%</td>
<td>11.11%</td>
<td>25.00%</td>
<td>20.00%</td>
</tr>
<tr>
<td>Child performs 60 min. of Moderate PA &gt; 3 days/week</td>
<td>38.89%</td>
<td>44.44%</td>
<td>62.50%</td>
<td>10.00%</td>
</tr>
<tr>
<td>Child has not participated in organized sports in last 12 months</td>
<td>46.67%</td>
<td>50.00%</td>
<td>37.00%</td>
<td>50.00%</td>
</tr>
<tr>
<td>Parent reports 30 min. of PA ≥ 3 days/week</td>
<td>36.11%</td>
<td>44.44%</td>
<td>50.00%</td>
<td>10.00%</td>
</tr>
<tr>
<td>Child has been without health insurance coverage for last 12 months</td>
<td>30.00%*</td>
<td>7.14%</td>
<td>50.00%</td>
<td>50.00%</td>
</tr>
<tr>
<td>Child has not seen a health care practitioner in last 12 months</td>
<td>13.33%</td>
<td>7.14%</td>
<td>25.00%</td>
<td>12.50%</td>
</tr>
</tbody>
</table>
Table 1.3 – Differences in activity limitations and body functions among healthy-weight, overweight and obese children

<table>
<thead>
<tr>
<th>Variables</th>
<th>Healthy weight ≤ 85th percentile</th>
<th>Overweight ≥ 85th percentile &amp; ≤ 95th percentile</th>
<th>Obese ≥ 95th percentile</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects</td>
<td>18</td>
<td>8</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>BMI-for-age Percentiles</td>
<td>48.27 (±23.84)</td>
<td>88.75 (±2.31)</td>
<td>97.70 (±0.48)</td>
<td>&lt; .0001</td>
</tr>
<tr>
<td>Pedometer Log (daily step average)</td>
<td>11,166 (±3462)</td>
<td>7657 (±569)</td>
<td>6668 (±2969)</td>
<td>.04</td>
</tr>
<tr>
<td>Sit-to-stand (reps/minute)</td>
<td>36 (±14)</td>
<td>29 (±5.68)</td>
<td>26 (±5.40)</td>
<td>.04</td>
</tr>
<tr>
<td>BOT-2 (total balance score)</td>
<td>14.76 (±5.52)</td>
<td>14.75 (±2.87)</td>
<td>11.30 (±3.27)</td>
<td>.13</td>
</tr>
<tr>
<td>6 Minute Walk (meters)</td>
<td>624.33 (±85.03)</td>
<td>624.27 (±88.66)</td>
<td>545.58 (±42.38)</td>
<td>.03</td>
</tr>
<tr>
<td>TUDS (seconds to complete)</td>
<td>9.50 (±2.02)</td>
<td>28.75 (±5.68)</td>
<td>26.1 (±5.4)</td>
<td>.07</td>
</tr>
</tbody>
</table>
Table 1.4: Correlations between BMI-for-age percentiles and Body Functions (BF), Activity Limitations (AL) and Contextual Factors (CF) in overweight children, ≥ 85th percentile.

<table>
<thead>
<tr>
<th>Variable</th>
<th>r</th>
<th>P for Pearson’s r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance (BOT2) BF-AL</td>
<td>-.479</td>
<td>.044*</td>
</tr>
<tr>
<td>Sit-to-Stand BF-AL</td>
<td>-.242</td>
<td>.334</td>
</tr>
<tr>
<td>Timed up &amp;down stairs AL</td>
<td>.593</td>
<td>.010*</td>
</tr>
<tr>
<td>Pedometer step log AL</td>
<td>-.173</td>
<td>.657</td>
</tr>
<tr>
<td>6 Minute Walk distance AL</td>
<td>-.469</td>
<td>.049*</td>
</tr>
<tr>
<td>PA Self-Efficacy CF</td>
<td>-.470</td>
<td>.049*</td>
</tr>
</tbody>
</table>
Table 1.5: Kids Eat Better & Move More Weekly physical activity and nutrition topics

<table>
<thead>
<tr>
<th>Session</th>
<th>Physical Activity Topic</th>
<th>Nutrition Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Pre-testing</td>
<td>Pre-testing</td>
</tr>
<tr>
<td>Week 2</td>
<td>Introduction to step counters <em>(pedometer instructions)</em></td>
<td>Introduction to nutrition</td>
</tr>
<tr>
<td>Week 3</td>
<td>Set a new step goal <em>(goal setting)</em></td>
<td>5-a-day fruits and vegetables</td>
</tr>
<tr>
<td>Week 4</td>
<td>Stretching and movement <em>(flexibility training)</em></td>
<td>5-a-day with color</td>
</tr>
<tr>
<td>Week 5</td>
<td>Step up your pace <em>(increase aerobic training)</em></td>
<td>4-a-day for calcium</td>
</tr>
<tr>
<td>Week 6</td>
<td>A healthier, stronger kid <em>(strength training)</em></td>
<td>Eat your breakfast</td>
</tr>
<tr>
<td>Week 7</td>
<td>Walking and exercising in all weather <em>(strategies to reduce exercise barriers)</em></td>
<td>Quenching your thirst</td>
</tr>
<tr>
<td>Week 8</td>
<td>Cut the screen time <em>(strategies to reduce sedentary time)</em></td>
<td>Great grains</td>
</tr>
<tr>
<td>Week 9</td>
<td>Walking tall <em>(balance/posture improving exercises)</em></td>
<td>Conquer the portion distortion</td>
</tr>
<tr>
<td>Week 10</td>
<td>Walking for fun <em>(strategies to have fun with exercise)</em></td>
<td>Powerful protein</td>
</tr>
<tr>
<td>Week 11</td>
<td>The fit family <em>(family support and exercise)</em></td>
<td>Beware the sweet tooth</td>
</tr>
<tr>
<td>Week 12</td>
<td>Stepping to a healthy weight <em>(what is healthy weight and step goal setting)</em></td>
<td>Food Guide Pyramid</td>
</tr>
<tr>
<td>Week 13</td>
<td>Celebrate success! Post-test</td>
<td>Celebrate success! Post-test</td>
</tr>
<tr>
<td>Health Outcome Constructs</td>
<td>Evaluation Instruments</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1. Health Knowledge of Diet &amp; Exercise, Self-efficacy, Health Behavior</td>
<td>After-School Student Questionnaire (ASSQ)</td>
<td></td>
</tr>
<tr>
<td>2. Health Behavior (Physical Activity)</td>
<td>Pedometer</td>
<td></td>
</tr>
<tr>
<td>3. Anthropometric Measurements</td>
<td>BMI-Body Mass Index (kg/m²)</td>
<td></td>
</tr>
<tr>
<td>4. Physical Fitness (aerobic capacity, body composition, flexibility, strength, endurance)</td>
<td>FITNESSGRAM</td>
<td></td>
</tr>
</tbody>
</table>
## Table 1.7 BOT-2-Short Form Items

<table>
<thead>
<tr>
<th>Testing Subsets</th>
<th>Point Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Fine Motor Precision</strong></td>
<td><strong>14</strong></td>
</tr>
<tr>
<td>1. Drawing Lines through paths-crooked</td>
<td>7</td>
</tr>
<tr>
<td>2. Folding Paper</td>
<td>7</td>
</tr>
<tr>
<td><strong>II. Fine Motor Integration</strong></td>
<td><strong>10</strong></td>
</tr>
<tr>
<td>3. Copying a Square</td>
<td>5</td>
</tr>
<tr>
<td>4. Copying a Star</td>
<td>5</td>
</tr>
<tr>
<td><strong>III. Manual Dexterity</strong></td>
<td><strong>9</strong></td>
</tr>
<tr>
<td>5. Transferring Pennies</td>
<td>9</td>
</tr>
<tr>
<td><strong>IV. Bilateral Coordination</strong></td>
<td><strong>7</strong></td>
</tr>
<tr>
<td>6. Jumping in Place-Same Side Synchronized</td>
<td>3</td>
</tr>
<tr>
<td>7. Tapping Feet and Fingers-Same Sides Synchronized</td>
<td>4</td>
</tr>
<tr>
<td><strong>V. Balance</strong></td>
<td><strong>8</strong></td>
</tr>
<tr>
<td>8. Walking Forward on a Line</td>
<td>4</td>
</tr>
<tr>
<td>9. Standing on One Leg on a Balance Beam-Eyes Open</td>
<td>4</td>
</tr>
<tr>
<td><strong>VI. Running Speed and Agility</strong></td>
<td><strong>10</strong></td>
</tr>
<tr>
<td>10. One legged Stationary Hop</td>
<td>10</td>
</tr>
<tr>
<td><strong>VII. Upper Limb Coordination</strong></td>
<td><strong>12</strong></td>
</tr>
<tr>
<td>11. Dropping and Catching a Ball-Both Hands</td>
<td>5</td>
</tr>
<tr>
<td>12. Dribbling a ball-Alternating hands</td>
<td>7</td>
</tr>
<tr>
<td><strong>VIII. Strength</strong></td>
<td><strong>18</strong></td>
</tr>
<tr>
<td>13. Knee push-ups or Full push-ups</td>
<td>9</td>
</tr>
<tr>
<td>14. Sit-ups</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total Point Score</strong></td>
<td><strong>Max=88</strong></td>
</tr>
<tr>
<td>Body Structures/Function</td>
<td>Activity Limitation</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td><strong>Anthropometric:</strong></td>
<td></td>
</tr>
<tr>
<td>1. BMI = Weight(kg)/Height (m$^2$)</td>
<td></td>
</tr>
<tr>
<td>2. Waist circumference (cm)</td>
<td></td>
</tr>
<tr>
<td>3. Hip circumference (cm)</td>
<td></td>
</tr>
<tr>
<td><strong>Climbing Stairs:</strong></td>
<td></td>
</tr>
<tr>
<td>1. Timed Up and Down Stairs Test (steps/sec)</td>
<td></td>
</tr>
<tr>
<td><strong>Motor proficiency:</strong></td>
<td></td>
</tr>
<tr>
<td>1. BOT2 Short Form-Standard Score and Percentile Scores</td>
<td></td>
</tr>
<tr>
<td><strong>Abdominal strength:</strong></td>
<td></td>
</tr>
<tr>
<td>(BOT-2 Item)</td>
<td></td>
</tr>
<tr>
<td>1. Sit-ups (reps/30s)</td>
<td></td>
</tr>
<tr>
<td><strong>UE strength:</strong></td>
<td></td>
</tr>
<tr>
<td>(BOT-2 Item)</td>
<td></td>
</tr>
<tr>
<td>2. Push-ups (reps/30s)</td>
<td></td>
</tr>
<tr>
<td><strong>LE Strength:</strong></td>
<td></td>
</tr>
<tr>
<td>1. Timed Sit-to-Stand (reps/1min)</td>
<td></td>
</tr>
<tr>
<td><strong>Pain Assessment</strong></td>
<td></td>
</tr>
<tr>
<td>1. Pain Drawing (VAS 1-10)</td>
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<tr>
<td><strong>Endurance</strong></td>
<td></td>
</tr>
<tr>
<td>1. 6 Minute Walking Test (meters)</td>
<td></td>
</tr>
<tr>
<td><strong>Physical activity level:</strong></td>
<td></td>
</tr>
<tr>
<td>1. StepWatch Step Activity Monitor (SAM)</td>
<td></td>
</tr>
<tr>
<td>a. Moderate to vigorous physical activity</td>
<td></td>
</tr>
<tr>
<td>b. Vigorous physical activity</td>
<td></td>
</tr>
<tr>
<td>c. Sedentary time.</td>
<td></td>
</tr>
<tr>
<td><strong>Self-Efficacy</strong></td>
<td></td>
</tr>
<tr>
<td>1. CSAPP A scale</td>
<td></td>
</tr>
</tbody>
</table>
According to the Centers for Disease Control (CDC), the combination of poor diet and physical inactivity are the second leading causes of preventable death in the United States.\textsuperscript{9} An increase in these adverse behaviors in the recent past has led to an increase in obesity that contributes to numerous chronic diseases including hypertension, dyslipidemia, osteoarthritis, and adult onset diabetes mellitus.\textsuperscript{1, 10, 74} Obesity is of particular concern with children. Diminishing levels of physical activity in children of all ages is thought to be one explanation for the astounding increase in childhood obesity in the last 20-25 years.\textsuperscript{1, 74}

According to the 2003-2006 National Health and Nutrition Examination Survey (NHANES), an estimated 16.3\% of U.S. children ages 2-19 years were above the 95th percentile and 11.3\% were above the 97th percentile of the 2000 BMI-for-age growth charts.\textsuperscript{11} An estimated 80\% of overweight children age 10-15 continue to be overweight or obese at age 25.\textsuperscript{13, 14} Indeed, childhood weight may increase the likelihood of adult morbidity and mortality due to the development of cardiovascular disease and diabetes.\textsuperscript{15}

The World Health Organization Consultation on Obesity concluded that behavioral and environmental factors are the primary reasons for the global dramatic increase in obesity in the last 20 years.\textsuperscript{1} Increased sedentary lifestyle and excessive energy intake have been identified as the primary sources of the obesity epidemic. Today’s environmental influences encourage overeating and discourage exercise and other types of physical activity. For example, the number of commercial eating
establishments increased 89% from 1972 to 1995 accompanied by a 14% increase in fast-food restaurants.\textsuperscript{132} It is believed that these trends contribute to the rising prevalence of obesity in both children and adults.

Disparities in the prevalence of obesity are seen among different racial and age groups with minority children at a greater risk than non-minority children of becoming overweight. The 2003-2004 National Survey of Children’s Health estimated that 49.2\% of African-American children and 44.0\% of Hispanic children were over the 85th percentile on the BMI chart, compared to 32.2\% of white children.\textsuperscript{18} In addition, the most recent 2003-2006 NHANES findings indicate that African-American girls are more likely than Hispanic or White Non-Hispanic girls to have a BMI above the 95\textsuperscript{th} percentile, with an obesity prevalence of 28\% compared to 20\% and 14.5\%, respectively.\textsuperscript{11} Among boys, Mexican-Americans were more likely to have a high BMI for age than white non-Hispanic boys.\textsuperscript{11}

As previously stated, the increase in obesity is concomitant with increases in numerous chronic diseases including hypertension, dyslipidemia, osteoarthritis, and adult onset diabetes mellitus.\textsuperscript{10} Increased prevalence of cardiovascular risk factors have been identified in overweight children even before they reach puberty.\textsuperscript{16} The obesity disparities previously noted in minority populations contribute to disparities in these chronic diseases as well. For example, Type 2 diabetes mellitus is on the rise among minority children.\textsuperscript{19-21} The Hispanic population makes up the largest minority group in the United States with particularly high predisposition for Type 2 diabetes due to the combination of genetic, social, cultural and lifestyle factors.\textsuperscript{22} Most of this research has looked at Mexican Americans, but little is known about other Hispanic subgroups.
Despite CDC and other national and international guidelines indicating that children should participate in at least 60 minutes of recreational activities daily to maintain good health, children who are overweight may have difficulty performing moderate physical activity. This difficulty may be due to impairments in strength, endurance, posture, and/or balance, and the presence of musculoskeletal pain brought on by high BMI and adiposity. Children with obesity-related musculoskeletal impairments and functional mobility limitations will face increased challenges in participating in programs designed to increase physical activity. Physical therapists are in an ideal position to identify and ameliorate these potential barriers to physical activity and to provide the essential elements of health promotion education for children who are overweight.

Obesity prevention and management programs for children have had both mixed and modest results. In general, programs that target both parent and child demonstrate superior health outcomes when compared to child only or parent only programs. Epstein looked at 10-year treatment outcomes for obese children in four randomized treatment groups which differed by presence of parental involvement. Findings suggested that family-based treatment programs are more likely to lead to long term behavior maintenance in children than treatment programs which do not involve the family.

Further evidence of the importance of parental involvement comes from the Child and Adolescent Trial for Cardiovascular Health (CATCH) program and the CATCH KidsClub, a pilot after-school adaptation of the CATCH program. Both showed
stronger results, for example, increased vigorous activity, when parents were included in the intervention.

Although physical therapists have the potential to positively contribute to obesity intervention, there is a paucity of physical therapy research in this area. Given this lack of evidence, and the pressing need for effective obesity interventions for minority children, the purpose of this study was to test the feasibility and examine outcomes of a 12-week extracurricular family-based physical therapy–led intervention for obesity with minority children. The intervention, designed for this study, was entitled Kids Eat Better & Move More (KEBMM).

**Methodology**

**Subjects**

This study utilized a pre-post design and was approved by the Institutional Review Boards at the University of Miami and Miami-Dade County Public School Systems. A sample of convenience was utilized; students and their parents from a K-8 school in the Miami-Dade County Public School System were invited to participate. This school was chosen for convenience, mix of social economic status in the school and their willingness to participate. The principal and teachers at this school received an IRB-certified information letter that summarized the purpose of the study, the time requirements and contact information. The parents of all students participating in after-school care received an informational letter distributed by the after-school program coordinator, which described the program and requested volunteers. Flyers were also placed on school announcement boards. Inclusion criteria were children between the ages
of 10-15, regardless of weight and fitness level, who attended the target school, and whose parents were available and willing to participate in the after-school activity. Exclusion criteria included the presence of learning and or physical disabilities, congenital cardiovascular pathology, respiratory pathologies, and eating disorders. Identification of the exclusion criteria was accomplished through parent-report.

Children that met the inclusion criteria and were not eliminated because of exclusion criteria, along with at least one parent or guardian, were enrolled into the intervention. Parents signed the informed consent and their children signed the informed assent. Parents indicated that they would be available to attend 12 weekly sessions focusing on healthy behavior change. Intervention began with six child-parent dyads enrolled in the intervention. Three of these subject pairs dropped out of the program at approximately four to six weeks due to scheduling conflicts of either the child or the parent. The three remaining children, aged 10-12, were all male and bilingual. One parent (father) was bilingual, and the other two parents (mothers) were Spanish speaking.

**Procedures**

KEBMM sessions were implemented in the school cafeteria. Pre-testing was conducted during Week 1 of the program and post-testing during Week 13. Session duration was one hour and the meeting time was in the evening for parent convenience.

The evidence-based intervention, KEBMM, was designed to improve healthy lifestyle behaviors in Hispanic children. It was based on a successful community-based program for older adults, “Eat Better & Move More,” that integrated nutrition and physical activity over 12 weekly sessions. The physical therapist-led KEBMM
intervention targeted both children and their parents and focused on lifestyle modification related to children’s food choices and physical activity. Two bilingual physical therapists interacted with participants in both Spanish and English. This interaction included presenting didactic information, instructing participants in physical activity and answering questions.

A KEBMM Guidebook was developed, and consisted of 12 weekly sessions incorporating 10-15 minute lectures and group parent- and student-targeted activities related to nutrition and physical activity behaviors. Parents attended and participated in the same lectures and activities as their child. Behavioral modification, goal-setting, use of existing social and family support structures, and changing the home environment were strategies used to facilitate healthy behavior changes related to physical activity and nutrition. The physical activity portion of the program taught children and their parents how to use pedometers to track physical activity and set goals for increasing physical activity by increasing exercise, increasing physical activity in lifestyle behaviors, and decreasing sedentary behaviors such as TV, computer, and video gaming.

The KEBMM nutrition content was based on the 2005-2011 U.S. Department of Agriculture’s My Pyramid Food Guide recommendations, which were recently replaced by My Plate. A variety of fresh fruit and vegetables were brought in to specific lessons for tasting. Participants were instructed to check off their nutrition intake and the number of steps taken daily on “Tips and Task” sheets. These take-home task sheets were specific to each week’s nutrition and physical activity lesson. A summary of the weekly topics is presented in Table 1.5.
**Outcome measures**

Four health outcome constructs were measured in this study: 1) health knowledge and behavior related to diet, exercise and self-efficacy, as measured by the After-School Student Questionnaire (ASSQ), 2) physical activity as measured by pedometer and recorded as steps/day, 3) BMI in kg/m² and converted into age percentiles, and 4) physical fitness represented by aerobic capacity, flexibility, strength, and endurance as measured by the FITNESSGRAM. In addition, parent subjects provided demographic information including child and parent age, gender, parent occupation, ethnic background, child’s past medical history and current medical conditions. A summary of outcomes and the associated constructs can be found in Table 1.6. All subjects received baseline testing of all outcomes at the start of the program and at program completion (13 weeks).

**Health Knowledge**

Health knowledge and behaviors, and self-efficacy were collected using the After-School Student Questionnaire (ASSQ), which is a modified version of the Health Behavior Questionnaire (HBQ) and the School-Based Nutrition Monitoring Student Questionnaire. The ASSQ consists of 58 items, mostly in three to seven point Likert scale format that evaluate self-efficacy in nutrition and physical activity, usual behavior in nutrition and physical activity, and knowledge in nutrition. The questionnaire takes about 30 minutes to complete. No reliability or validity studies on the ASSQ have been published to date, however reliability on the HBQ and the School-Based Nutrition Monitoring Student Questionnaire appear to be adequate. The internal consistency of the
HBQ has been reported to be $\alpha = .75$ for diet knowledge and $\alpha = .78$ for diet intentions. The child dietary self-efficacy construct from the HBQ was found to have moderate test-rest reliability ($r = .63$), with the food scale showing slightly lower reliability at $r = .58$. The School-Based Nutrition Monitoring Student Questionnaire has a moderate correlation ($r = .66$) with same day test-retesting.

**Health Behavior**

To assess physical activity behavior, the one-button AccusplitX pedometers were placed on all participants. In general, pedometers are small, inexpensive, battery-operated movement monitors that are attached to the waistband. They are specifically designed to measure the number of steps taken by an individual during ambulation. Intraclass correlation analyses by Tudor-Locke found that three consecutive days of data collection with a pedometer were necessary to achieve a moderately high correlation of .80 for estimating steps per day. Through a review of cross-sectional studies, the following BMI-referenced standard cut points recommendations for maintaining a healthy weight range for 6- to 12-year-old girls and boys are 12,000 and 15,000 steps a day. Both children and their parents were given a pedometer and tracking log in order to document their daily steps and set weekly step goals. Tracking logs were collected weekly, and children were assisted in setting new step goals.

**Anthropometric Variable - BMI**

The American Medical Association in collaboration with the Health Resources and Service Administrations and Center for Disease Control and Prevention (CDC)
assembled an expert committee to develop recommendations on evaluation and treatment of child and youth obesity. Body Mass Index (BMI) for age percentile is the recommended clinical screen for body fat assessment in children.\textsuperscript{32} Children are categorized as normal if BMI age percentile is greater than 5% and less than or equal to 85%, overweight if BMI for age percentile was greater than or equal to 85% and less than 95%, and obese if BMI for age percentile is greater than or equal to 95%.\textsuperscript{32} High levels of body fat are associated with increasing health risks. However, no single body fat value, whether measured as fat mass or as percentage of body weight, clearly distinguishes health from disease or risk of disease.\textsuperscript{36}

**Physical Fitness**

The children’s fitness level, including aerobic capacity, muscle strength, flexibility and endurance, was evaluated using FITNESSGRAM Items.\textsuperscript{40} The FITNESSGRAM is administered to all physical education students in the Miami-Dade County Public School Systems. It is a health related assessment tool that helps identify the individual fitness level of students through five components of health-related fitness: aerobic capacity, muscle strength, muscle flexibility, muscle endurance and body composition.\textsuperscript{105} Aerobic capacity was measured with a timed one mile walk or run. Resting and post-exercise blood pressure (BP) and heart rate (HR) were recorded immediately following the one-mile walk/run; a five-minute recovery HR was also recorded.

Abdominal strength was measured as the number of times students could lift their head and shoulders off the floor with knees bent and feet unanchored in a supine position.
to a maximum of 75 repetitions. Upper body strength and endurance were measured as the number of completed 90 degree push-ups. Students begin in a prone plank position with knees and hands on the floor then lower their body to a 90-degree elbow angle and push up while maintaining their spine straight. Flexibility was measured using the Back-Saver Sit and-reach test, where students sit with one knee bent and one leg straight against a box and reach forward to record the number of inches they can reach past the extended leg.105

**Results**

For the three subjects who completed the program, all attended 100% of the sessions. Parents of the three subjects attended an average of 90% of the weekly group sessions. Subject demographic information is reported in Table 2.1. Descriptive data on the outcome variables are presented in Tables 2.2 through 2.5.

**Discussion**

As the nation’s obesity epidemic continues to rise, especially among minority children, accessible health and wellness education will be in greater demand. This study was aimed at testing the feasibility and examining outcomes of a 12-week extracurricular family-based diet and exercise intervention. One of the strengths of the program was that children and parents were enrolled as a team and together taught strategies to assist the children in developing healthy eating and exercise habits. Another advantage was having two bilingual physical therapists administering the intervention to the minority subjects. This allowed greater trust to develop between researchers and subjects and allowed the researchers to address questions and concerns from both children and their parents.
The physical therapist researchers educated and trained the children to safely perform exercises and modify exercise postures if necessary. Although, balance was not tested as part of this study, dynamic balance deficiencies were observed among the study subjects. They required verbal instruction and tactile cues to complete lower and upper extremity strengthening exercises such as lunges and squats. This is of particular interest to physical therapists given their training to identify and manage body impairments to facilitate and promote physical activity.

This study yielded considerable interest from school administration, staff, parents and students during project preparation and recruitment. This program was implemented using the school’s current infrastructure and it did not require additional resources from the school. Investigators provided the weekly nutrition and physical activity education along with the food and exercises demonstration at the school cafeteria. Parents were also encouraged to exercise with their children both at the sessions and during the week.

Changes in health knowledge and behaviors, and self-efficacy as measured by the After-School Student Questionnaire (ASSQ) were minimal. One explanation for this maybe that the lessons were not specifically geared to the information tested by this questionnaire, and a more lesson-specific post-test on a larger sample may have been more sensitive to change. Additionally, use of the self-report instruments to measure health behaviors for this study may have been problematic since students may over or under-report their health behaviors. Asking participants to complete a food log throughout the study would have provided important data on changes in food choices over this time period.
Data in this study failed to show improvements in most of the fitness testing items. However both abdominal and upper extremity strengths as measured by curl-ups and push-ups were showing a modest improvement and resting systolic blood pressure decreased post intervention. Unexpectedly, the average times for the mile/run test increased rather than decreased. Furthermore, baseline pretest mile walk/run resulted in a greater increase in post-exercise HR (56 bpm mean increase) than in post intervention, indicating that this was a difficult task for the subjects at baseline. It was also apparent that walking or running this distance was a task in which the subjects had limited experience. It is possible that the increased experience that the subjects gained in performing physical activity led to better pacing of the 1 mile walk/run at post test, as evidenced by a less pronounced HR response and longer walking time. In addition, the post-intervention mile walk times may have increased because of the increased ambient temperature: pre-testing took place in February (high average 78° F) while post-testing was in May (high average 87° F). Finally, as expected from a short-term intervention, there were no significant changes in BMI for age percentiles for all subjects.

The most impressive result of this pilot study was the significant increase in daily step counts for all three students. Step increases were equivalent to walking an average of an additional 1.5 miles per day. In addition, we demonstrated that a low cost intervention of a pedometer, which costs approximately ten dollars each, can improve physical activity behavior. This intervention can be done without expensive equipment and implemented almost anywhere.

These findings suggest that it is possible to realize meaningful benefits from a low cost extracurricular program such as the one described here. The program’s estimated cost
of $65/student, included a pedometer for both child and parent, weekly healthy snack for demonstrations, and home worksheets for 12 weeks. The researchers were not reimbursed for their time, which averaged about 4 hours/week for preparation and implementation. The measurement tools included low cost equipment such as stop watches, measurement tape, cones and portable exercise mats. It should also be noted that having populations of sedentary persons, such as the subjects in this study, become more active (rather than targeting already active persons becoming even more active) could create substantial public health benefits through wide spread implementation of this intervention, by providing an opportunity to raise health and wellness awareness for both parent and child. An increase in physical activity is an important health outcome because it often precedes a change in fitness, which is more difficult to observe in short-term interventions. Outcomes from this study delivered similar results to the CATCH and CATCH After-School program where physical activity was significantly increased in participants.88, 91

The promising results of the KEBMM Program must be balanced against several disadvantages. Although the Program yielded considerable interest from parents, commitment to participate was difficult. In general, there were difficulties in recruiting both parents and children to attend the program on a regular basis. The evening times were selected by the investigators to facilitate working parent participation, however it was also noted by some parents that this was close to “dinner time” or they had other children at home to take care of. Another obstacle with recruitment of children that already participated in after-school programs was that parents and children either had to return to school shortly following their after-school pick-up time or the children had to
stay after school for over 3.5 hours to participate in the KEBMM program. In addition, retention and attendance was mixed among all subjects. The three subjects presented here had over a 90% attendance rate, however the other three participants attended about 50% of the sessions and final testing was not completed and therefore we were unable to compare “high” attendees to “low” attendees. These scheduling complications exemplify the difficulties that working parents have in finding time to exercise. We recommend that additional strategies such as incentives and performance-based rewards be instituted to maximize retention and participation.

As a research study, this project also had limitations. As the present study was mainly designed to test the feasibility of KEBMM, there was no control group. The pre-post design inherently raises questions about internal validity. As with limitations in previous school-based interventions implemented in local communities, small sample size from specific demographic groups may not be representative of students as a whole. In addition, behavioral characteristics of parents and students that volunteer in this type of intervention may not be characteristics of the average overweight child and their parent.

**Conclusion and Clinical Implications**

The KEBMM intervention is an example of a program designed for physical therapists to address the growing childhood obesity epidemic. Physical therapists can deliver some essential elements of health promotion education for children who are overweight or at risk for overweight in an accessible environment as they are uniquely qualified to assess the need for modifications in activity and exercise for children with
musculoskeletal impairment and mobility limitations. Physical therapists can facilitate this in two ways. First, they are specifically trained to evaluate, identify and manage impairments in balance, strength and flexibility which may limit a child’s ability to participate in healthy lifestyle activities. The KEBMM program specifically addresses activities to enhance strength, balance and flexibility. Second, physical therapists are trained to work with patients to identify psychosocial barriers to physical activity and develop strategies to overcome these barriers.

Although controlled trials are needed to evaluate the effectiveness of this health promotion and behavior change intervention, the preliminary data from this study suggests that improvements in physical activity support further investigation. Future health policy decisions should consider the need for this type of accessible family-based intervention as a useful strategy for encouraging higher levels of physical activity in children who are overweight or at risk of becoming overweight.
Table 2.1. Demographic Information

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child age (gender)</strong></td>
<td>12(M)</td>
<td>10(M)</td>
<td>12(M)</td>
</tr>
<tr>
<td><strong>Parent age (gender)</strong></td>
<td>33(F)</td>
<td>28(M)</td>
<td>37(F)</td>
</tr>
<tr>
<td><strong>Parent's Occupation</strong></td>
<td>Broker</td>
<td>Firefighter</td>
<td>Housecleaner</td>
</tr>
<tr>
<td><strong>Past medical history</strong></td>
<td>Anxiety Headaches</td>
<td>Insignificant Medical Hx</td>
<td>Allergies</td>
</tr>
<tr>
<td><strong>Ethnic background</strong></td>
<td>Cuba/Mexico</td>
<td>Cuba/United States</td>
<td>Colombia/Colombia</td>
</tr>
<tr>
<td><strong>Birthplace</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Parent attendance</strong></td>
<td>90%</td>
<td>90%</td>
<td>90%</td>
</tr>
</tbody>
</table>

Table 2.2: Health Knowledge of Diet & Exercise, Self-efficacy, Health Behavior at Pre and Post Intervention – After-School Student Questionnaire (ASSQ)

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Mean Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ASSQ Total Score</strong></td>
<td>45 (Week 1) 59 (Week 13)</td>
<td>64 (Week 1) 58 (Week 13)</td>
<td>64 (Week 1) 64 (Week 13)</td>
<td>2.667</td>
</tr>
<tr>
<td><strong>Diet Behavior</strong></td>
<td>12 (Week 1) 15 (Week 13)</td>
<td>23 (Week 1) 19 (Week 13)</td>
<td>19 (Week 1) 19 (Week 13)</td>
<td>-0.333</td>
</tr>
<tr>
<td><strong>Diet Knowledge</strong></td>
<td>9 (Week 1) 9 (Week 13)</td>
<td>9 (Week 1) 9 (Week 13)</td>
<td>12 (Week 1) 11 (Week 13)</td>
<td>-0.333</td>
</tr>
<tr>
<td><strong>Diet Intention</strong></td>
<td>6 (Week 1) 5 (Week 13)</td>
<td>4 (Week 1) 6 (Week 13)</td>
<td>8 (Week 1) 6 (Week 13)</td>
<td>-0.333</td>
</tr>
<tr>
<td><strong>Physical Activity</strong></td>
<td>5 (Week 1) 11 (Week 13)</td>
<td>8 (Week 1) 6 (Week 13)</td>
<td>7 (Week 1) 7 (Week 13)</td>
<td>1.333</td>
</tr>
<tr>
<td><strong>Diet Self-efficacy</strong></td>
<td>10 (Week 1) 14 (Week 13)</td>
<td>13 (Week 1) 14 (Week 13)</td>
<td>15 (Week 1) 15 (Week 13)</td>
<td>1.667</td>
</tr>
<tr>
<td><strong>Physical Activity Self-Efficacy</strong></td>
<td>3 (Week 1) 6 (Week 13)</td>
<td>7 (Week 1) 4 (Week 13)</td>
<td>3 (Week 1) 6 (Week 13)</td>
<td>1.00</td>
</tr>
</tbody>
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### Table 2.3: Physical Activity - Pedometer Step Count

<table>
<thead>
<tr>
<th>Daily Step Count (mean)</th>
<th>Week 1</th>
<th>Week 6</th>
<th>Week 12</th>
<th>Mean Step Difference over 12 weeks (% Increase)</th>
<th>Mean Step Δ Wk 1 to Wk 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>4264</td>
<td>6044</td>
<td>6855</td>
<td>+2591 (60.8%)</td>
<td>2,509</td>
</tr>
<tr>
<td>Case 2</td>
<td>10314</td>
<td>11822</td>
<td>12794</td>
<td>+2480 (24.0%)</td>
<td></td>
</tr>
<tr>
<td>Case 3</td>
<td>8290.5</td>
<td>10867</td>
<td>11560</td>
<td>+3269.5 (39.4%)</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>7622.8</td>
<td>9577.7</td>
<td>10403</td>
<td>+2780.2 (36.47%)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2.4: Anthropometric Measurements

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 1</td>
<td>Week 13</td>
<td>Week 1</td>
</tr>
<tr>
<td>Height (in)</td>
<td>66</td>
<td>67.5</td>
<td>54.5</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>166.2</td>
<td>169</td>
<td>107.4</td>
</tr>
<tr>
<td>BMI (kg/ m²)</td>
<td>26.8</td>
<td>26.1</td>
<td>25.4</td>
</tr>
<tr>
<td>BMI-for-age percentile</td>
<td>97&lt;sup&gt;th&lt;/sup&gt;</td>
<td>96&lt;sup&gt;th&lt;/sup&gt;</td>
<td>97&lt;sup&gt;th&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
Table 2.5: Pre and Post Intervention Fitness Items

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
<th>Mean</th>
<th>Mean</th>
<th>Mean</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wk 1</td>
<td>Wk 13</td>
<td>Wk 1</td>
<td>Wk 13</td>
<td>Wk 1</td>
<td>Wk 13</td>
<td>Wk 1</td>
</tr>
<tr>
<td>Rest HR (bpm)</td>
<td>84</td>
<td>92</td>
<td>104</td>
<td>96</td>
<td>76</td>
<td>92</td>
<td>88</td>
</tr>
<tr>
<td>Post-Ex. HR (bpm)</td>
<td>148</td>
<td>124</td>
<td>156</td>
<td>120</td>
<td>128</td>
<td>114</td>
<td>144</td>
</tr>
<tr>
<td>Rest BP (mmHg)</td>
<td>122/78</td>
<td>112/80</td>
<td>111/70</td>
<td>102/80</td>
<td>110/72</td>
<td>105/78</td>
<td>114.3/73</td>
</tr>
<tr>
<td>Post-Ex. BP (mmHg)</td>
<td>122/80</td>
<td>122/78</td>
<td>90/65</td>
<td>110/80</td>
<td>110/70</td>
<td>110/72</td>
<td>107.3/72</td>
</tr>
<tr>
<td>Curl-ups (max)</td>
<td>34</td>
<td>50</td>
<td>30</td>
<td>39</td>
<td>20</td>
<td>55</td>
<td>28</td>
</tr>
<tr>
<td>Push-Ups (max)</td>
<td>0</td>
<td>9</td>
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<td>Sit-and-Reach (in)</td>
<td>L (-2)</td>
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The alarming increase in the prevalence of pediatric obesity has become a complex issue with many potential areas in which to intervene including addressing poor diet and physical inactivity. The latter two have been suggested as the second leading cause of preventable death in the United States. In general, minority children are at a greater risk of becoming overweight. According to data from the 2003-2004 National Survey of Children’s Health it was estimated that 49.2% of the African-American children and 44.0% of Hispanic children were over the 85th percentile on the Center for Disease Control’s (CDC) body mass index (BMI) chart, compared to 32.2% of white children. Current CDC and other national and international guidelines recommend that children should participate in at least 60 minutes of recreational activities daily. Skeletal fractures and reports of musculoskeletal pain and difficulties with mobility are significantly higher in overweight than in non-overweight children. Overweight children are more likely to have poorer dynamic balance and impaired lower extremity strength. Children who are overweight and obese may have difficulty performing recommended levels of physical activity to maintain a healthy weight due to musculoskeletal impairments and activity limitations brought on by high body mass index and adiposity. Physical therapists are in a position to identify barriers for physical activity such as musculoskeletal impairments and activity limitations and to provide the essential elements of health promotion education for children who are overweight.

Obesity in children leads to other types of physiological, psychological and physical disorders. Early menstruation in girls, increased risk of low self-esteem or
social stigmatization, and sleep apnea are more common in children who are obese. The latter has been associated with learning and memory impairments that limit success in school. Recent studies have suggested that at least three or more metabolic syndrome risk factors are significantly increased among the overweight 8 to 14 year old age group, consequently putting them at a greater risk to develop adult onset cardiovascular disease or Type 2 Diabetes in their early teen age years. Poor cardiovascular fitness and obesity are well documented risk factors for cardiovascular disease in adults. Lower VO2 max values, the criterion measurement for cardiorespiratory fitness has been associated with reduced capacity for weight-bearing physical activity and exercise, and increased health risk in older adults. Obese children and adolescents account for two thirds of the cases of slipped capital femoral epiphyses and tibia varum. Obese children experience more difficulty moving their greater mass against gravity. Decreased lower extremity musculoskeletal strength and power may negatively affect a child’s ability to successfully learn and perform activities of daily living. This may exacerbate the progression of obesity by encouraging sedentary behaviors such as remaining seated for prolonged periods.

**Motor Proficiency**

As early as 1968, a military study on factors that affect equilibrium function found that body shape and mass were a significant factor in postural stability due to the displacement of the center of gravity in overweight adult men. Research has shown significant positive associations among motor skills, gross motor development, and self-reported athletic coordination and physical activity in children. A more recent study by Wrotniak et al, found that physical activity was moderately associated with
motor proficiency scores \( (r = 0.33; p = .008) \) among eight to ten year old children.\(^{41}\) Furthermore, there were also moderately negative correlations between z-BMI and percentage of time in moderate physical activity \( (r = -0.36; p = .003) \), percentage of time in moderate to vigorous physical activity (MVPA) \( (r = -0.30; p = .014) \), and motor proficiency \( (r = -0.30; p = .015) \).\(^{41}\) A weaker but significant correlation was found between moderate to vigorous physical activity as measured by an accelerometer and motor skills among nine to twelve year old boys, \( (r = .25, p \leq .01) \).\(^{42}\) Overweight and obese children are more likely to have poorer dynamic balance and impaired lower extremity strength.\(^3, 4\) In a postural balance study by Goulding et al, overweight boys had significantly poorer composite Bruininks-Oseretsky balance test scores than non-overweight boys, \( (24.5 \text{ versus } 26.2, p < .005) \).\(^3\) These differences were particularly greatest in items that required single leg stance and standing on a balance beam.\(^3\) In another pediatric postural study by Mcgraw et al, obese boys were more likely to experience medial-lateral instability when compared to non-overweight boys.\(^{43}\) Obese children may be experiencing greater difficulty engaging in physical activity due to poor motor competence.

**Muscle Strength-Endurance (Lower extremity and trunk)**

Decreased lower extremity musculoskeletal strength and power may negatively affect a child’s ability to successfully perform activities of daily living. Riddiford et al examined the effects of obesity on upper and lower extremity strength and power among obese and non-obese children using basketball throws, vertical jumps (VJ) and standing long jumps (SLJ).\(^6\) Although there were no differences in upper extremity performance between the two groups, the results of lower extremity tests were poorer for obese
children, VJ (22.1 vs 24.7 cm; SLJ (94.6 vs 101.7 cm, p≤.05). In another study by Almuzaini, a fair but significant inverse relationship was found between knee extensor endurance and BMI (r = -0.34) among children. This may exacerbate the progression of obesity by encouraging sedentary behaviors such as remaining seated for prolonged periods. In a childhood obesity review study by Tsiros et al, overweight and obese children performed significantly poorer in weight bearing tasks when compared to non-overweight children. Abdominal strength and stamina has also been found to be compromised among obese children. These strength deficiencies in obese children may further exacerbate musculoskeletal pain and increase risk of injury.

**Endurance**

Cardiovascular endurance is defined as the ability of the cardiovascular and pulmonary systems to deliver oxygen to the tissues appropriate for the level of activity. Poor cardiovascular fitness and obesity are well documented risk factors for cardiovascular disease in adults. Lower VO2 max values, the criterion measurement for cardiorespiratory fitness has been associated with reduced capacity for weight-bearing physical activity and exercise, and increased health risk in older adults. Obesity is energy taxing on an obese child since they must perform at a higher percentage of their maximal oxygen uptake. Generally, their maximal uptake values are lower than those of lean children. This gives obese children less reserve capacity and causes them to perceive higher exertion when performing a task. Therefore, an endurance task such as walking or running for exercise may be more difficult for an obese child to complete.
Musculoskeletal Pain

In adults, plantar fasciitis is a common soft-tissue disorder of the foot. Obesity is a risk factor for developing unilateral plantar fasciitis (OR 5.6; CI 95% 1.6 -16.6; p<.05) when compared to individuals with a normal BMI. Obesity is also associated with chronic plantar heel pain. In overweight children, skeletal fractures and reports of musculoskeletal pain and difficulties with mobility are significantly higher than in non-overweight children. Specifically, overweight children are 4.04 times more likely than non-overweight children to report back and lower extremity pain (OR: 4.04; 95% CI: 1.5–10.6; p=.007). In a study by Taylor et al., knee pain was the most common documented musculoskeletal joint complaint, which was noted in the medical charts of 6.6% of overweight versus 2.3% of non-overweight children (OR: 2.95; 95% CI: 0.8 – 10.4; p=.079). Another potential challenge for the overweight child is carrying excess body weight over the long term resulting in an abnormal posture and gait pattern. Assessment of musculoskeletal pain in overweight children is imperative since it may be a possible determinant for engagement in recreational and physical activities.

Important activities of daily living such as walking, transferring from sit to stand, and climbing stairs for school or recreational purposes and musculoskeletal pain, lower body strength and postural balance can potentially be important determinants that need to be addressed for a successful intervention strategy. Children with obesity related musculoskeletal impairments and activity limitations will face increased challenges in participating in school-based programs designed to increase physical activity.
A review of cross-sectional studies revealed BMI-referenced standard cut points recommendations for maintaining a healthy weight range for 6- to 12-year-old girls and boys are 12,000 and 15,000 steps a day respectively. Cross-sectional and longitudinal studies have suggested that when children of both sexes engage in high levels of physical activity they tend to demonstrate relatively less adiposity. However, an overweight child’s perception of moderate physical activity may be altered due to increased lower extremity pain, cardiopulmonary and biomechanical strains and premature fatigue. This may decrease adherence to physical activity programs. Physical activity also decreases with age among children. In a cohort study that followed a group of children from the 1991-2007 National Institute of Child Health and Human Development Study of Early Child Care and Youth Development, it was determined that children decrease their level of moderate to vigorous physical activity (MVPA) as measured by an accelerometer from age 9 to 15 years of age, with girls demonstrating MVPA levels below the recommended 60 minutes by age 13.1 and boys by age 14.7. In a study that observed physical activity levels of Hispanic children using accelerometers, time in moderate to vigorous activity were lower (boys: 88 vs 96 min. and girls: 74 vs 79 min., p = 0.002) and sedentary activity counts were higher (boys: 40.7 vs 34.2 min. and girls: 39.5 vs 35.2 min., p = 0.001) in overweight than in non-overweight boys and girls.  

Although it may be reasonable to suggest that overweight and obese children perform less physical activity, the literature on this topic remains inconsistent. A study by Wrotniak et al, found no significant associations between children’s percentage overweight and physical activity. Previous analysis of the Third National Health and
Nutrition Examination Survey (NHANES III), found no clear trends with obesity prevalence and participation in vigorous physical activity for both boys and girls.\textsuperscript{58} Time spent in sedentary activity may be equally as important since this is a period that is often associated with TV watching and may cue eating when a child is not even hungry.\textsuperscript{59} In another analysis study for the (NHANES III), boys and girls who watched four or more hours of television each day had greater body fat (p< .001) and had a greater body mass index (p< .001) than those who watched less than 2 hours per day.\textsuperscript{60} Previous studies have indicated that decreasing sedentary behaviors is a key ingredient to the successful treatment of childhood obesity.\textsuperscript{61}

\textit{Physical Activity Self-Efficacy}

According to previous research literature, self-efficacy is an important correlate of physical activity.\textsuperscript{65,66} It has also been found to be associated with motor proficiency scores among children, (r=0.39; p=.001).\textsuperscript{41} In a study by Cairney et al. that looked at self-efficacy and performance in a 20 meter shuttle run among children, after adjusting for age, gender, and BMI, higher perceived adequacy regarding physical activity (r\textsuperscript{2}= 0.09, p< 0.001) and greater predilection to select physical over sedentary activities (r\textsuperscript{2}= 0.09, p< 0.001), were independently weakly associated with better test performance.\textsuperscript{67} Furthermore, overweight children tend to demonstrate lower actual and perceived physical competence when compared to non-overweight children.\textsuperscript{68}

\textit{Family Support}

Family and parental support is positively associated with increased physical activity levels.\textsuperscript{69,70} Furthermore, parental support may be an important correlate of
children’s physical activity level accounting for 4% of the variance in children’s physical activity self-efficacy level. Specific parental supportive behaviors that apparently assist in increasing a child’s self-efficacy level include; transporting the child to an activity, observing activity, and encouraging the child. In addition, family-based obesity treatment programs are among the most effective for combating pediatric obesity. To improve the success rate for a children’s physical activity intervention, parents are encouraged to be positive role models for their children and to provide the resources to support a desired healthy-lifestyle behavior.

Although a few investigators have examined the relationship between obesity, motor proficiency and physical activity, further studies are needed to clarify this relationship among middle school children of different ethnic backgrounds. Objective measurements of impairments and physical activity levels are scarce in this population, often relying on self-report measures. Previous studies have not incorporated a battery of functional outcome measures to assess motor proficiency, muscular strength and endurance, physical activity and exercise self-efficacy among Hispanic middle school children. These outcome measures may provide a more global picture of the functional abilities of an obese child. Further understanding of the disparities in impairments and activity limitations may have the potential to assist in the design and implementation of effective strategies to increase physical activity levels and decrease obesity especially among a population of children that are most at risk. The purpose of this study was to compare impairments, activity limitations and physical activity constructs through validated measurement tools among Hispanic overweight (BMI >85th percentile) and obese (BMI >95th percentile) children versus healthy weight children (BMI between 5th
and 84th percentile). The objectives of this report are 1) to examine differences among the three groups in motor proficiency (BOTS), strength (push-ups, sit-ups, timed sit-to-stand), endurance (6MWT), musculoskeletal pain, and activity limitations (Timed Up-Down Stairs); 2) to describe quantitatively duration, intensity and frequency of physical activity using a step activity monitor and compare physical activity between groups; 3) to examine differences in self-efficacy (CSAPPA total scores); 4) to examine differences in parental health behaviors and children’s participation in sports and leisure activities using a parent activity questionnaire and 5) to compare relationships between BMI, impairments, activity limitations, physical activity, and self-efficacy in children who are overweight versus healthy weight.

Methods

This study utilized a cross sectional design and was approved by the Institutional Review Boards at the University of Miami and the Miami-Dade County Public School Systems. A sample of convenience was utilized; students from two middle schools in the Miami-Dade County Public School System were invited to participate. These two schools were chosen for convenience, mix of social economic status in the school and their willingness to participate. The principals and teachers at these schools received an IRB-certified information letter that summarized the purpose of the study, the time requirements and contact information. To assist with recruitment and return of step activity monitors, parents were given monetary compensation with gift cards at a value of $10.00 when returning their child’s step activity monitor.
a. Subjects

Children were recruited for voluntary participation in the screening from Coral Way K-8 Center and West Miami Middle School. Both are part of the Miami-Dade County Public School System, which is the fourth largest school district and the second largest minority school system in the nation with over 350,000 students enrolled. Sixty percent of their student body is of Hispanic origin, 28% African American, and 10% White.136

The selected schools’ principal, teachers, community school faculty and staff, and parents received an IRB-certified information letter that summarized the purpose of the study, the time requirements and contact information. Informed consents were translated to Spanish and certified for this community. Investigators in communication with participating students were bilingual and explanation of the study was completed in the preferred language of participants. Informed consent and assent forms were signed by both the parent and child onsite.

Eighty-six middle school children participated in the screening. Inclusion criteria were children between the ages of 10-15, regardless of weight and fitness level, who attended the target schools, and were available and willing to participate in the after-school screening activity. Exclusion criteria included the presence of physical disabilities, congenital cardiovascular pathology, and children with respiratory pathologies. Identification of the exclusion criteria was accomplished through parent-report. Children that met the inclusion criteria and were not eliminated because of exclusion criteria, were enrolled into the screening. Parents signed the informed consent, their children signed the
informed assent. Screeningsessions were implemented in the school’s library and nearby corridors for walking and stair-climbing measurements.

Subjects participated in the screening activity between October of 2010 and June of 2011 during extracurricular hours. Participating children and parents in this screening were given a summary of findings related to physical fitness and physical performance testing and were given the opportunity to discuss these findings with a licensed physical therapist. Participants were informed through an individualized summary report on their physical fitness, motor proficiency BMI for-age percentile results. See an example of a summary report in Appendix C.

**Outcome Measures**

**Anthropometric Measurements**

Anthropometric measurements were taken for all participants. These included height and weight measurements and waist and hip circumference. Height was measured using a standing height scale where a rater measured to the nearest .25 inch. Weight was measured in standing using a portable digital weight scale to the nearest pound. These measurements were then converted to meters and kilograms to calculate body mass index. Waist circumference was taken in standing position at the level between the last rib and the iliac crest; hip circumference was taken at the level of the greatest protrusion of the gluteal muscles.

Children’s BMI for-age-percentiles were calculated using standard procedures and standardized tables from the Center for Disease Control. Children were categorized as *normal* if BMI for age was greater than 5% and less than 85%, *overweight* if BMI for
age was greater than or equal to 85% and less than 95%, and obese if BMI for age was greater than or equal to 95%.32 High levels of body fat are associated with increasing health risks. However, no single body fat value, whether measured as fat mass or as percentage of body weight, clearly distinguishes health from disease or risk of disease. The sensitivity of BMI of 85th percentile for identifying the fattest children is good, and, in contrast to more-precise measures of body fat (such as dual-energy x-ray absorptiometry or underwater weighing), health care providers can assess weight and height routinely and easily in a clinical or community setting.32

**Blood Pressure and Heart Rate**

As per National Institute of Health guidelines, blood pressure in children was measured with a standard clinical sphygmomanometer, using a stethoscope placed over the brachial artery pulse, proximal and medial to the cubital fossa, and below the bottom edge of the cuff (about 2 cm above the cubital fossa).109 The child was seated for at least five minutes on a chair with feet on the floor prior to BP assessment. The child’s back was supported and right arm (cubital fossa) was held supported at the heart level.109 Children’s BP standards are based on sex, age, and height for a more accurate classification.109

**The Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) Short Form**

As stated previously, overweight children may demonstrate poorer dynamic balance during play, walking and running activities.3, 4 The BOT-2 is an individually administered performance assessment that measures fine and gross motor skills. This
instrument is intended to be used by clinicians and researchers to screen children four through 21 years of age to support a diagnosis of motor impairment, assist in making placement or program adjustments decisions and to evaluate motor interventions. Eight fine and gross motor subtests are evaluated in this battery including: fine motor precision, fine motor integration, manual dexterity, bilateral coordination, balance, running speed and agility, upper limb coordination and strength. In previous literature, the *inter-rater reliability* has been examined using two examiners and 47 children.

For the purpose of this field study, all 14 items from the BOT-2 *Short Form* version, which is taken proportionally from the complete version were evaluated. These items were divided into 3 testing stations where the child moved along from one testing item to the next, until all fourteen items were completed.

The BOT-2 evaluation tool took approximately 15 minutes to complete. This assessment was completed inside an air conditioned library in the school. View Table 1.7 for a complete list of the 14 testing items in the BOT-2 Short Form. A raw score is obtained for each of the fourteen testing items and then converted to a point score, which allows each item to be evaluated on a graded scale. Point scores from each individual item are then added to obtain the total Short Form point score. Based on this total point score, a standard score and a percentile rank can then be obtained in age and sex specific tables provided in the BOT-2 manual. The type of push up (full or knee) is also identified in the table when obtaining these final two scores.

Number of Curl-Ups performed is one of the items in the BOT-2 short form battery that was analyzed individually as a measurement of trunk (abdominal) strength. The examiner instructed the child to complete as many curl-ups as possible in thirty
seconds. The Curl-Up test has a high degree of test-retest reliability ($r=.97$) among college students. Among younger children (ages 6-10), the reliability is lower but acceptable ($r=.70$).

Number of Push-ups performed is another item in the BOT-2 battery that was analyzed individually as an upper body strength and endurance measurement. The examiner gave the child the choice to complete as many 90 degree Push-ups with or without knees supported in thirty seconds. Specific muscles tested in Push-Ups were the pectoralis major, triceps and anterior deltoid. The intraclass test-retest reliability coefficients for the 90 degree push-up among three separate samples of elementary and high school students ranged from .50 to .86.

**Timed Sit to Stand Test**

The timed Sit to Stand (STS) is a functional performance measure that evaluates lower extremity strength and endurance. Similar to walking, this is a repeated activity that is done throughout one’s activities of daily living. STS can be measured as the number of repetitions performed over a given amount of time (10 or 30 seconds). Our study involved overweight and obese children who may have weak lower extremity strength and impaired lower extremity endurance due to increased body mass. A 60 second STS test was chosen for our study. With the use of an adjustable chair, the starting position of each child was standardized with hip flexion at 90°, knee flexion at 90° (full extension was defined as 0°), feet parallel and flat on the floor, trunk erect, and hands on waist or crossing the chest. The child was asked to stand up and repeat as many cycles of STS as possible at a comfortable speed to the defined standing position in 60
seconds, which required the child’s trunk and lower extremities be fully extended. To date there is no published data on the reliability and validity of the 60-Second Sit to stand test in the pediatric population.

**6-Minute Walk Test (6MWT)**

Overweight children may face musculoskeletal discomforts and deficiencies such as lower extremity pain and decreased trunk and lower extremity strength that consequently impair their mobility.\textsuperscript{3, 4} The 6MWT is a functional performance measurement that evaluates endurance and can easily be administered in school grounds. The object of the 6MWT is to have the child walk as much distance as they can in six minutes.\textsuperscript{116} Concurrent validity was examined among a group of children and adolescents between the ages of 12 and 16 by demonstrating a fair correlation between the 6MWT and maximum oxygen uptakedetermined on the exercise treadmill (r= .44) and the test–retest reliability within a subgroup found the ICC coefficient to be 0.94 (0.89–0.96).\textsuperscript{119}

For this study, the 6MWT was administered on a flat covered corridor with a walking course that measured 100ft. The course was outlined by bright colored cones. Students were instructed to “walk as many laps as they can around the course.” Students were informed how much time was left to their course at one minute intervals. In addition, resting heart rate and blood pressure was recorded before and after6MWT using standard procedures as described previously.
Pain Assessment

Children were given a pain drawing to determine if they were experiencing any musculoskeletal pain during standing, walking, or running activities and if so, the child was asked to quantify their pain on a visual analogue scale. The body outline used was adapted from the body outline format of the McGill Pain Questionnaire.\textsuperscript{120} Body outlines are valuable because children are often more able to communicate through drawings than through verbal responses.\textsuperscript{121, 122} View Pain VAS Questionnaire in Appendix D.

Timed Up and Down Stairs Test (TUDS)

The Timed Up and Down Stairs Test (TUDS) test is a functional mobility outcome measurement that can also be administered on school grounds. The TUDS requires the child to ascend a flight of stairs (12-14 steps) and descend to the starting point as quickly as possible. The final score is the time required to climb and descend a flight of stairs. Adequate reliability and validity has been found with the TUDS test, and scores correlated with functional mobility and balance in the pediatric population.\textsuperscript{123} Intrarater and interrater reliability is good, ICC (2,1)=0.99. The test-retest reliability of the TUDS is good, ICC =0.94.

In this study, the TUDS was performed by the child in a school stairwell. One flight of stairs with a landing was chosen in both schools. Since number of steps per flight of stairs was different for each school, steps per second was calculated instead of the TUDS score. View Appendix E for all performance measurement instructions (excluding BOT2 Short Form).
**Physical Activity Level- StepWatch Step Activity Monitor**

As previously mentioned, cross-sectional and longitudinal studies report mixed results when interpreting the relationship between levels of physical activity and BMI among children.\textsuperscript{54, 57, 58} This may be due to methodological issues related to physical activity assessments. For example, self-report recall of physical activity has its limitations, especially with children, due to their limited concept of time and memory capacity.\textsuperscript{124}

A StepWatch Step Activity Monitor (SAM), provides an objective measurement of a child’s physical activity frequency, intensity and duration.\textsuperscript{126-128} The SAM is a lightweight instrument, worn around the ankle that uses a custom accelerometer linked to a microprocessor to detect and store step counts in user-definable time intervals and it can record data continuously at 1-minute intervals for up to 41 days.\textsuperscript{126} The investigator programmed the monitor with the child’s height using computer software supplied by the manufacturer and uploaded along with the time of day to the SAM through a docking station.\textsuperscript{126} The SAM is programmed prior to sending the subject home. The subject was asked to attach the SAM correctly to the appropriate ankle and wear it daily for seven days.\textsuperscript{126} The SAM was returned and uploaded unto the computer to obtain data activity counts including total steps per day, and total steps and minutes per day of physical activity at different intensities of step activity. Intensity levels were defined as zero step rate (0 steps per minute), low (1-15 steps per minute), medium (greater than 16 steps per minute) and high (greater than 40 steps per minute).\textsuperscript{128} A child running would be considered at a high walking activity level, whereas a child walking slowly would be classified as moderate walking activity level.\textsuperscript{128} Reliability of SAM step measurements
compared with observer counted steps in walking has been documented at \( r = 0.91 \) to 0.99.\(^{126, 127}\) The SAM has been reviewed and validated in children in previous studies.\(^{126, 127}\)

Trost et al. reported that a seven-day monitoring protocol produced reliable estimates of daily participation in moderate to vigorous physical activity in children, \( r = 0.76 \) to 0.87.\(^{129}\) For the primary study, children were fitted with a SAM to wear for a seven day monitoring period in order to capture both week and weekend days. The days on which the monitor was donned and taken off were not analyzed due to incomplete monitoring data. Days with incomplete data were also not included for analysis. Incomplete data was defined as data obtained on days with greater than 3 hours of poor activity monitoring during daytime hours. Children were instructed to remove the SAM only during bathing/showering, and to wear it on their ankle until they go to bed, then to place it back on in the morning. At least two to five complete days from the seven day sampling period were used to estimate average daily physical activity levels. Investigators also piloted a strategy to increase compliance with SAM wear and return by sending a daily text message to participating students to remind them to wear their SAM. SAMs were collected by investigators after seven days.

**Children’s Self-Perception of Adequacy in and Predilection for Physical Activity Scale (CSAPPA)**

The CSAPPA is a 20 item written questionnaire that evaluates a child’s self-perception of adequacy in performing and desiring to participate in physical activities. The questions are equally divided between active and inactive statements. Eight of the statements address adequacy while the remainder address predilection. For each
item, the child must decide between two phrases that best describes them, and select if that description is “sort of” or “really” true for them. The most inactive or inadequate response is scored as 1 while the most active or adequate response receives a 4. The CSAPPA was found to have strong reliability and validity where low scores correlated with less participation in organized and free time activities and being more clumsy. Total test score test-retest reliability among grades 4\textsuperscript{th}, 5\textsuperscript{th} and 6\textsuperscript{th} was r=0.84, among 7\textsuperscript{th}, 8\textsuperscript{th} and 9\textsuperscript{th} graders r=0.90. See Appendix F for CSAPPA questionnaire example.

**Demographics and Parent Reported Physical Activity Survey**

Each child’s parent completed a demographic, medical, and physical activity inventory that included child and parent’s age, gender, ethnic background, child’s past medical history and current medical conditions. They also completed questions related to parent physical activity, child physical activity, child TV viewing and information about physician visits and whether the child was insured. A bilingual interviewer conducted the preliminary screenings and attainment of consents. Medical and physical activity questions were taken using the 2007 National Survey of Children’s Health which is also available in the Spanish version. View physical activity questions (English & Spanish) in Appendix G&H. A summary of the Outcome Measures and their related constructs are available in Table 1.7.

**Blinding:**

All subjects were familiarized with the different surveys and performance measurements in which they participated, however the purpose of the study and test
results were not provided until study completion at their participating school. There were a total of four physical therapists and a number of physical therapy students involved with data collection. Each survey and performance measure was completed by the subject individually and privately to prevent competition among the children. A specific physical therapy student or physical therapist was assigned to each outcome measure for all participating subjects. Survey and performance testing was done in a circuit format and every effort was made to ensure that the same person administered a specific testing item. All personnel involved with data collection were instructed to avoid discussion of results between themselves and participants.

**Procedure/Protocol:**

After consent and assents were explained to child and parent and signed, students completed demographic, musculoskeletal pain and self-efficacy in physical activity questionnaires. Research assistants completed anthropometric assessments including weight, height, waist and hip circumference. Subjects were then guided to each testing station to complete the 6MWT, followed by the TUDS, Sit to Stand Test, and the BOT-2 short form assessment. After careful review by the last rater that all outcome measures were completed the subject including surveys and the physical assessments, subjects were fitted with a step activity monitor for seven days. SAM instructions were provided at this time by a physical therapist. Seven days after the distribution of the accelerometers, subjects returned their device to a study team member who downloaded the SAM input and reviewed the SAM output for possible incomplete data. If the study member found
that the input was incomplete due to donning error by the subject or if the subject forgot to wear the SAM daily, then the SAM was re-administered for another week.

Data Analysis

Statistical analysis was conducted using SAS software, Version 9.1 (SAS Institute Inc., Cary, NC). Descriptive statistics were computed to determine the mean, median and standard deviation for child age, height, weight, grade level, ethnicity, BMI, and BMI for-age percentile. Subjects were categorized as healthy weight, overweight and obese as previously described. Analysis of variance was used to compare differences in motor proficiency (BOT-2), strength (push-ups, curl-ups, STS), endurance (6MWT), musculoskeletal pain (pain assessment questionnaire), and activity limitations (Timed Up-Down Stairs) among children who were at a healthy weight, overweight, and obese. Analysis of variance was calculated to compare differences in moderate to vigorous physical activity levels which includes: 1. minutes in moderate to high activity, 2. high activity only, 3. moderate and high level step counts, 4. total step counts and 5. sedentary time as per SAM data, among the three BMI categories. Due to smaller samples of overweight and obese children, BMI for age percentile categories were further collapsed to two groups, healthy weight versus all overweight. In order to further investigate differences between boys and girls, and between healthy weight and overweight, an independent T-test was used to examine these differences. Analysis of variance was calculated to compare differences in physical activity self-efficacy (CSAPPA score) among children who were non-overweight, overweight, and obese. An independent T-test was also applied to examine differences in CSAPPA responses for each of the twenty
individual items between healthy weight and overweight children. Chi square tests were calculated to examine differences in parent physical activity, child physical activity, child TV viewing and information about physician visit and whether the child was insured. Pearson product-moment correlations were computed to examine relationships between children’s BMI tile and motor proficiency, strength, endurance, presence of musculoskeletal pain, SE and physical activity levels in children who were at a healthy weight and children who were overweight/obese.

Results

A total of 86 subjects participated in the study, 47 male (55%) and 39 females (45%). Subjects were an average of 12 years old, with a range from 10 to 15 years of age. Forty-two percent, 34%, and 24% were in the 6th, 7th and 8th grade respectively. Seventy-eight subjects (92%) reported to be of Hispanic ethnicity. BMI percentile ranged from 7% to 99.3%. Fifty-five percent were classified as healthy weight, 23% overweight and 22% obese. There was no statistical difference in age among the three BMI percentile categories. Resting and post exercises vital signs were not statistically different among children in the three categories except for resting systolic blood pressure which was significantly higher among obese children, (109 vs 112 vs 118, p<.05). A further analysis using chi-square statistics identified 53% of obese children as pre-hypertensive in comparison to 22% and 20% of healthy weight and overweight children, p=.032. Refer to Table 3.1 for subject characteristics and vital signs results.

The first objective of the study was to examine differences in motor proficiency (BOT-2), strength (push-ups, sit-ups, STS), musculoskeletal pain, endurance (6MWT),
and TUDS among the three BMI for age percentile categories. For all impairment measures except for TUDS, healthy weight children performed better than overweight children who performed better than obese children. Compared to healthy weight children, overweight and obese children had significantly lower BOT-2 short form percentile scores (33% vs 29% vs 17%, p=.005). The mean standardized score for the BOT-2 was 43.77 (SD= 6.1) and is at approximately the 28th percentile. Most of the children (68.4%) that were categorized as obese, scored less than 17% in the BOT-2 which is interpreted as below average. There were no significant differences between girls and boys in motor proficiency percentile ranks or any of the impairment performance measurements. Refer to Table 3.2 for BOT-2 percentile rankings.

Obese children also performed fewer curl-up repetitions (5.4 vs. 9.3 vs. 9.7, p <.001) and STS repetitions (23 vs. 26 vs. 27, p=.045) than overweight and healthy weight children. 6MWT were also different among the three groups with obese children walking the least distance (598m vs 568m vs 552m, p=.033). Push-ups differences showed similar trends, but differences were not statistically significant. TUDS differences were not significant and no clear trend was observed. Following post hoc testing, significant differences were between healthy weight and obese children. Refer to Table 3.2 for Impairments and Activity Limitation results.

The second objective was to compare duration, intensity and frequency of physical activity using a step activity monitor and compare physical activity between the three groups. Physical activity was examined for a weekly (weekday and weekend), and weekdays only average. Weekend data was omitted from analysis since number of days with SAM varied considerably among this cohort, ranging from 0-2 days. Statistically
significant differences among healthy weight, overweight, and obese children were not found for total step counts and sedentary time means as measured by the SAM. However, trends were observed where obese and overweight children’s step counts were lower when compared to healthy weight children for weekly (11,977;12,187 vs 13,240 steps/day, p = .358). A similar trend was observed for sedentary time, where obese children spent the most time sedentary (1,039;1039 vs 1,012 min/day, p = .217). SAM weekly physical activity data results including steps and minutes in moderate to high activity are presented in Figure 3.1-3.2.

When overweight and obese children were combined, there were significant differences in weekday only physical activity between overweight (overweight and obese) versus healthy weight children. Weekday only data for total daily step count means (12,848 vs 14,214, p = .043), and high-step means (4,520 vs 5,378, p = .050) were lower and minutes in sedentary time (1,016.3 vs 986.18, p = .038) was higher for overweight children. Refer to Table 3.3 for Weekday only physical activity level results.

In addition, physical activity counts were examined for gender differences. Girls had lower physical activity levels for all intensities, decreased total step counts (10,668 vs 13,969 steps, p < .001) and higher sedentary time than boys (1052.1 vs 1010.5 minutes, p < .001). These results are presented in Figure 3.3 and 3.4. Significant differences in steps and minutes in high activity levels were demonstrated between the healthy weight and obese group in boys only, (5560 vs 4237 steps, p = .03 and 56 vs 43 minutes, p = .04). Although physical activity in all intensities including total step counts appeared to be greater among healthy weight girls when compared to obese girls, differences were non-significant (9579.8 vs 7444.4 steps, p = .175).
The third objective was to examine differences in self-efficacy (CSAPPA total scores). Subjects did not demonstrate differences in total Self-Efficacy scores among the 3 groups. However, when analyzing each of the twenty items individually, scores for one question pertaining to adequacy (last chosen for active games) and the other for predilection (like to take it easy during recess) were lower for overweight children when compared to healthy weight children, (2.67 vs 3.02, p=.05) and (2.8 vs 3.29, p=.02). Refer to Table 3.2 for Self-efficacy total score results.

The fourth objective was to examine differences in parental health behaviors and children’s participation in sports and leisure activities using a parent activity questionnaire. Most of the items in the parent activity questionnaire showed no difference between groups except for child sport participation within the last year. Obese children were less likely to have participated in organized sports when compared to overweight and non-overweight children (14.29% vs 62.50% and 44.44%, p=.02). A greater percentage of parents of healthy weight children reported that their child watched more than two hours of television during school nights when compared to the parents of overweight and obese children. Only 27% of parents of obese children reported to engage in at least 30 minutes of physical activity at least three times a week, compared to 44% and 63% of parents of healthy weight and overweight children. Parent’s physical activity levels and questions pertaining to child’s current engagement in physical and leisure activities are presented in Table 3.4.

The final objective was to examine relationships between BMI, impairments, activity limitations, physical activity, and self-efficacy in children who are overweight versus healthy weight. In overweight children, BMI for-age percentile showed a moderate
negative correlation to the BOT-2 percentile scores ($r=-.47$, $p=.003$) and a fair negative
correlation to STS ($r=-.36$, $p=.024$), and total curl-ups ($r=-.33$, $p=.041$). No associations
were found between children’s BMI percentile and physical activity.

BMI for age percentile had a fair negative correlation with only one of the twenty
questions in the Self-Efficacy questionnaire which pertained to predilection (having fun
while playing sports) ($r=-.33$, $p=.03$) among overweight children. No correlations between
any impairment outcome measures and BMI percentile were observed among healthy
weight children except for self-efficacy, which had a fair positive association, ($r=.43$, $p=
.004$). Refer to Table 3.5 for BMI percentile and impairment correlation results.

**Discussion**

The results of this study indicate that obese children have impairments in motor
proficiency, strength, endurance and activity limitations when compared to healthy
weight children. Children who are overweight, but not obese, tend to perform better than
obese children, but not as well as healthy weight children, but these differences are not
statistically significant in most cases. In addition, higher BMI for age percentile had a
negative moderate correlation with motor proficiency, trunk and lower extremity
strength. These associations between BMI for age percentile and impairment
performance measurements were not observed in healthy weight children.

When examining motor proficiency, the mean percentile for healthy weight
children in this sample was 33%, indicating an average ability in motor proficiency while
obese children’s mean BOT-2 percentile was only 17%, classifying them as below
average.$^{114}$ Furthermore, higher BMI for age percentile was associated with lower scores
on the BOT-2 in children who are overweight. Similar negative associations between childhood obesity and motor proficiency has been found by Graf et al.\textsuperscript{39} Wrotniack et al. also found negative associations between z-BMI and motor proficiency in non-obese children.\textsuperscript{41} The results of this study further support the inverse associations between BMI for-age percentile and motor proficiency in Hispanic children who are overweight. Obese children with poor mastery of movement skills required for physical games and sports may be less likely to engage in these physical activities and subsequently choose a more sedentary lifestyle. Therefore, a physical therapist assessment of their motor proficiency may identify weaker movement skills that are often the foundation of many adult related physical activities. Further training and development of an obese child’s motor proficiency may facilitate participation in physical activities and sustain these behavioral changes because of improved skill and ease of movement.

Trunk and lower extremity strength differences were observed between obese and healthy weight children, where obese children performed fewer curl-ups (5 vs 9 reps, p=.001) and 60 second sit-to-stand repetitions (23 vs 27 reps, p=.045). There was also a fair negative relationship between abdominal and lower extremity strength and BMI for age percentile among overweight children only. These results support previous findings that abdominal strength and stamina were found to be compromised among obese children.\textsuperscript{46} The latter is supported by previous research by Almuzaini, where an inverse relationship was found between knee extensor endurance and BMI among children.\textsuperscript{44} Strength deficiencies in trunk and lower extremity may place obese children at a disadvantage when performing activities of daily living and particularly when learning new tasks. Furthermore, deficiencies in trunk and lower extremity strength in this
population may further contribute to musculoskeletal fatigue and increase risk of injury. These strength deficiencies in obese children should be addressed in order to reduce potential complaints of musculoskeletal pain, back injury and movement difficulties related to physical activities.

Although not statistically significant, child reported complaints of musculoskeletal pain with physical activity were greater among obese and overweight children when compared to healthy weight children (20%, 29% vs 15%, p = .504). Greater prevalence of musculoskeletal pain among obese and overweight children is another barrier towards physical activity participation. These results further confirm the need of a physical therapy assessment to address exercises and physical activity modifications due to musculoskeletal pain.

There were no differences in TUDS speed among overweight and healthy weight children. This may have been observed because lower extremity strength deficits are often observed among overweight children when there is an endurance component as well. In both schools selected for this study, the flight of stairs used for the TUDS test is accessed by children who participated in the study on a daily basis. Therefore, the muscular endurance component for this functional activity limitation test was minimized. One flight of stairs may not have been sufficient to detect differences among these three groups of children. In addition, the TUDS finding agrees with the report by Maffiuletti, where obese adolescents produced greater absolute isokinetic and isometric torque at short quadriceps muscle length such as alternating step over step in stair climbing such as in the TUDS test but not at long muscle length such as performed from sitting to standing compared to healthy weight adolescents.
Obese children walked an average of 150 meters less than healthy weight children in the 6MWT reflecting a slower walking speed and poorer activity tolerance. Similar observations were reported in a study by Geiger et al., where the 6MWT distance was significantly less among overweight children when compared to non-overweight children pre weight-loss intervention.\textsuperscript{116} This decrease in endurance may contribute to increased fatigue during physical activities. However, no significant correlations between BMI for age percentile and 6MWT distance in overweight children were observed.

To our knowledge, this is the first study to objectively examine and compare physical activity levels and intensities among Hispanic healthy weight, overweight and obese children using a StepWatch activity monitor. We had a SAM compliance rate of 86\% among the middle school children in this study which required physical activity data for at least two full days out of a seven day monitoring period. Mcdonald et al., found slightly better, 87\% compliance rate with the SAM, which was defined as at least 1 day of complete SAM data collection from a 3 day monitoring period.\textsuperscript{126} The results of this study indicate that total steps taken per day by middle school children in this sample were not enough to meet BMI-referenced standard cut points recommendations for maintaining a healthy weight range for 6- to 12-year-old girls and boys (10,668 and 13,969 steps versus recommended levels of 12,000 and 15000 steps).\textsuperscript{53} Furthermore, only 24\% of obese children met these recommendations compared to 32\% of healthy weight children. Levels of physical activity as measured by a step activity monitor seem to be greater among healthy weight children than in children who are overweight. These results are consistent with another cross sectional study investigating physical activity and obesity among Hispanic children.\textsuperscript{56} Number of steps in high intensity was statistically significant
greater among non-overweight versus overweight children, indicating the importance of physical activity intensity recommendations.

Minutes in medium and high activity were higher among healthy weight children when compared to overweight and obese children, however differences did not reach statistical significance. However, these trends demonstrate a dosage response to physical activity. Current CDC recommendation for physical activity among all children is 60 minutes of moderate-to-vigorous physical activity daily. Children in this sample averaged well above the recommended duration, 151 minutes and 147 minutes for healthy weight and overweight children. However, duration spent in vigorous activity was 44 and 39 minutes. It is plausible that high intensity physical activity may have greater health benefits among children. Greater improvements in cardiovascular endurance have been found when training in physical activities at vigorous intensities. It may be necessary to consider recommending higher intensity of physical activity with greater sustained duration for children in this age range for improved health benefits.

Sedentary duration was also greater during weekdays among healthy weight children versus overweight children. The predominant sedentary behavior among American children is television viewing, leading to higher BMI percentiles and being overweight. In our parent report survey, 45% of the children watch more than the recommended levels of 2 hours of television per day. Although there were no statistical differences among healthy weight and overweight children, a greater percentage of healthy weight children are watching more than 2 hours of television, (55% versus 33%). This finding is of alarming concern since adolescents that watch more than 2 hours of
television a day are twice as likely to be overweight at three year follow-up,\textsuperscript{139} thus adding to the national obesity epidemic. Efforts to decrease sedentary duration among children and adolescents should continue and emphasis should be placed on reducing television time.\textsuperscript{139} Reducing number of televisions in the household and removing TVs from the child’s bedroom may be considered in an effort to reduce TV viewing duration.

We also confirmed that Hispanic boys demonstrate overall greater physical activity when compared to girls. This finding is consistent with a previous 1991-2007 National Institute of Child Health and Human Development Study of Early Child Care and Youth Development, where girls demonstrated MVPA levels below the recommended 60 minutes by age 13.1 and boys by age 14.7.\textsuperscript{55} Girls also spent a greater amount of minutes in sedentary time when compared to boys.

It is possible that our study did not find statistical associations between children’s physical activity levels or sedentary time and BMI percentile possibly due to insufficient power. Despite the fact that afterschool leaders at participating schools were instructed on the importance of having participating students wear their SAMs daily and reminded students to wear them, physical activity data was available for only 72 out of 86 children (86\%) due to either improper donning of SAM or noncompliance with daily wear of SAM by the child. Furthermore, the relationship between physical activity and increase BMI percentile has been previously inconsistent due to physical activity assessment limitations.\textsuperscript{140} Future studies with the SAM should incorporate greater incentives to improve SAM compliance by children.
Self-efficacy is an important correlate of physical activity and it has also been found to be associated with motor proficiency scores among children. Although in our present study, differences for several physical activity variables and motor proficiency among healthy weight and overweight children were observed, there were no differences in self-efficacy total scores among the three weight categories as measured by the CSAPPA instrument. However, when examining CSAPPA items individually, scores for the statements (last chosen for active games) and (like to take it easy during recess) were significantly greater among healthy weight children when compared to overweight children. BMI percentile also had a fair negative correlation with only one of the twenty questions in the Self-Efficacy questionnaire which pertained to predilection (having fun while playing sports) among overweight children. This may indicate that physical activity self-efficacy may be evolving in this age range and therefore differences were not observed. There may also be other factors besides self-efficacy in physical activity that influence overweight children in this sample. For example, it appears that neuromuscular strategies maybe a more important mediator for physical activity among overweight children.

Importantly, obese children participated in organized sports significantly less when compared to healthy weight and overweight children. This coincides with our findings that overweight children are spending more time in sedentary activities during weekdays. Practices for organized sports are traditionally held during the week and game days are alternated during the week and weekend. It is plausible that when children are not engaged in weekday sport activities they are watching television. Furthermore, obese children in our sample have impaired motor proficiency when compared to healthy
weight children. This deficiency in motor proficiency is relevant since these gross motor skills are often requirements for movement skills used in organized sports. Obese children may be avoiding participation in organized sports because of movement difficulties, hence becoming more sedentary.

Parents in this sample were also relatively inactive, only 27% of parents of obese children indicated that they participated in 30 minutes of physical activity at least three times a week compared to 45% of parents of healthy weight children. For greater success in healthy lifestyle for children, parents should be encouraged to be positive role models and engage in habitual physical activity.

This study is an example of how physical therapists can be involved in the prevention and assessment of childhood obesity within a school-based population. As stated previously, obese children are engaging in less physical activity and organized sports than their healthy weight peers, possibly due to the impairments identified in this study. An initial screening of an obese child’s impairments by a physical therapist may result in treatment recommendations. Assessment and treatment of an obese child’s motor proficiency, musculoskeletal strength and endurance deficiencies may enable an obese child with improved skills to learn new tasks for greater participation in either sport related or non-sport related physical activity. Obese children may improve their movement skills with individualized or small group motor proficiency training by a physical therapist and by accessing opportunities to practice their skills. Initial training may start with non-weight bearing activities such as bicycling and swimming that move large muscle mass without discomfort and reduce potential of musculoskeletal injury.
Training may include balance beam walking, single leg stance balance training, obstacle course maneuvering while walking fast or jogging and dancing.

According to the American Physical Therapy Association’s Vision Statement 2020; Physical therapist will be recognized as healthcare professionals with direct access by consumers and the leading experts for the diagnosis, intervention, and prevention of impairments, functional limitations, and disabilities related to movement, function, and health.\textsuperscript{72} The Guide to Physical Therapist Practice elucidates the role of the physical therapist in the Prevention and the Promotion of health, wellness and fitness in the context of the disablement model.\textsuperscript{73} Obesity is identified as one of the risk factors for cardiovascular, pulmonary and integumentary disorders. Primary prevention strategies prevent disease in a susceptible or potentially susceptible population through specific measures such as general health promotion efforts.\textsuperscript{73} Physical therapists must identify risk factors and behaviors that may impede optimal functioning. The pediatric physical therapist must be proficient in identifying related measurements such as the child’s BMI for-age percentile on the CDC growth chart along with possible balance, endurance, posture or strength deficits in order to fulfill the goal of health promotion in at-risk groups.

As stated previously, participating children and parents in this screening were given a summary of findings related to physical fitness and physical performance testing and were given the opportunity to discuss these findings with a licensed physical therapist. Participants were informed through an individualized summary report on their physical fitness, motor proficiency BMI for-age percentile results. Parents were made aware of possible neuromusculoskeletal deficiencies and their child’s BMI for age percentile.
Although this was only a screening, there was an opportunity to begin a dialogue with parents about their own healthy eating and physical activity habits following the screening. Future work may incorporate inexpensive height and weight screening tools and accessible impairment screening instruments for health and wellness evaluation by a physical therapist with parental involvement. Parents may be contacted at pre and post screening to discuss possible cardiovascular or motor proficiency concerns. Follow-up interviews with parents should be incorporated as well to discuss potential benefits of the child screening.

There are some limitations that must be considered when interpreting the results of the current study. Although the *National Survey of Children’s Health* is a common and widely used measurement of behavioral and health assessment, the self-report nature of this instrument may result in underreporting of at risk behavior and over-reporting of physical activity. In addition, behavioral characteristics of parents and students that choose to participate in this type of screening may not be characteristic of the average overweight child and their parent. Children wore the step activity monitors on a volunteer basis. We also had an 86% compliance rate for the step activity monitors. Children who were not as active may have chosen not to participate in this step of the screening. In addition, children of Hispanic ethnicity residing in Miami-Dade County may have very different backgrounds from Hispanic children in other regions of the United States; therefore, results may not be generalizable to the entire pediatric overweight and obese population. Most children in this data were also in an after-school care and programs varied from homework assistance to music instruction to outdoor play activities. These activities were not accounted for in this study. Further work in school-based screening...
should take into consider types of programs that children are involved in after-school. Finally, results from this study and previous correlational studies described above stem from cross-sectional study designs that indicate an interrelationship between physical activity, motor proficiency and BMI. One must also consider that being less physically active may make you more overweight, an increase in weight may make you less proficient in your motor abilities. Future study recommendations would include a longitudinal examination to best explain the direction of causality for these variables.

Conclusion

The findings of this study indicate that there are deficiencies in motor proficiency, endurance, lower extremity and trunk strength among Hispanic obese children when compared to healthy weight children. These impairments may limit their ability to participate in the recommended levels of physical activity. Our study also found that overweight children were engaging in less physical activity when compared to their healthy weight peers. Both overweight and healthy weight Hispanic girls are engaged in less physical activity and greater sedentary duration when compared to boys. The findings of this study have important clinical relevance for physical therapists since motor proficiency and muscular strength are within the realm of our practice. These identified deficiencies in overweight and obese children need to be addressed and may require intervention by a physical therapist. Addressing motor proficiency, trunk and lower extremity musculoskeletal strength and endurance in overweight and obese children may enable them to successfully integrate into daily physical activity and sport participation. Physical therapists are uniquely qualified to assess the need for modifications in activity
and exercise for children with musculoskeletal impairments and mobility limitations. School-based screenings performed by a physical therapist such as the study described may be accessible to most children and result in either intervention, consultation or a referral. Physical therapists may further strengthen the evidence for the management of childhood obesity with these comprehensive outcome measures and thus providing further understanding of minority health behavior practices. Finally, physical therapists may play an important role as part of the multidisciplinary team working towards reaching the main objectives of the World Health Organization’s Global Strategies on Diet, Physical Activity and Health which include 1. Reduce risk factors for chronic diseases that stem from unhealthy diets and physical inactivity through public health actions. 2. Increase awareness and understanding of the influences of diet and physical activity on health and the positive impact of preventive interventions. 3. Develop, strengthen and implement global, regional and national policies and action plans to improve diets and increase physical activity that are sustainable, comprehensive and actively engage all sectors, and 4. Monitor science and promote research on diet and physical activity.
Table 3.1 Characteristics of Healthy Weight (5th-84th percentile), Overweight (85th-94th percentile), and Obese (≥95th percentile) Middle School Children.

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>Healthy weight</th>
<th>Overweight</th>
<th>Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>47 (54.65%)</td>
<td>20 (23.26%)</td>
<td>19 (22.09%)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>24</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Girls</td>
<td>23</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td><strong>BMI (kg/m²)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>18.90 (±1.72)</td>
<td>23.90 (±1.33)</td>
<td>28.71 (±3.66)</td>
</tr>
<tr>
<td><strong>Waist/Hip ratio</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>0.81 (±0.05)</td>
<td>0.85 (±0.05)</td>
<td>0.89 (±0.05)</td>
</tr>
<tr>
<td><strong>Age (years old)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>12.3 (±0.95)</td>
<td>12.4 (±0.93)</td>
<td>11.9 (±1.10)</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6th</td>
<td>24</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>7th</td>
<td>14</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>8th</td>
<td>19</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>42</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Rest HR</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>80.30 (±12.61)</td>
<td>77.90 (±10.63)</td>
<td>81.00 (±12.82)</td>
</tr>
<tr>
<td><strong>Rest BP systolic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>109.35 (±11.21)</td>
<td>112.15 (±11.46)</td>
<td>118.11 (±10.78)</td>
</tr>
<tr>
<td><strong>Rest BP diastolic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>69.83 (±12.61)</td>
<td>66.45 (±8.85)</td>
<td>69.00 (±12.51)</td>
</tr>
</tbody>
</table>

*=p<.05.
Table 3.2 – Physical performance measures and Self-Efficacy results (mean values and P-values of Healthy Weight (5–84th percentile), Overweight (85th–94th percentile), and Obese (≥95th percentile) Middle School Children.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Healthy Weight mean (sd) n=47</th>
<th>Overweight mean (sd) n=20</th>
<th>Obese mean (sd) n=19</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit-to-stand</td>
<td>27.25 (+/-6.9)</td>
<td>26.5 (+/-5.1)</td>
<td>23.1 (+/-4.6)</td>
<td>.0451</td>
</tr>
<tr>
<td>(repetitions in 1 minute)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOTS2 shortform</td>
<td>33.09 (+/- 18.6)</td>
<td>29.25 (+/-17.8)</td>
<td>17.06(+/-10.04)</td>
<td>.0051</td>
</tr>
<tr>
<td>(score percentile)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Minute Walk</td>
<td>597.53 (+/-60.59)</td>
<td>568.3 (+/-80.82)</td>
<td>552.28 (+/-64.75)</td>
<td>.0341</td>
</tr>
<tr>
<td>(meters)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TUDS</td>
<td>2.02 (+/- .52)</td>
<td>2.09 (+/- .59)</td>
<td>1.8 (+/- .52)</td>
<td>.2111</td>
</tr>
<tr>
<td>(steps/second)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curl-ups</td>
<td>9.7 (+/-2.96)</td>
<td>9.3 (+/-5.26)</td>
<td>5.4 (+/-4.2)</td>
<td>.0011</td>
</tr>
<tr>
<td>Push-ups</td>
<td>10.86 (+/-6.56)</td>
<td>11.2 (+/-6.71)</td>
<td>8.8 (+/-6.83)</td>
<td>.4921</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>62.25 (+/-9.19)</td>
<td>66.89 (+/-7.84)</td>
<td>63.52 (+/-11.67)</td>
<td>.1531</td>
</tr>
<tr>
<td>(self-report)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of musculoskeletal pain with</td>
<td>14.81%</td>
<td>29.41%</td>
<td>20.0%</td>
<td>.5042</td>
</tr>
<tr>
<td>physical activity (Self-report)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. p value for differences between healthy weight vs. overweight vs obese (≥95th percentile), ANOVA
2. x²test
Figure 3.1 – Weekly (Weekday + Weekend) Average Minutes Spent in Moderate and High Activity per Day

\[\text{minhi} = \text{minutes spent at step rate} > 40 \text{ steps per minute.} \]
\[\text{minmod} = \text{minutes spent at step rate} > 16 \text{ steps per minute.} \]
\[\text{minsed} = \text{minutes spent at step rate} 0 \text{ steps per minute.} \]
Figure 3.2 – Weekly (Weekday + Weekend) Average for Total Step, Steps Taken at Moderate and High Activity Levels per Day

<table>
<thead>
<tr>
<th>Activity Level</th>
<th>Obese</th>
<th>Overweight</th>
<th>Healthy Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steptot</td>
<td>11977</td>
<td>12187</td>
<td>12760</td>
</tr>
<tr>
<td>Stepmmod</td>
<td>9375</td>
<td>9572</td>
<td>9971</td>
</tr>
<tr>
<td>Stephi</td>
<td>3583</td>
<td>4115</td>
<td>4456</td>
</tr>
</tbody>
</table>

steptot = total number of steps taken at low (1-15 steps per minute), moderate (> 16 steps per minute) and high step (>40 steps per minute) rates.

stepmmod = number of steps taken at step rate > 16 steps per minute

stephi = number of steps taken at step rate >40 steps per minute
Table 3.3 – Weekday Physical Activity Measures for Healthy weight (≤85th percentile), Overweight (85th to 94th percentile), and Obese (≥95th percentile) as measured by the Step Activity Monitor (SAM)

<table>
<thead>
<tr>
<th>Step Activity Monitor</th>
<th>Number of Subjects (n)</th>
<th>Healthy-weight Mean (SD)</th>
<th>Overweight Mean (SD)</th>
<th>Obese Mean (SD)</th>
<th>Healthy, Overweight and Obese Group Difference p-value</th>
<th>Overweight and Obese Group Difference p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total daily steps</td>
<td>n=36</td>
<td>14,214 (3537)</td>
<td>13,186 (2682)</td>
<td>12,511 (2749)</td>
<td>.33</td>
<td>12,848 (2690)</td>
</tr>
<tr>
<td>Moderate daily steps</td>
<td>n=15</td>
<td>11,317 (3616)</td>
<td>10,493 (2295)</td>
<td>9,848 (2524)</td>
<td>.45</td>
<td>10,171 (2392)</td>
</tr>
<tr>
<td>High daily step</td>
<td>n=15</td>
<td>5,277 (2692)</td>
<td>4,866 (1402)</td>
<td>4,175 (1254)</td>
<td>.29</td>
<td>4,520 (1353)</td>
</tr>
<tr>
<td>Daily minutes of</td>
<td>n=15</td>
<td>167 (44)</td>
<td>156 (33)</td>
<td>152 (40)</td>
<td>.60</td>
<td>154 (36)</td>
</tr>
<tr>
<td>moderate intensity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily minutes of</td>
<td>n=15</td>
<td>53.55 (26)</td>
<td>49 (14)</td>
<td>43 (13)</td>
<td>.38</td>
<td>46 (13)</td>
</tr>
<tr>
<td>high intensity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily minutes of</td>
<td>n=15</td>
<td>986 (58)</td>
<td>1009 (82)</td>
<td>1023 (77)</td>
<td>.23</td>
<td>1,016 (78)</td>
</tr>
<tr>
<td>sedentary activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant differences between healthy weight and overweight (all ≥85th percentile)
Figure 3.3 – Boys vs Girls Weekly (Weekday + Weekend) Average for Total steps and Steps taken at Moderate and High Activity Levels per Day

\[\text{steptot} = \text{total number of steps taken at low (1-15 steps per minute), moderate (> 16 steps per minute) and high step (>40 steps per minute) rates.}\]

\[\text{stepmod} = \text{number of steps taken at step rate > 16 steps per minute}\]

\[\text{stephi} = \text{number of steps taken at step rate >40 steps per minute}\]

\[p < 0.001 \text{ for all comparisons}\]
Figure 3.4  – Boys vs Girls Weekly (Weekday + Weekend) Average for Minutes Spent in Moderate and High Activity per Day

\[
\begin{align*}
\text{minhi} &= \text{minutes spent at step rate } >40 \text{ steps per minute.} \\
\text{minmod} &= \text{minutes spent at step rate } >16 \text{ steps per minute.} \\
\text{minsed} &= \text{minutes spent at step rate } 0 \text{ steps per minute.} \\
p &< 0.001 \text{ for all comparisons}
\end{align*}
\]
Table 3.4 – (All Children) Parent Reported PA levels, Health Care Coverage, complaints of pain. (mean values and P-values of healthy-weight and overweight/obese children)

<table>
<thead>
<tr>
<th>Question</th>
<th>Healthy Weight</th>
<th>Overweight</th>
<th>Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child watches &gt;2 hours/day of TV, videos, video game, + (non-school related computer time)</td>
<td>55%</td>
<td>45%</td>
<td>26%</td>
</tr>
<tr>
<td>Child performs 60 min. of Moderate PA ≥ 5 days/week</td>
<td>44.44%</td>
<td>50.00%</td>
<td>35.71%</td>
</tr>
<tr>
<td>Child has participated in organized sports in last 12 months*</td>
<td>44.44%</td>
<td>62.50%</td>
<td>14.29%</td>
</tr>
<tr>
<td>Parent report 30 min. of PA ≥ 3 day/week</td>
<td>44.12%</td>
<td>64.29%</td>
<td>27.27%</td>
</tr>
<tr>
<td>Child has been without health insurance coverage for last 12 months</td>
<td>8.33%</td>
<td>18.75%</td>
<td>7.14%</td>
</tr>
<tr>
<td>Child has not seen a health care practitioner in last 12 months</td>
<td>8.33%</td>
<td>6.25%</td>
<td>14.29%</td>
</tr>
</tbody>
</table>

*p for chi-square=.023,
| Variables                  | Healthy weight (5\textsuperscript{th}-84\textsuperscript{th} percentile) (n=47) | | Overweight (≥85\textsuperscript{th} percentile) (n=39) | |
|---------------------------|---------------------------------------------------------------------------------|---|-----------------------------------------------------------------|
|                           | r                                | p  | r                                | p  |
| Sit-to-stand (repetitions in 1 minute) | r = .04                         | .772 | r = -.36\textsuperscript{b}     | .024 |
| BOTS2 shortform (score percentile)   | r = .06                         | .696 | r = -.47\textsuperscript{b}     | .003 |
| 6 Minute Walk Test (feet)        | r = .251                        | .096 | r = -.18                         | .279 |
| TUDS (steps/second)              | r = -.16                        | .287 | r = -.27                         | .095 |
| Curl-ups                    | r = .27                         | .076 | r = -.33\textsuperscript{b}     | .041 |
| Push-ups                     | r = .04                         | .789 | r = -.15                         | .373 |
| SE                          | r = .43                         | .004 | r = -.19                         | .258 |
| Pain (VAS)                   | r = -.08                        | .669 | r = -.02                         | .902 |
Chapter 4. SUMMARY AND CONCLUSION

Physical therapists have the potential to positively contribute to the management of the childhood obesity, but there is a paucity of physical therapy related research in this area. Given this lack of evidence, and the pressing need for effective obesity interventions for minority children, the purpose of the preliminary study was to test the feasibility and examine outcomes of a 12-week extracurricular family-based physical therapy–led intervention for the management of obesity in minority children. The intervention, designed for this study, was entitled Kids Eat Better & Move More (KEBMM).

In addition, objective measurements of impairments and physical activity levels are scarce in this population, often relying on self-report measures. Previous studies have indicated a relationship between obesity, motor proficiency and physical activity, specifically a negative correlation between BMI and motor proficiency and BMI and strength. However, additional work was needed to clarify this relationship among middle school children of different ethnic backgrounds. A better understanding of obesity related impairments and activity limitations may assist in the design and implementation of effective strategies to increase physical activity levels. More effective strategies to increase physical activity may decrease obesity among a population of children that are most at risk. Therefore, the purpose of the primary study was to compare impairments, activity limitations and physical activity using validated measurement tools among Hispanic overweight (BMI >85th percentile), obese (BMI >95th percentile) children and healthy weight children (BMI between 5th and 84th percentile). The objectives of this report were 1) to examine differences in motor
Specific Aim 1: To describe the feasibility and outcomes of a 12-week extracurricular family-based intervention led by physical therapists that was designed to increase physical activity in three Hispanic male children in middle-school.

A 12 week extracurricular family-based intervention led by a physical therapist has limited feasibility and can increase physical activity levels for overweight Hispanic middle school children. The three subjects in this study demonstrated a substantial increase in the number of steps taken per day by the 12th week, with an average increase of 2,509 steps or 33%. Children also demonstrated an average decrease of 8 mm Hg in resting systolic BP after 12 weeks. For the three subjects who completed the program, all attended 100% of the sessions. Parents of the three subjects attended an average of 90% of the weekly group sessions.

Step increases were equivalent to walking an average of an additional 1.5 miles per day. In addition, we demonstrated that a low cost intervention of a pedometer, which
costs approximately ten dollars each, can improve physical activity behavior. This intervention can be completed without expensive equipment and implemented almost anywhere. These findings suggest that it is possible to realize meaningful benefits from a low cost extracurricular program such as the one described here. The program’s estimated cost of $65/student included a pedometer for both child and parent, weekly healthy snack for demonstrations, and home worksheets for 12 weeks. The researchers were not reimbursed for their time, which averaged about 4 hours/week for preparation and implementation. The measurement tools included low cost equipment such as stop watches, measurement tape, cones and portable exercise mats.

Implementing programs that encourage sedentary persons, such as the subjects in this study, to become more active rather than targeting already active persons becoming even more active could create substantial public health benefits through wide spread implementation of this intervention, by providing an opportunity to raise health and wellness awareness for both parent and child. An increase in physical activity is an important health outcome because it often precedes a change in fitness, which is more difficult to observe in short-term interventions. Outcomes from this study delivered similar results to the CATCH and CATCH After-School program in which physical activity was significantly increased in participants. The KEBMM program was superior to the CATCH After-School program in that the intervention was individualized for each child. Physical fitness as measured by the FITNESSGRAM and physical activity levels as measured by a pedometer were assessed prior to intervention. Based on these assessments individual exercises and step goals were made for each child. Step goal assessments were modified on a weekly basis. Parents were also active participants in this
study, attending most of the 12 weekly sessions with their child thus providing ample opportunities to discuss potential physical activity barriers with a physical therapist. This program used concepts and strategies from previous health and wellness research and from behavioral change theoretical models such as the Social Cognitive Theory and Self-Regulation through Goal setting.

The promising results of the KEBMM Program must be balanced against several disadvantages. The program yielded considerable interest from parents, however obtaining commitment to participate was difficult. We observed difficulties with the scheduling of both parents and children for the afterschool intervention since all parents involved had full-time jobs. In general, there were difficulties in recruiting both parents and children to attend the program on a regular basis. The evening times were selected by the investigators to facilitate working parent participation, however it was also noted by some parents that this was close to dinner time or they had other children at home to take care of. Another obstacle to recruitment of children that already participated in afterschool programs was that parents and children either had to return to school shortly following their after-school pick-up time or the children had to stay after school for over 3.5 hours to participate in the KEBMM program. In addition, retention and attendance was mixed among all subjects. Initially, six parents signed up for the intervention and only three subjects remained for the 12 week duration. The three subjects presented here had over a 90% attendance rate, however the other three participants attended about 50% of the sessions and did not complete final testing. Therefore, we were unable to compare high attendees to low attendees. Parents that did not continue with the intervention were contacted and explained that the timing of the program interfered with child’s homework
responsibilities. These scheduling complications exemplify the difficulties that working parents have in finding time to exercise, and helping their children find time to exercise. This low retention of participants presents a serious drawback and demands a more in-depth examination to reduce attrition. Future work for programs that target parents and children should include a focus group with parents to improve retention.

As a research study, this project also had limitations. As the present study was mainly designed to test the feasibility of KEBMM, there was no control group. The pre-post design inherently raises questions about internal validity. As with limitations in previous school-based interventions implemented in local communities, small sample size from specific demographic groups may not be representative of students as a whole. In addition, behavioral characteristics of parents and students that volunteer in this type of intervention may not be characteristics of the average overweight child and their parent.

Future work in this area should include an examination of outcome measure and screening tools that examine potential body impairments that limits an obese child’s participation in physical activities. Health and wellness interventions should also be individualized for children and parents. It should also incorporate a multi-disciplinary approach to address diet, physical activity and possible counseling needs. Since the attrition rate in this study was especially high for girls, a physical activity intervention should also focus on activities that appeal to girls as well such as dance or whole body video games. For boys, team sport activities and weight training may be more appealing forms of physical activity.
Specific Aim 2: To examine differences in motor proficiency, strength, musculoskeletal pain, activity limitations, and level of physical activity among children who are obese (BMI >85th percentile), overweight (BMI between 85th and 94th percentile) and children who are at a healthy weight (BMI between 5th and 84th percentile).

i. Hypothesis 2a: Impairments in motor proficiency (BOT-2), strength (push-ups, sit-ups, timed sit to stand), endurance (6MWT), musculoskeletal pain, and Timed Up-Down Stairs will be greater among overweight children than in children who are at a healthy weight.

ii. Hypothesis 2b: Higher BMI will be associated with lower motor proficiency (BOT-2 percentile scores), abdominal and LE strength (curl-ups, timed sit to stand test) endurance (6MWT), and more reported pain in children who are overweight.

Obese children had impairments in motor proficiency, strength, and endurance when compared to healthy weight children. Among overweight children, higher BMI for age percentile was associated with poor motor proficiency, decreased trunk strength and lower extremity strength, and poorer endurance. Obese children demonstrated poorer results in motor proficiency as per BOT-2 percentile scores than overweight and healthy weight children (33% vs 29% vs 17%; p=.005). The mean percentile for healthy weight children in this sample was 33%, indicating an average ability in motor proficiency while obese children’s mean BOT-2 percentile was only
17%, classifying them as below average. Motor proficiency had a negative moderate association with BMI for age percentile among overweight children ($r=-.47$, $p=.003$). Wrotniack et al., also found negative association between z-BMI and motor proficiency in non-obese children. Similar negative associations between childhood obesity and motor proficiency have been found by Graf et al. The results of this study further support the inverse associations between BMI for-age percentile and motor proficiency in Hispanic children who are overweight. This relationship between level of obesity and motor proficiency may be an indication that difficulty with motor tasks increases the likelihood of being more overweight or obese for children. It may also be that being overweight increases the probability of having difficulty with motor tasks. An obese child with low motor proficiency will have more difficulty participating in recreational and physical activities than their healthy weight peer with average motor proficiency ability. These identified deficits should be addressed and treated by a physical therapist and later examined for changes in physical activity behavior.

Trunk and lower extremity strength deficiencies were observed among obese children, as measured by number of curl-ups performed in 60 seconds (9.7, 9.3 vs. 5.4, $p <.001$) and STS repetitions (27, 26 vs 23, $p=.045$). Children who are overweight, but not obese, performed better than obese children, but not as well as healthy weight children, but these differences were not statistically significant in most cases. Differences in number of push-ups performed were not statistically significant. This finding was expected since strength deficiencies in obese children are mostly observed in weight-bearing musculature. When examining only overweight and obese children, there was a fair negative relationship between abdominal and lower extremity strength and BMI for
age percentile ($r = -0.33, p = 0.041; r = -0.36, p = 0.024$). These trends were not observed in healthy
weight children. The results related to abdominal strength support previous findings that
abdominal strength and stamina were found to be compromised among obese
children. The findings related to LE strength are supported by previous research by
Almuzaini, where an inverse relationship was found between knee extensor endurance
and BMI among children. Deficiencies in trunk and lower extremity strength in this
population may further contribute to musculoskeletal fatigue and increase risk of injury
during both functional activities and recreational physical activities. Strength
deficiencies in trunk and lower extremity may place obese children at a disadvantage
when performing activities of daily living and particularly when learning new tasks.
More strength is needed in order to move the extra weight carried by overweight
children, and in fact absolute measures of strength may be equivalent or greater in
overweight children, but strength may remain insufficient to move greater body weight.
Furthermore, biomechanical factors such as insufficient musculoskeletal strength and
obesity may further perpetuate chronic degenerative conditions such as osteoarthritis,
which is prevalent in obese adults.

It has been previously proposed that overweight and obese children may be
experiencing more musculoskeletal pain than their non-overweight peers due to
prolonged excessive loading on tissues, which may be detrimental during the periods of
rapid growth and development, such as in the present study. Although not statistically
significant, the current study found that child-reported complaints of musculoskeletal
pain with physical activity were greater among obese children when compared to healthy
weight children, (20% vs 15%, $p = 0.504$). This trend towards complaints of musculoskeletal
pain among overweight children is another barrier towards physical activity participation, and should be further explored. These results further support the need of a physical therapy assessment to address exercises and physical activity modifications to prevent further musculoskeletal pain. It is also necessary to address pain due to excessive joint load or poor functioning of lower extremity in children prior to musculoskeletal degenerative changes that may take place as adults.

Obese children walked an average of 150 meters less than healthy weight children in the 6MWT (598m vs 568m vs 552m, p=.033), reflecting a slower walking speed and poorer activity tolerance. Similar observations were reported in a study by Geiger et al., where the 6MWT distance was significantly less among overweight children when compared to non-overweight children prior to a weight-loss intervention. This decrease in endurance may contribute to increased fatigue during physical activities due to greater metabolic demands. The 6MWT distance not only revealed impaired endurance by obese children but this finding can also be reflective of limitations of activities of daily living. No significant correlations between BMI for age percentile and 6MWT distance in overweight or healthy weight children were observed.

There were no differences in TUDS speed among overweight and healthy weight children. In fact, no clear trends were observed as well. Amuzaini explains that lower extremity strength deficits are often observed among overweight children when there is an endurance component as well. In both schools selected for this study, the flight of stairs used for the TUDS test is accessed by children on daily basis, including those students that participated in the current study. Therefore, the muscular endurance component for this functional activity limitation test was minimized. One flight of stairs...
may not have been sufficient to detect differences among these three groups of children. Perhaps using two flights of stairs would have better incorporated the muscular endurance component. Nevertheless, Maffiuletti, also observed that obese adolescents produced greater absolute isokinetic and isometric torque at short quadriceps muscle length such as in alternating step over step in stair climbing but not at long muscle length such as preformed from sitting to standing compared to healthy weight children. For future studies in this population, it may be necessary to identify differences in ascending and descending strategies used by the three groups.

_Hypothesis 2c: Level of physical activity as measured by a step activity monitor will be lower among overweight children than in healthy weight children._

**Overweight children are less physically active than healthy weight children.** A high proportion of children are not meeting daily step recommendations to maintain a healthy weight. Girls are significantly less active than boys at this critical time of development. Average steps per day in medium and high activity were lower among obese children when compared to overweight and healthy weight children, however differences did not reach statistical significance, (11,977 vs 12,187 vs 13,240 steps/day, p= .358). These trends suggest a possibility of a dosage response to physical activity.

When comparing all overweight children (BMI for age percentile ≥ 85) to healthy weight children, weekday only data for total daily step count means (12,848 vs 14,214, p=.043), and high-step means (4,520 vs 5,378, p=.050) were lower and minutes in sedentary time (1,016.3 vs 986.18, p=.038) were higher for overweight children. Weekend data was not analyzed due to inconsistencies with number of weekend days with complete data.
Importantly, the mean for the total steps taken per day by middle school children in this sample was not enough to meet BMI-referenced standard cut points recommendations for maintaining a healthy weight range for 6- to 12-year-old girls and boys (10,668 and 13,969 steps versus recommended levels of 12,000 and 15000 steps). Specifically, only 24% of obese children met these recommendations compared to 32% of healthy weight children. These results are consistent with another cross sectional study investigating physical activity and obesity among Hispanic children.

Furthermore, only 12% of obese girls met their minimum of 12,000 steps/day. Girls especially appear to be at a greater risk for declining their level of physical activity as they reach maturation due to low perceived competence in their skills for physical activities. Culture may also play an important role for the disinclination towards physical activity among Hispanic girls. Anderson et al. found that adolescent girls and Hispanic children have lower perceptions of the importance of physical activity and receive less encouragement from parents to participate in athletics. Greater efforts are needed to improve physical competencies and perceptions of physical activity among girls who are overweight and obese. Furthermore, healthy weight children who are less active may be at increased risk of becoming overweight or obese as development continues, and it might be useful to intervene in this at-risk group as well.

Current CDC recommendation for physical activity among all children is 60 minutes of moderate-to-vigorous physical activity daily. Children in this sample averaged well above the recommended duration, 151 minutes and 147 minutes for healthy weight and overweight children. Pre-defined steps/minute cut-points as determined by the investigator for moderate and high activity for the step monitor may
not have reflected moderate activity and may have to be reevaluated for this population. For example, a walking rate of 16-39 steps/minute may be too slow to be considered moderate activity in children and adolescents. Furthermore, duration spent in vigorous activity was 44 and 39 minutes. It is plausible that high intensity physical activity may have greater health benefits among children. Greater improvements in cardiovascular endurance have been found when training in physical activities at vigorous intensities.¹³⁸ Future work using the current study’s SAM data should include a reexamination of the pre-defined steps/minute cut-points and possibly readjust for higher steps/minute cut-points to re-define moderate physical activity. In addition, frequency and duration of sustained activity should be explored as well.

Interestingly, exactly the same duration of sedentary time was observed among obese and overweight children (1,039 minutes), while healthy weight children spending less time (1,012 minutes, p=.217) as per SAM data. The predominant sedentary behavior among American children is television viewing, leading to increases in BMI percentiles and overweight.¹³⁹ In our parent report survey, 45% of the children watched more than the recommended 2 hours of television per day. Although there were no statistical differences among healthy weight and overweight children, a greater percentage of healthy weight children watched more than 2 hours of television, (55% versus 33%). This finding is alarming since adolescents who watch more than 2 hours of television a day are twice as likely to be overweight at three year follow-up,¹³⁹ thus adding to the national obesity epidemic. Efforts to decrease time spent in sedentary activities among all children and adolescents should continue and emphasis should be placed on reducing television time.¹³⁹
We also confirmed that Hispanic boys demonstrated overall greater physical activity when compared to girls. This finding was consistent with a previous 1991-2007 National Institute of Child Health and Human Development Study of Early Child Care and Youth Development, where girls demonstrated moderate to vigorous physical activity levels below the recommended 60 minutes by age 13.1 and boys by age 14.7.\textsuperscript{55} The mean age in our study was 12 years old. This is a pivotal time for children as they begin to make more health behavior decisions for themselves, bodies are changing and physical activity participation begins to decline.

Our study did not find statistical associations between children’s physical activity levels or sedentary time and BMI percentile. The findings of previous studies of the relationship between physical activity and BMI percentile have been inconsistent due to limitations in methods used to assess physical activity assessment.\textsuperscript{140} Compliance with SAM wear was anticipated to be a problem for this pediatric population as described by Mcdonald et al, where they found an 87% compliance rate, which was defined as at least 1 day of complete SAM data collection from a 3 day monitoring period.\textsuperscript{126} Compliance was defined as at least 2 days of complete SAM data from a 7 day monitoring period for this study. This study had an 86% compliance rate. Physical activity data was analyzed for only 72 out of 86 children due to either improper donning of SAM or noncompliance with daily wear of SAM by the child. Afterschool leaders at participating schools were instructed on the importance of having participating students wear their SAMs daily and reminded students to wear them. Failure to find statistical significance is possibly due to insufficient power. A pre study power analysis indicated that a sample of size of at least 30 subjects per BMI for age percentile category was necessary to achieve high statistical
power (87-97%) when calculating ANOVA. Future studies with the SAM should incorporate greater incentives to improve SAM compliance by children.

Specific Aim 3: To examine differences in self-efficacy and parental health behaviors and attitudes in children who are at a healthy weight versus children who are overweight.

Hypothesis 3a: Self-Efficacy scores (CSAPPA) will be lower among children who are overweight than in children who are at a healthy weight.

Subjects did not demonstrate differences in total Self-Efficacy scores among the three BMI for age percentile categories. However, when analyzing each of the twenty items individually, overweight children had less self-efficacy when compared to healthy weight children for one question pertaining to adequacy (last chosen for active games, 2.67 vs 3.02, p=.05) and one for predilection (like to take it easy during recess, 2.8 vs 3.29, p=.02). These responses indicated that overweight children were not feeling competent in their athletic abilities and preferred light activity during recess. Self-efficacy is an important correlate of physical activity and it has also been found to be associated with motor proficiency scores among children. Although in our present study differences in motor proficiency scores among healthy weight and overweight children were observed, there were no differences in self-efficacy total scores among the three weight categories as measured by the CSAPPA instrument. Our study also did not detect a relationship between SE and motor proficiency among overweight children. This may indicate that self-efficacy may be evolving in this age range and therefore differences were not observed. There may also be other factors besides self-efficacy in physical
activity that influence overweight children in this sample. It should also be considered that perhaps the CSAPPA instrument was not ideal for this population of Hispanic children. Many children spoke English as their second language and although the questions were translated verbally into Spanish by the examiner to the child individually, this method may have been insufficient to capture true responses. Currently, there is no validated Spanish CSAPPA instrument. Future studies that investigate self-efficacy should incorporate more ethnic sensitive instruments.

_Hypothesis 3b: Parental health behaviors and attitudes to exercise will be different in children who are at a healthy weight than in children who are overweight._

**Parents of obese children report being less physically active than parents of healthy weight children and were less likely to have their child participate in organized sports.** Parents in this sample were also relatively inactive, only 45% of parents indicated they participated in 30 minutes of physical activity at least three times a week. The percentage of physically active parents was even lower (27%) among obese children. For greater success in healthy lifestyle intervention for children, parents should be encouraged to be positive role models and engage in habitual physical activity themselves.

Obese children (14.29%) were less likely to have participated in organized sports when compared to overweight (62.50%) and healthy weight children (44.4%), p=.02. This coincides with our findings that overweight children are spent more time in sedentary activities during weekdays as per SAM data. Practices for organized sports are traditionally held during the week and game days are alternated during the week and
weekend. It is plausible that when children are not engaged in weekday sport activities they are watching television, and that obese children are more likely to be both not engaged in organized sports and spending more time in sedentary activities during the week. However, the present study did not examine the role of social economic status among this population. Families with less means may not be able to support the time and the monetary responsibilities of having a child participate in organized sports. Future studies should incorporate the role of SES and organized team sport participation among overweight and non-overweight children.

**Limitations of the study**

There are several limitations which should be considered when interpreting the findings presented here. These include limitations related to recruitment, generalizability, measurement of impairments/physical activity, self-report, blinding, and attrition.

Selective recruitment is a limitation of this study. Behavioral characteristics of parents and students who choose to participate in this type of screening may not be characteristic of the typical overweight child and their parents. Not all of the children wore the step activity monitors. Children who were not as active may have chosen not to participate in this part of the project. Also, wearing the monitors may have changed behavior, although this is likely a systematic bias. Most children in this cohort were also in after-school care. These programs varied from homework assistance to music instruction to outdoor play activities, and the types of activities were not accounted for in this study. Further work in school-based screening should consider types of programs that children are involved in after-school. Failure to account for these activities may limit the
ability to detect strong correlations between physical activity and body impairments, activity limitations and BMI-for-age percentiles in overweight children.

Self-report by the participants is inherently a limitation of this type of study. For the preliminary study, weekly logs were filled out by the children and there may have been self-report errors. In addition, several questions from the *National Survey of Children’s Health*\(^{131}\) were used to measure behavior and health, and the self-report nature of this instrument may result in underreporting of at risk behavior (time spent in sedentary activities) and over-reporting of physical activity. In addition, answers to questions about time spent watching TV and computer use was measured as category producing data, For example (< 1 hour, 2-3 hours). A better assessment would allow for the parent to answer the exact number of hours and minutes (ratio data) spent in these activities. Ethnic background questions were also limited to mostly Hispanics. Future studies in this population in South Florida should assess the child’s country of origin if not born in the United States and parent’s country of origin and a measurement of acculturation. Acculturation to the United States has been linked to decreased physical activity among Hispanic 7th grade adolescents.\(^{24}\) Within the Hispanic population, there may be disparities in health conditions, impairments and activity limitations.

Measurement strategies employed in this study, including those for BMI, have some limitations. BMI for-age-percentile was calculated using standard procedures and standardized tables from the Center for Disease Control. However, BMI for age percentile is not a direct measurement of body composition (fat mass vs fat free mass). The relationship between body composition and BMI for age percentile improves at higher BMI for age percentile levels. This may have explained why most of the differences
among the three BMI for age percentile categories were between the healthy weight and obese children. The overweight group likely included some children with a healthy level of fat who were placed in the overweight category because they had higher lean muscle mass thus confounding the results. Freedman et al., found that levels of body fatness among children who had a BMI for age between the 85th and 94th percentiles were more variable where 50% of these children had a moderate level of body fatness, 30% had a normal body fatness and 20% had an elevated body fatness as determined by dual-energy x-ray absorptiometry. As a reminder to clinicians, no single body fat value, whether measured as fat mass or as percentage of body weight, clearly distinguishes health from disease or risk of disease.

The adolescent period may be a vulnerable time for the development of obesity due to sexual maturation. There is also a concomitant reduction in physical activity by the age of 13 in girls and 14 in boys. Sexual maturation should be taken into account for future screenings of obesity among this age group. Furthermore, a study by Wang, revealed a positive association between early sexual maturation and obesity among girls and a negative association among boys. Futures studies with this age group may benefit from analyzing boys and girls separately and from a measurement of sexual maturation.

Children were given a pain drawing to determine if they were experiencing any musculoskeletal pain during standing, walking, or running activities and if so, the child was asked to provide a subjective quantity of pain from a scale of one through ten. The body outline used was adapted from the body outline format of the McGill Pain Questionnaire. This form of questioning may have been too broad or general for children to answer. For example, several children reported on stomach pain or finger pain
unrelated to musculoskeletal problems. Differences were detected among the group of children, with obese children reporting a greater prevalence of musculoskeletal pain. However, differences were not statistically significant. A more precise measurement of musculoskeletal pain that is specific to the lower limb and its impact on activities and participation restrictions should be considered.

For this study, the 6MWT was administered on a flat covered corridor with a walking course that measured 100ft. The course was outlined by bright colored cones. Students were instructed to “walk as many laps as they can around the course.” Students were informed how much time was left at one minute intervals. The 6MWT was a good instrument to detect differences among the three BMI for age percentile categories, where obese children walked 150 feet less than healthy weight children. However, the 6MWT was not correlated with BMI for age percentile. It was noted by examiners and investigators that the amount of effort exerted varied among the participants. This may have limited the correlational value of this instrument to BMI for age percentile. Previous studies have incorporated a measuring wheel with children to increase motivation during the performance of the 6MWT. Since the 6MWT is a self-paced test, it can reflect patterns of daily activities among typically developing children. Future studies should incorporate the 6MWT, however an additional prop such as the measuring wheel may be necessary to improve motivation among the participants. Another cardiovascular endurance outcome measure that may be considered among this population is the 5 minute Harvard Step Test.

The TUDS is found to be more reliable with children with disabilities such as CP. Our study did not detect differences in TUDS speed among the healthy weight,
overweight and obese children. This may have occurred because our sample consisted of typically developing children. In addition, overweight and obese children tend to have more difficulty with tasks that have a greater muscular endurance component; ascending and descending one flight of stairs may not have been sufficient to capture deficiencies in this population. Future studies should include observational descriptions of strategies used by overweight and obese children when ascending and descending stairs compared to healthy weight children. Increasing flights of stairs to two for the TUDS testing may also be considered to better examine the lower extremity muscular endurance component among this typically developing population of children.

Trost et al. reported that a seven-day monitoring protocol produced reliable estimates of daily participation in moderate to vigorous physical activity in children, (r =0.76 to 0.87). For the primary study, children were fitted with a SAM to wear for a seven day monitoring period in order to capture both week and weekend days. The days on which the monitor was donned and taken off were not analyzed due to incomplete monitoring data. At least two to five complete days from the seven day sampling period was used to estimate average daily physical activity levels. We found an 86% compliance rate among children. Investigators also piloted a strategy to increase compliance with SAM wear and return by sending a daily text message to participating students to remind them to wear their SAM. SAMs were collected by investigators after seven days.

Our study found that minutes spent in moderate to vigorous activity, averaged well above the 60 minutes/day recommended duration, 151 minutes and 147 minutes for healthy weight and overweight children. However, duration spent in vigorous activity was 44 and 39 minutes. This study defined its physical activity levels based on
StepWatch monitor data from a previous study for adults who maintained daily diaries. Zero step rate was defined as 0 steps, low step activity rate is defined as 1-15 steps per minute, medium step activity rate is defined as greater than 16 steps per minute, and high walking activity is defined as greater than 40 steps per minute. These previously defined intensities for adults may not be appropriate for children of middle school age. Future studies may need to re-evaluate intensity levels on the SAM for medium and high activity to specify for the pediatric population.

The CSAPPA is a 20 item written questionnaire that evaluates a child’s self-perception of adequacy in performing and desiring to participate in physical activities. However, the CSAPPA scale did not detect significant differences among this group sample. The CSAPPA was used with upper elementary school kids in our pilot study with greater success in detecting differences in BMI for age percentile and physical activity. The primary study focused instead on middle school children, indicating that this is a transitional age for children and physical activity self-efficacy may be in a fluctuating state. This coincides with the time when children have a significant decline in physical activity levels. The CSAPPA scale may not have been appropriate for this population.

**Attrition**

The KEBMM intervention drew interest from many parents however the scheduling of meeting times became a challenge. Future recommendations to reduce attrition for an after-school based physical activity intervention for this population should include a focus group with parents prior to start of intervention to assess best meeting times for both parents and children. A few suggestions to resolve this issue would be the following: 1. separate meeting times for parent and child, 2. require parents to attend
fewer sessions. Incentives and performance-based rewards may also be instituted on a weekly or bi-weekly basis, and phone calls with parents to review weekly tips and tasks. These suggestions may increase enthusiasm and participation by children and clear up time with parents. These additional strategies may improve retention and maximize cooperation by all participants.

**Directions for Future Research**

**BMI and Impairment Screening**

This study is an example of how physical therapists can be involved in the prevention and assessment of childhood obesity within a school-based population. As stated previously, participating children and parents in this screening were given a summary of findings related to physical fitness and physical performance testing and were given the opportunity to discuss these findings with a licensed physical therapist. Participants were informed through an individualized summary report on their physical fitness, motor proficiency BMI for-age percentile results. Parents were made aware of possible musculoskeletal deficiencies and their child’s BMI for age percentile. Although this was only a screening, this was an opportunity to begin a dialogue with parents about their own healthy eating and physical activity habits following the screening. Many parents asked health behavior questions during the consent process, however none re-contacted the physical therapists for further questions or suggestions following testing and assessment reports. It would be interesting if in future studies, parents were re-contacted to see if the information provided was helpful and if changes were made.

Future work may incorporate inexpensive height, weight and impairment screening instruments for a health and wellness evaluation by a physical therapist. If balance,
strength or endurance deficiencies are identified, then a physical therapist can provide either a consultation or treatment with the individual child and their parent. Strategies to address identified impairments may also be tested, such as receiving outpatient physical therapy services to improve balance and coordination deficiencies. For example, static and dynamic postural balance exercises on a balance beam may be a feasible way to address this in a school-based setting. In addition, a physical therapist can provide specific lower extremity strength training that progresses from non-weight bearing tasks to weight bearing tasks, while monitoring for possible lower extremity musculoskeletal pain. Furthermore, agility training session can incorporate obstacle courses and dance movements for girls. Institutions or programs that utilize physical therapy intervention strategies can be compared to those who do not. Changes in levels of physical activity, motor proficiency, physical activity self-efficacy and athletic competence can be measured pre and post screening for possible benefits.

Finally, results from this study and previous correlational studies described above utilized cross-sectional study designs that support an interrelationship between physical activity, motor proficiency and BMI but fail to demonstrate causality. Future study recommendations would include a longitudinal study to best identify the direction of causality for these variables. For example, one must also consider that being less physically active may make a child more overweight, an increase in weight may make a child less proficient in motor abilities, and result in them becoming even more overweight. Furthermore, regression analysis on physical activity and motor proficiency among overweight children may also elucidate the multidirectional relationships.

Health Wellness Promotion-Intervention
Physical activity interventions are much more accessible to children who are most at need when provided in their school in an afterschool program. Many children have working parents who do not have the time or the means to drive their child to a facility away from their home to participate in a weight loss intervention. For greater success, a school-based intervention should have a multidisciplinary team that includes a physician (Family, Internist or Pediatrician) to manage the overall health condition of the child and possible comorbidities, a dietitian for nutrition assistance/education and a physical therapist to address impairments that may impede adherence to physical activity or exercise and assist in exercise prescription. Each member of this team has a specific role and task to address for individual families. This may be a cost effective and efficient manner to discuss dietary and physical activity changes required for obesity prevention and intervention. A physical therapist can have an instrumental role as part of a multidisciplinary team for obese children.

There are significant differences in physical activity levels between girls and boys, with girls participating in less physical activity and more time in sedentary activities than boys. The KEBMM intervention attempted to recruit girls for participation however it drew little enthusiasm from girls. Hispanic girls are more at risk to become overweight and obese than non-Hispanic girls. A school-based intervention must draw girls to participate and incorporate physical activities that are inclusive to girls. There are definite gender differences when selecting types of physical activities. Future recommendations for a physical activity intervention should focus on physical activities that appeal to girls such as dancing. Boys also tend to enjoy weight training and team sports activities. In addition, incorporating video games that require whole body
movement such as the Wii is very appealing to both genders and may motivate children that do not usually play outside to become active inside their home. Group activities should remain small in size for greater comfort and privacy among participants. Focus for an intervention in this population should remain on wellness based activities versus sports related activities.

**Conclusion**

The findings of this study indicate that a 12 week extracurricular family-based intervention led by a physical therapist has limited feasibility and can increase physical activity levels for overweight Hispanic middle school children. This study also demonstrated that obese and overweight children tend to have greater impairments and activity limitations when compared to healthy weight children. Specifically, obese children have greater impairments in motor proficiency, strength, and endurance when compared to healthy weight children. Higher BMI for age percentile had a negative moderate correlation with motor proficiency, trunk strength and lower extremity strength among overweight children. These impairments may limit their ability to participate in the recommended levels of physical activity. Parents of obese children also report to be less physically active than parents of healthy weight children and less likely to have their child participate in organized sports. Both overweight and healthy weight Hispanic girls engage in less physical activity and greater sedentary duration when compared to boys. The findings of this study have important clinical relevance for physical therapists, who are uniquely qualified to assess these identified impairments and activity limitations in overweight and obese children that may limit their ability to engage in greater levels of physical activity.
Physical therapists may play an important role in the management, reversal and prevention of childhood obesity in the school based setting. They may offer an important contribution in identifying barriers and assisting children to find strategies to change health behaviors. These findings lend support to Vision 2020 of the APTA as physical therapists become practitioners of choice by consumers for health and wellness needs and Healthy People 2020 objectives as pediatric obesity continues to be an important public health priority. Finally this study demonstrated how physical therapists can play an important role as part of the multidisciplinary team working towards reaching the four main objectives of the World Health Organization’s Global Strategies on Diet, Physical Activity and Health. The WHO objectives were met by 1. having physical therapists perform a school-based physical activity screening accessible to all children, 2. incorporating nutrition and physical activity education components for children in an after-school health-wellness intervention, 3. having physical therapists strengthening the evidence for the management of childhood obesity with comprehensive outcome measures and strategies to increase physical activity and 4. performing research on interventions that promote physical activity and provide further understanding of minority health behavior practices.

Childhood obesity is a major health concern in the US and around the world. Physical therapists should continue to strive for opportunities to develop, implement and validate strategies to address this growing public health problem. Physical therapists currently play a limited role in the school-based setting. This study provides evidence to support the role of physical therapists in administering consultative services in the
extracurricular setting, and provides specific strategies to implement assessment and intervention programs aimed at helping children attain and maintain optimal health.
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52. Irving DB, Cook JL, Young MA and Menz HB. Obesity and pronated foot type may increase the risk of chronic plantar heel pain: a matched case-control study. BMC Musculoskeletal Disorders 2007; 8(41).


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Appendix A

Kids Eat Better & Move More!

Week 1: Introduction & Enrollment - Introduction to Step Counters

After this session, kids and their parents will:

1. Recognize the importance of Steps to Healthier Living: Eat Better - Preparation
   - Recruit participants following the suggestions in Setting up Your program.
   - Copy Preparation questionnaire (See Appendix 1).
   - See the List of Online Resources for Week 1 (See Appendix 4).

2. Start Up
   - Introduction: An icebreaker may be necessary. If so, have participants introduce themselves and say why they decided to come to the Eat Better & Move More Program.
   - Discuss goals or concerns that people brought up in their introductions.
   - Review the weekly schedule and where information about the program will be posted.

Eat Better: Mini-Talk
Eat Better for Health

Nutrition is a complex topic, but we don't have to be scientists to improve our diets. Eat Better shows us simple ways to improve how we eat. Small changes can make big differences...we don't need to completely change everything.

Along with being more active, when we Eat Better we improve our quality of life and decrease our risk for many diseases and problems as we grow older.

Over the next weeks, we will learn more about the importance of fruits and vegetables, real food and fake food, good grains and bad grains, and portion sizes. We will learn how eating the right thing affects our health and our growth and development, and leads us to a healthy weight.

A lot of kids are eating “fake food” instead of “real food.” Fake foods are foods that are made in factories and are highly processed products, loaded with calories, and almost absent of nutrition. Instant meals and fast foods are examples of “fake foods.” We should try to limit the amount of processed foods we eat.

If we are interested in changing the way we eat, we should do a “clean sweep” this week. The idea is to get rid of all the foods that are unhealthy in the house. These include: sugary drinks and cereals, chips, cookies, candy, ice cream, white crackers, and other fake food. Just throw them away! This may be wasteful, but eating them is bad for your health, and the health costs are far less than their purchase price.

It is not easy to make changes in diet. Some kids and their parents are more ready than others to make those changes. Your attendance here says you are interested in taking steps to Eat Better and Move More!

Activities

1. Ice breakers! Have participants talk about their favorite healthy foods, and the unhealthy food that will be the hardest for them to give up.

2. Administer and explain the preparation questionnaire from the Optimal Weight for Life Program, and the guide to serving size.

3. Remind people of next week’s meeting time and place.
Appendix A

**Eat Better & Move More for kids!**

**Week 1: Introduction & Enrollment - Introduction to Step Counters**

After this session, kids and their parents will:

- Recognize the importance of Moving More. They will know how to use a step counter.

**Preparation**

- Have step counters with safety leashes ready for each participant. Plan for extra help to show people how to reset and use the step counters.
- Copy Week 1 Tips & Tasks for each participant.

**Start Up**

- Discuss goals or concerns that people may have about the program.
- Review the weekly schedule and where information about the program will be posted.

**Move More Mini-Talk**

**Move more for Health**

Most health experts agree that children and teenagers should engage in at least 60 minutes of moderate physical activity every day.

Since the 1970s, the number of kids who are overweight has more than doubled among young children aged 2–5 years and almost tripled among school-aged children aged 6–19 years. According to international experts, (WHO) the two primary reasons for this substantial change are eating too much unhealthy food and doing too little physical activity and exercise. A moderate and gradual walking program is a safe start to changing our physical activity habits.

This program focuses on walking and exercise activities that can be done almost anywhere. Some ways that walking and exercising are good for us are:

- Helps build and maintain healthy bones, muscles and joints
- Improves sleep, balance and muscle strength for daily physical, mental and emotional challenges such as catching the bus and studying for tests
- Encourages children to remain physically active throughout adolescence and into adulthood
- Decreases risk of becoming overweight and/or obese
- Lowers risk factor for diabetes and other chronic diseases
- Makes heart stronger and helps control blood pressure, and a healthy balance of lipids in the blood
- Makes feel good about ourselves
- Reduces feelings of anxiety, stress and depression

The goal is to do a little more—not to run a marathon! Each week we will set a personal step goal. Success means that both children and parents will **Move More** than we do now.

We will use step counters— an easy and fun way to track our progress!

**Activities**

1. Ice breakers! Have participants talk about their favorite physical activities, and the sedentary activities will be the hardest for them to give up.
2. Administer and explain the preparation questionnaire from the Optimal Weight for Life Program, and the guide to serving size.
3. Distribute step counters. Review Week 1 Tips & Tasks sheet on wearing one.
4. Explain how to record steps on the Tips & Tasks sheet each day.
Appendix A

Week 1 Orientation to Step Counters

**Tips & Tasks**

Walking is a safe, fun, and easy way to be more active.

Keeping track of your steps with a step counter can help you walk more every day and be more active.

Wear the step counter every day. Put it on in the morning when you get up. Take it off at the end of the day.

Where should I wear my step counter?
It works best on your waist directly above your knee or directly below your armpit. Attach the safety leash to a belt loop or buttonhole or use a safety pin to fasten the counter. Clip the counter on a belt or waistband. Make sure it is close and flat to your body. Wear the counter on the same side every day to ensure that it is measuring the same way every day.

Where do I wear my step counter if I have no waistband?
Try attaching it to your underwear, but make sure it is close and flat on your body. Do not put it in your pocket.

Can the step counter get wet?
No. It is not waterproof.

When should I take off the step counter?
Take it off when bathing, swimming, and sleeping.

I don’t think my step counter is working right.
What should I do?
Be sure it is upright and you are wearing it as recommended. It must be vertical and closed for accurate counts. If it is still not working, ask your program leader for help.

What if the display is blank, black or showing irregular characters?
If it is blank, the battery should be replaced. Otherwise the LCD (liquid crystal display) is probably broken because it was dropped or directly hit. If so, you need a new step counter.

I hear something moving inside my step counter.
Is that normal?
Yes. That’s the lever arm, which moves up and down as you move.

This first week, do what you usually do. Remember to write down the number of steps you take each day. These are your “baseline” numbers.

Check the box for “all day” if you wore your counter the entire day

<table>
<thead>
<tr>
<th>Week &gt; 1</th>
<th>Name/ID#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
<td>Monday</td>
</tr>
<tr>
<td>Steps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>all day</td>
</tr>
</tbody>
</table>
Appendix B

Kids Eat Better & Move More!
Week 3: 5-a-Day with Color

Eat Better: Mini-Talk
5-a-Day with Variety and Color

Last week we talked about eating 5 or more servings of fruits and vegetables a day. This week we're talking about eating a variety of colorful fruits and vegetables that may help us reach our 5-a-Day goal.

Choosing different colors is a way to increase variety. Colorful fruits and vegetables help promote health.

Your goal this week is to eat a variety of more colorful fruits and vegetables every day.

One way to encourage eating more vegetables is to have them ready and accessible. Preparing fruits and vegetables can be a great family activity. When you get back from the grocery store, take 15 minutes to wash and cut up the colorful fruits and vegetables so they can be eaten as a raw snack just as easily as opening a bag of potato chips or pretzels. Put on your grocery list some healthy vegetable dips as well, such as yogurt or hummus (just make sure there's not a lot of added sugar or high fructose corn syrup.)

Even better, put on some music and dance while you're doing this! This encourages healthy snacking, moving more (you get lots of steps when you dance,) and family time together.

Activities

1. The color contest: Divide the group into teams of three or four. Have teams come up with as many fruits and vegetables according to color as they can. Give prizes of colorful fruits and vegetables to the winning team overall, or to the winning team for each color.

2. Discuss the lists from the activity above. What are people’s favorites? Which ones are the easiest to get? Which are the least expensive in each color? Discuss nature’s convenience foods—no preparation needed—most fruits and many vegetables.
Appendix B

Kids Eat Better & Move More!
Week >3: Stretching & Movement

To have a healthy body, we must have healthy muscles and joints. Stretching our muscles keeps us from getting hurt and helps us to relax.

Stretching after walking, running, jumping or playing a sport can make you more flexible. It can also lower the chance of becoming achy and sore.

Use Appendix 4 for instructions and illustrations about how to perform the stretches and movements below.

Three simple stretches: Hold each stretch for 15 to 30 seconds without bouncing. You should feel a gentle pull with no pain.

1) Calf stretch
2) Hamstring stretch
3) Groin stretch
4) Knee to chest
5) Cat and Camel
6) Side bend
7) Hurdler’s stretch

Starting with the Presidential Physical Fitness Award in 1966, The President’s Challenge has rewarded and motivated millions of youth. Today the Challenge includes four separate programs:

Physical Fitness test
Promotes a basic level of fitness among students.

Health Fitness test
Encourages students to achieve a healthy level of fitness.

Active Lifestyle program
Encourages students and adults to make activity part of their everyday lives.

Presidential Champions program
Challenges students and adults to raise their activity and fitness to a whole new level.

We can find all of these programs online at www.presidentschallenge.org

Activities

1. Have all the participants try the stretches. Have staff help participants while they stretch.

2. Calculate step goals for next week. Write each person’s new daily step goal on the Week 4 Tips & Tasks sheet.
Appendix C

Body Mass Index, Fitness, and Functional Mobility in Hispanic and non-Hispanic Elementary and Middle School Children in Miami-Dade County

May 29th, 2011

Dear Parents/Guardians and Students:

Thank you for allowing your child or children to participate in the screening that took place between January and May 2011 at West Miami Middle School. The University Of Miami, Department of Physical Therapy conducted this free physical activity and fitness screening to students between the ages of 10-15 years of age. A total of 51 children volunteered for this screening. We hope that your child had fun and that the gift cards were put to good use. The purpose of this screening was to investigate the relationship between body mass index, balance problems, physical activity, and the prevalence of musculoskeletal pain and mobility limitations among this population of children and adolescents living in Miami-Dade County.

The goal of the study is to provide a greater understanding of children’s movement abilities to further promote increased physical activity and healthy lifestyle behaviors and subsequently reduce the prevalence of childhood obesity. It will help us in leading the fight against childhood obesity.

We are attaching your child’s preliminary screening results. Parents/Guardians are encouraged to discuss your child’s results with the investigators.

For more information, please feel free to contact Annabel Nunez, Research Coordinator at 305-284-4535 or e-mail her at annabelnunez@bellsouth.net.

Thank you for your participation,

Neva Kirk-Sanchez, PhD, PT  Principal Investigator
Annabel Nunez, MSPT  Co-Investigator
University of Miami Miller School of Medicine
Department of Physical Therapy
5915 Ponce de Leon Blvd. 5th Floor
Coral Gables, FL 33146-2435
Tel: 305-284-4535
Fax: 305-284-6128
## Appendix C

### Screening “Physical Fitness Measures” results Sample Report

<table>
<thead>
<tr>
<th>Variables</th>
<th>National Normal/Healthy Values</th>
<th>Child Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMI-for-age Percentiles</strong></td>
<td>Healthy weight= 5-85%tile</td>
<td>98.4 percentile</td>
</tr>
<tr>
<td></td>
<td>Overweight= &gt;85-95 %tile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Obese= &gt;95 %tile</td>
<td></td>
</tr>
<tr>
<td><strong>Step Activity Monitor</strong></td>
<td>Recommended values:</td>
<td>5510 steps/day</td>
</tr>
<tr>
<td><em>Average steps per day</em></td>
<td>Girls=12,000 steps/day</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boys=15,000 steps/day</td>
<td></td>
</tr>
<tr>
<td><strong>Sit-to-stand</strong></td>
<td>Normal standards are not available</td>
<td>20 reps</td>
</tr>
<tr>
<td><em>repetitions in 1 min</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BOT 2</strong></td>
<td>Percentile Ranks</td>
<td>12 %</td>
</tr>
<tr>
<td>1. Fine Manual Control</td>
<td>&gt;98% = Well-Above Average</td>
<td></td>
</tr>
<tr>
<td>2. Manual Coordination</td>
<td>84-97% = Above Average</td>
<td></td>
</tr>
<tr>
<td>3. Body Coordination/Balance</td>
<td>18-83% = Average</td>
<td></td>
</tr>
<tr>
<td>4. Strength and Agility</td>
<td>3-17% = Below Average</td>
<td></td>
</tr>
<tr>
<td><strong>6 Minute Walk</strong></td>
<td>Normal values:</td>
<td>464 meters</td>
</tr>
<tr>
<td>(meters walked in 6 minutes)</td>
<td>Girls= 642.7 meters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boys= 680.9</td>
<td></td>
</tr>
<tr>
<td><strong>Timed Up &amp; Down Stairs</strong></td>
<td>Normal standards are not available</td>
<td>7.8 sec</td>
</tr>
<tr>
<td><em>seconds to go up and down 1 flight of stairs</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Blood Pressure</strong></td>
<td>110 - 120 (systolic)</td>
<td>120/60 mmHg</td>
</tr>
<tr>
<td>(resting)</td>
<td>70 - 80 (diastolic)</td>
<td></td>
</tr>
<tr>
<td><strong>Heart Rate (resting)</strong></td>
<td>1 -10 y/o= 70 - 120 bpm</td>
<td>96 bpm</td>
</tr>
<tr>
<td><em>beats per minute</em></td>
<td>&gt;10 y/o= 60-100 bpm</td>
<td></td>
</tr>
</tbody>
</table>
Pain Drawing

1. Mark these drawings according to where you hurt (if the right side of your right shoulder hurts, mark the drawing on the right shoulder).

   1. Circle your current pain level.
Appendix E

Performance Testing Forms

eProst ID: 20080487
Version: Approved
Approval Date: 8/26/2008

Children and Adolescent Functional Mobility Screening
Subject ID:
Date:

Fitness and Activity Limitations

<table>
<thead>
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<th>Rate ID:</th>
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</thead>
<tbody>
<tr>
<td>Date: <strong><strong>/</strong></strong>/____</td>
<td>Trial 1</td>
</tr>
</tbody>
</table>

Step Activity Monitor #

Height ______ (inch)

Weight (kg)

BMI Calculation
Kg/m²

Waist Circumference (inches)
Between last rib & iliac crest

Hip Circumference (inches)
At the level of greatest protrusion of the gluteal muscles

FITNESSGRAM Items

1. Sit & Reach

2. Chair Sit-to-Stand
Child will start from sitting on chair with feet flat on floor, knees bent to about 90 degrees. From this position they are to stand until their knees are completely straight. Then they should lower into sitting until their thighs are parallel to the floor. Child will complete as many cycles of sit-to-stand as possible at a rhythmic pace in 1 minute or until they show poor form or they are unable to continue.
3. Forward Lean
The examiner will demonstrate the lean maneuver and ask each subject to repeat until they were able to perform the maneuver without corrective feedback (approximately 2-3 trials), at which time the testing began. Subjects will be asked to lean forward as far as they can without losing their balance, lifting their heels off of the floor, or taking a step. “Keep your body straight and feet on the floor while you lean. Hold the position until I say stop (5 seconds).” Shoulder displacement measures will be obtained as the subject actively leans forward with arms forward (i.e., extended forward level with the shoulders)

<table>
<thead>
<tr>
<th>Trial 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
</tbody>
</table>

Functional Mobility
7. Timed Up and Down Stairs Test (use flight of stairs)
“Quickly, but safely go up the stairs, turn around on the top step (landing) and come all the way down until both feet land on the bottom step (landing).” “Start when I say ‘GO’”
- Time starts from “GO” cue until the second foot returns to the landing
- Subjects can use any method of climbing stairs (step over step, skipping, running)
- Must face direction of movement (cannot climb sideways), May use handrails

<table>
<thead>
<tr>
<th>Amount of Time Walked (min. sec)</th>
<th>Steps ambulated (# of stairs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Pre-6MWTT Borg Scale (1-10)</td>
<td>Pain (1-10)</td>
</tr>
<tr>
<td></td>
<td>BP (Systolic)</td>
</tr>
<tr>
<td></td>
<td>Heart Rate</td>
</tr>
<tr>
<td></td>
<td>BP (Diastolic)</td>
</tr>
</tbody>
</table>
9. **Six Minute Walk Test**

1. The object of the test is to walk as far as possible in 6 min., which means to score as many meters on the scale as possible. You will be walking back and forth around the cones. You are permitted to slow down, to stop, and to rest as necessary. You may lean against the wall while resting, but walk as soon as you are able.”
2. “Are you ready to do that?”
3. “Remember to walk as many meters as possible, but without jogging or running”
4. “Start now”
5. After min. 1 you can tell them “You are doing well, you have 5 more min. to go”
6. After min. 2: “Keep up the good work, you have 4 more min. to go”
7. After min. 3: “You are doing well, you are half way done”
8. After min. 4: “Keep up the good work, you have only 2 more min. left”
9. After min. 5: “You are doing well, you only have 1 more min. to go”
10. At 6 min, tell participant to “STOP”

<table>
<thead>
<tr>
<th>10. <strong>Post-6MWT</strong></th>
<th>Meters walked</th>
<th>Time walked</th>
<th>Time Rested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borg Scale (1-10)</td>
<td>Pain (1-10)</td>
<td>BP(Systolic)</td>
<td></td>
</tr>
<tr>
<td>Heart Rate</td>
<td>BP(Diastolic)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What's Most Like Me

Instructions:
In this survey you have to read a pair of sentences and then circle the sentences that you think is the most like YOU.

EXAMPLE 1:
Some kids have one nose on their face. But other kids have three noses on their face!

That shouldn’t be too hard for you to decide! Once you have circled the sentence that is most like you, then you have to decide if it is SORT OF TRUE for you 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 and then check off if it is REALLY TRUE or only SORT OF TRUE for you.

EXAMPLE 2:

<table>
<thead>
<tr>
<th>Really true for me</th>
<th>Sort of true for me</th>
<th>Sort of true for me</th>
<th>Really true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Some kids like to play with computers</td>
<td>but Other kids don’t like playing with computers</td>
<td></td>
</tr>
</tbody>
</table>

- Now you are ready to start filling in this form. There are no right or wrong answers, just what is most like you. Take your time and do the whole form carefully. If you have any questions just ask! If you think you are ready you can start now. **BE SURE TO FILL IN THE BACK OF THIS PAGE!**

- This test is modified from: Hay J. Adequacy in and predilection for physical activity in children. Clin J Sport Med. 1992;2: 192-201. **Remember:** First circle the sentence that is most like you and then check off if it is REALLY TRUE or only SORT OF TRUE for you.
### Appendix F

eProst ID: 20080487  
Version: Approved  
Approval Date: 8/26/2008

<table>
<thead>
<tr>
<th>No.</th>
<th>Really true for me</th>
<th>Sort of true for me</th>
<th>Sort of true for me</th>
<th>Really true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Some kids can’t wait to play active games after school</td>
<td>but</td>
<td>Other kids would rather do something else</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Some kids really enjoy physical education class</td>
<td>but</td>
<td>Other kids don’t like physical education class</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Some kids don’t like playing active games</td>
<td>but</td>
<td>Other kids really like playing active games</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Some kids don’t have much fun playing sports</td>
<td>but</td>
<td>Other kids have a good time playing sports</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Some kids think physical education is the best class</td>
<td>but</td>
<td>Other kids think physical education isn’t much fun</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Some kids are good at active games</td>
<td>but</td>
<td>Other kids find active games hard to play</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Some kids don’t like playing sports</td>
<td>but</td>
<td>Other kids really enjoy playing sports</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Some kids always hurt themselves when they play sports</td>
<td>but</td>
<td>Other kids never hurt themselves playing sports</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Some kids like to play active games outside</td>
<td>but</td>
<td>Other kids would rather read or play video games</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Some kids do well in most sports</td>
<td>but</td>
<td>Other kids feel they aren’t very good at sports</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Some kids learn to play active games easily</td>
<td>but</td>
<td>Other kids find it hard learning to play active games</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Some kids think they are the best at sports</td>
<td>but</td>
<td>Other kids think they aren’t very good at sports</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Some kids find games in physical education hard to play</td>
<td>but</td>
<td>Other kids are good at games in physical education</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Some kids like to watch games being played outside</td>
<td>but</td>
<td>Other kids would rather play active games outside</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Some kids are among the last to be chosen for active games</td>
<td>but</td>
<td>Other kids are usually picked to play first</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Some kids like to take it easy during recess</td>
<td>but</td>
<td>Other kids would rather play active games</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Some kids have fun in physical education class</td>
<td>but</td>
<td>Other kids would rather miss physical education class</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Some kids aren’t good enough for sports teams</td>
<td>but</td>
<td>Other kids do well on sports teams</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Some kids like to play quiet games</td>
<td>but</td>
<td>Other kids like to play active games</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Some kids like to play active games outside on weekends</td>
<td>but</td>
<td>Other kids like to relax and watch TV on weekends</td>
<td></td>
</tr>
</tbody>
</table>
Appendix G

Parent Demographic Form

I. Contact Information

Name: ___________________________________________
Address: ____________________________________________________________
City: ___________ State: ___________ Zip Code ___________
DOB: ___/___/___ (mm/dd/yy)  Age: ________ y.o.
Home Phone: (___) ____-____ Work Phone: (___) ____-____
Cell Phone: (___) ____-____
Email Address: ________________________________________
Occupation: _________________________________________________

Smoke: □ No, never □ No, quit □ Yes  If Yes or quit: Packs per day______ No. of years ____

a. Child’s Current School _____________________________________________

b. Child’s Name: _______________________________________________

c. Child’s Date of Birth: ___/___/___ (mm/dd/yy)  Age: ____________ y.o.

d. Grade School level: ____________________________

e. Child’s Gender: (0) Male  (1) Female

f. Racial Group:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>□ White</td>
</tr>
<tr>
<td>2</td>
<td>□ Asian</td>
</tr>
<tr>
<td>3</td>
<td>□ Black or African American</td>
</tr>
<tr>
<td>4</td>
<td>□ American Indian or Alaskan Native</td>
</tr>
<tr>
<td>5</td>
<td>□ Native Hawaiian or other Pacific Islander</td>
</tr>
</tbody>
</table>


g. Ethnic Group:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>□ Hispanic or Latino</td>
</tr>
<tr>
<td>2</td>
<td>□ Not Hispanic or Latino</td>
</tr>
</tbody>
</table>
### III. Relevant Medical History

a. Please check if your child has been diagnosed by a doctor with any of the following conditions: (check all that apply)

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Arthritis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2. Broken Bones</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3. Osteoporosis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4. Blood Disorder</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5. Peripheral Vascular Disease</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6. High Blood Pressure</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7. Heart Problems</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>8. Lung Problems</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>9. Stroke</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>10. Diabetes, Type I</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>11. Diabetes, Type II</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>12. Head Injury/TBI</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>13. Multiple Sclerosis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>14. Muscular Dystrophy</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>15. Cerebral Palsey</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>16. Kidney Disease</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>17. Seizures/epilepsy</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>18. Allergies</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>19. Asthma</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>20. Emphysema/Bronchitis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>21. Ulcers/Stomach Problems</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>22. Skin Disease</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>23. Depression</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>24. Hepatitis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>27. Anemia</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>28. Rheumatoid Arthritis</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>29. Other:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix G

b. Within the past year, has your child complained of any of the following symptoms? (Check all that apply)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chest Pain</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2. Heart Palpitations</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3. Cough</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4. Hoarseness</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5. Shortness of Breath</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6. Dizziness or blackouts</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7. Coordination problems</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>8. Weakness in the arm or legs</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>9. Loss of balance</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>10. Difficulty walking</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>11. Joint Pain or Swelling</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>12. Pain at night</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>13. Difficulty sleeping</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>14. Loss of appetite</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>15. Nausea/vomiting</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>16. Difficulty swallowing</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>17. Bowel Problems</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>18. Weight loss or gain</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>19. Urinary Problems</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>20. Fever/chills/sweats</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>21. Headaches</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>22. Hearing problems</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>23. Vision problems</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>24. Numbness and/or Tingling</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>24. Others:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
VIII. Parent Physical Activity Survey

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is your child limited or prevented in any way in his/her ability to do the things most children of the same age can do?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>2. On an average school day, about how many hours does the child use a computer for purposes other than schoolwork?</td>
<td>&lt;1 hour / between 1-2 hours / ≥3 hours</td>
</tr>
<tr>
<td>3. On an average school day, about how many hours does the child usually watch television, watch videos, or play video games?</td>
<td>&lt;1 hour / between 1-2 hours / ≥3 hours</td>
</tr>
<tr>
<td>4. During the past week, on how many days did the child exercises or participate in physical activity for at least 60 minutes that made (him/her) sweat and breath hard, such as basketball, soccer, jump rope, brisk walking, running/jogging, swimming laps, fast bicycling, fast dancing, or similar aerobic activities?</td>
<td>none / 1 day / 2 days / 3 days / 4 days / 5 days / 6 days / 7 days</td>
</tr>
<tr>
<td>5. During the past 12 months, was the child on a sports team or did (he/she) take sports lessons after school or weekends?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>6. Does the child have any kind of health care coverage, including health insurance, prepaid plans such as HMO’s, or government plans such as Medicaid?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>7. During the past 12 months, how many times did your child see a doctor, nurse, or other health care provider for preventive medical care such as a physical exam or well-child check-up?</td>
<td>1 visit / 2 visits / ≥3 visits</td>
</tr>
<tr>
<td>8. During the past weeks, on how many days did the child’s mother exercise or participate in physical activity for at least 30 minutes that made you sweat and breath hard, such as brisk walking, basketball, soccer, running, swimming laps, fast bicycling, fast dancing or similar aerobic activities?</td>
<td>none / 1 day / 2 days / 3 days / 4 days / 5 days / 6 days / 7 days</td>
</tr>
<tr>
<td>9. During the past weeks, on how many days did the child’s father exercise or participate in physical activity for at least 30 minutes that made you sweat and breath hard, such as brisk walking, basketball, soccer, running, swimming laps, fast bicycling, fast dancing or similar aerobic activities?</td>
<td>none / 1 day / 2 days / 3 days / 4 days / 5 days / 6 days / 7 days</td>
</tr>
</tbody>
</table>

(Modified from the 2003-2004 National Survey of Children’s Health, Sections:2,3,4,7,9)
Appendix H

VIII. Parent Physical Activity Survey (Spanish)

1. ¿Tiene [S.C.] algún tipo de limitación o impedimento para hacer las cosas que hace la mayoría de los niños de su edad?
   - Yes
   - No

2. Normalmente, en un día entre semana, ¿cuánto tiempo utiliza [S.C.] una computadora para otros fines que no sean las tareas escolares?
   - <1 hour
   - between 1-2 hours
   - ≥ 3 hours

3. Normalmente, en un día entre semana, ¿cuánto tiempo ve [S.C.] televisión y videos o juega videojuegos?
   - <1 hour
   - between 1-2 hours
   - ≥ 3 hours

4. La semana pasada, ¿cuántos días hizo [S.C.] ejercicio, practicó un deporte o participó en algún tipo de actividad física que lo/la hiciera transpirar y respirar agitadamente durante al menos 60 minutos?
   - none
   - 1 day
   - 2 days
   - 3 days
   - 4 days
   - 5 days
   - 6 days
   - 7 days

5. Durante los últimos 12 meses, ¿Participó [S.C.] en algún equipo deportivo o asistió a clases de deporte fuera del horario escolar o los fines de semana?
   - Yes
   - No

6. Tiene (S.C.) algún tipo de cobertura médica, incluyendo seguro de salud, planes de pago anticipado como los planes de HMO o planes gubernamentales como Medicaid?
   - Yes
   - No

7. Durante los últimos 12 meses, ¿cuantas veces visitó (S.C.) a un médico, una enfermera u otro profesional de la salud para recibir atención médica preventiva, como un examen físico o un chequeo preventivo infantil
   - 1 visit
   - 2 visits
   - ≥ 3 visits

8. Durante la semana pasada, ¿cuántos días hizo [usted/la madre [TIPO] de (S.C.)] ejercicio, practicó deportes o participó en alguna actividad física durante al menos 30 minutos que la hiciera transpirar y respirar con dificultad?
   - none
   - 1 day
   - 2 days
   - 3 days
   - 4 days
   - 5 days
   - 6 days
   - 7 days

9. Durante la semana pasada, ¿cuántos días hizo [usted/el padre [TIPO] de (S.C.)] ejercicio, practicó deportes o participó en alguna actividad física durante al menos 30 minutos que la hiciera transpirar y respirar con dificultad?
   - none
   - 1 day
   - 2 days
   - 3 days
   - 4 days
   - 5 days
   - 6 days
   - 7 days

(Modified from the 2003-2004 National Survey of Children’s Health, Sections:2,3,4,7,9)