UNIVERSITY OF CALIFORNIA, SAN DIEGO

SAN DIEGO STATE UNIVERSITY

An Examination of Behavioral, Psychological, Socio-Cultural and Environmental Factors that may Explain Gender Differences in Children's Physical Activity

A dissertation submitted in partial satisfaction of the requirements for the degree of Doctor of Philosophy

in

Public Health (Health Behavior)

by

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2009

The Dissertation of Noé Cuauhtémoc Crespo Rodríguez is approved, and it is acceptable in quality and form for publication on microfilm:

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DEDICATION

I dedicate this dissertation to my wife, Sonia, who supported me through the long days of work and late nights of study; to my mother, Aurora, for her unconditional love and support; to my father, Fausto, for his guidance and wisdom; to my brother, Julio, for his encouraging words and advice; and to my friends and colleagues for making my life a joy.

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ACKNOWLEDGEMENTS

I would like to thank Dr. John Elder for his friendship, guidance and mentorship. I will be forever indebted for the opportunities you have given me and for believing in me.

I would like to thank my dissertation committee members, Drs. Simon Marshall, Greg Norman, James Sallis and Kevin Patrick for their patience and for their critical and constructive feedback. I greatly appreciate your time and support.

I would like to acknowledge the National Institutes of Health (NIDDK) for the funding support (F31DK079345).

Lastly, I would like to thank the families that participated in the MOVE/Me Muevo project. Without your participation, this study would not have been possible.

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FIELDS OF STUDY

Major Field: Public Health/Health Behavior

ABSTRACT OF THE DISSERTATION

An Examination of Behavioral, Psychological, Socio-Cultural and Environmental Factors that may Explain Gender Differences in Children's Physical Activity

by

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INTRODUCTION: Boys are consistently more physically active than girls, yet no single study has examined the multiple factors that may contribute to these differences. Therefore, the purpose of this study was to determine the multilevel factors that may explain gender differences in children's moderate-to-vigorous physical activity (MVPA).

METHODS: A multilevel framework and two cross-sectional datasets were used to identify and examine multiple factors that may explain gender

differences in MVPA. *Sample One* and *Sample Two* consisted of 178 and 133 child/parent dyads, respectively. Measures included child seven-day accelerometry and a parent survey consisting of previously developed or new instruments. Linear regression analysis tested for bivariate associations between several multilevel factors with child's gender and MVPA. Hierarchical linear regression tested the variance explain in MVPA by multilevel factors.

RESULTS: Parents were mostly young overweight females and 40% were Hispanic. The mean age of children was 8.1±0.7 years and 43% were Hispanic. Only 24% of children engaged in ≥60 minutes of MVPA on ≥5 days and boys engaged in eleven more minutes of MVPA per day than girls. Parent explicit modeling for PA was related to both child's gender and MVPA. The overall association between gender and MVPA was reduced by 22.7% when accounting for multiple variables in the model. Child's gender explained 4-5% of the variance in MVPA and demographic variables explained an additional 16-17%. Among girls, participating in more days of PE per week was associated with greater MVPA. Among boys, lower preference for sedentary behavior, greater parent perceptions of child's sports ability, greater parent support for child's PA, greater parent explicit modeling for PA, lower parent frequency of participating in sports, and greater number of PA equipment/facilities in the home were associated with MVPA.

CONCLUSIONS: Gender differences in children's PA were not fully explained by the multilevel factors examined. Future research should use more objective measures and use prospective study designs. Health

educators and public health professionals should advocate for more physical activity opportunities and more frequent participation in physical education for girls. The influence of parental factors on children's physical activity should be further evaluated.

I. INTRODUCTION

STUDY AIMS

Regular physical activity confers many health benefits, [1,2] yet many children are not physically active on a regular basis. [3] Gender differences in children's physical activity have been extensively reported, yet no single study has sought to identify the multiple factors that may explain these gender differences. Understanding the factors that contribute to gender differences in children's physical activity will help inform the development of effective physical activity interventions for both boys and girls.

Specific Aim. The aim of this study was to identify multilevel factors that explain gender differences in children's moderate-to-vigorous physical activity (MVPA).

Hypothesis: It is hypothesized that gender differences in children's MVPA will be explained by a combination of multilevel factors, in a mediation analysis model.

Secondary Aim: To assess the factor structure of previously validated and new scales using exploratory factor analysis.

II. BACKGROUND AND SIGNIFICANCE

Prevalence of Children's Physical Activity and Sedentary Behaviors

The United States (U.S.) Department of Health and Human Services recommends that children ages 6-17 engage in 60 minutes or more of physical activity every day. [4] However, only 34.7% and 42% of U.S. children met these guidelines based on self-report [5] and accelerometer measures, [3] respectively. These statistics are alarming given an equally high prevalence of sedentary behavior. In 2007, 35.4% of children watched 3 or more hours of television on an average school day. [5] These trends show that few children are engaging in sufficient physical activity to achieve health benefits.

Children's Physical Activity and Health

Children who are physically active or fit have a lower risk of obesity [1] and cardiovascular disease [2] and inactive children have increased risk for cardiovascular disease and diabetes. [6-8] Also, inactive children are more likely to remain inactive as they enter adulthood [9] and thus increase their risk of health complications as adults. [10,11] Low physical activity might also be more harmful if it is clustered with other unhealthy behaviors such as high sedentary behavior (e.g., TV viewing) [12] and consumption of energy-dense nutrient-poor foods; [13] each of which contributes to increased risk of obesity. [14-17]

Correlates of Children's Physical Activity

The mechanisms for the habituation of children's physical activity behaviors are still under study; however, much is known from correlational and prospective studies about the key correlates and determinants of children's physical activity. A comprehensive review of the correlates of physical activity in children and adolescents [18] showed that child *gender* (male), intentions to be active, previous physical activity, access to programs/facilities for children and opportunities to exercise for adolescents were positively associated with physical activity. [18] A more recent review showed that child's age, *gender* (male), self-efficacy, parental physical activity (for boys), and parent support were related to physical activity in children. [19] Together, these findings support the interpretation that children's physical activity is influenced by multiple factors. It was also evident that one of the most consistent correlates of children's physical activity was *gender*. In the earlier review, [18] gender was associated with greater physical activity in 81% of studies in children and in 96% of studies in adolescents. In the second review, [19] gender was associated with greater physical activity in 100% of the studies. In comparison, many other correlates were associated with physical activity in less than 60% of studies. [18] These results merit further study since physical activity is important for the health and well-being of both boys and girls.

Gender Differences in Children's Physical Activity

Studies consistently show that boys are more physically active than girls. This phenomenon has been reported by numerous studies of participants from various socio-demographic subgroups and via various physical activity measurement methods. [18,19] In fact, studies that do not show gender differences in children's physical activity are rare, [20] possibly due to measurement error rather than a true null finding. Gender differences have also been noted for meeting the physical activity guidelines. Using objective methods, a recent study showed that 49% of boys met the physical activity guidelines compared to 35% of girls; a difference of 14%. [3] These differences were persistent (although less pronounced) in older age groups, with the gender difference being 8.5% and 4.6% for ages 12-15 and 16-19, respectively. Boys aged 6-11 years engaged in 20.2 daily minutes of moderate-to-vigorous physical activity (MVPA) above girls in the same age group (95.4 minutes vs. 75.2 minutes, respectively). These findings are further supported by a longitudinal study of 375 children and adolescents which showed that boys had significantly higher MVPA and vigorous physical activity (VPA) in nearly all grade groups; with the average difference between genders being 11% and 44.7% for MVPA and VPA, respectively. [21] Thus, there is strong evidence that gender differences in physical activity are persistent and sometimes substantial in childhood (although less pronounced in adulthood). [22]

Researchers often test for gender differences and gender interactions in addition to the primary analyses, or adjust for gender effects in primary analyses. This is because study findings may be either confounded or moderated by child gender. [23] Gender differences in children's physical activity are of concern since they can reflect gender inequities in physical activity programming and promotion or an inability of behavioral interventions to adequately address the needs of girls. For example, one study found that gender differences in children's physical activity were partially explained by lower enrollment in sports and greater withdrawal from sports in girls compared to boys. [24] This may be the result of poor promotion of sports participation as well as lack of incentives to participate for girls. Another study showed that boys had greater adherence to a family-based physical activity intervention compared to girls, and greater adherence was related to significantly better BMI outcomes among boys. [25] The authors speculated that gender differences in adherence to the intervention were due to lower predilection to exercise among girls. Thus, interventions may need to target motivational factors and provide extra incentives for girls to participate. Studies are needed to examine the reasons why gender differences in physical activity exist, given that the magnitude of difference in physical activity between boys and girls can potentially contribute to differences in important health indicators such as percent body fat and depressive symptoms. [26-28]

The following sections will review current scientific evidence for possible biological, behavioral, psychological, socio-cultural, and environmental factors that can contribute to gender differences in children's physical activity.

Purpose and Function of Physical Activity

In earlier human history, physical activity served a survival rather than recreational purpose. Humans engaged in physical activity as part of daily living and survival (e.g., hunting, gathering food, running from predators and/or fighting other humans to establish and maintain territory). From an evolutionary perspective, physical activity and physical fitness were reinforced behaviors and physical characteristics for the survival of the species. These physical activity behaviors persisted as long as they were critical for survival. In modern times, physical activity has been steadily transformed from a survival attribute, into a primarily social and recreational behavior. Technological advances have (in part) contributed to the elimination of many previously physically demanding tasks, such as hunting for food and collecting wood for a fire. [29] One might expect that humans would engage in more recreational physical activity due to these technological advances; however, this is not the case. New social and environmental pressures have been engineered into daily living which compete (and often win) for our time. For example, television viewing, video game play, computer use and passive transportation (cars) are normal and expected behaviors that take up a lot of

recreational time. Lastly, even though physical activity is now seen as a recreational and optional behavior, not all segments of the population engage in the same frequency or level of leisure physical activity. [30,31] Various socio-cultural and environmental factors can determine whether a person is willing and able to put time aside to engage in leisure-time physical activity. [31,32] Identification of these factors is the focus of many investigations and of the present study.

Biological Basis for Gender Differences in Children's Physical Activity

The role of genetics on influencing physical activity behaviors is not well understood. Twin studies in children and young adults have investigated the proportion of variance in physical activity explained from additive genetic factors, shared environment, and unique environment. [33] Results showed wide ranging estimates of explained variance in sports participation and leisure-time physical activity by additive genetic factors (32% to 68.4%), shared environment (0% to 38%) and unique environment (11.6% to 37.0%). In addition, these estimates varied by gender; whereby males had a greater genetic contribution to physical activity behaviors than females (63%-68.4% vs. 32.0%-39.8%, respectively). However, in a more recent twin study, [34] the variance explained in children's physical activity and total energy-expenditure by additive genetic factors was zero or negligible, while the variance explained by common and unshared environmental factors ranged from 31% to 69%. Although not conclusive, these results support that genetic factors are a

plausible and a partial explanation for gender differences in children's physical activity. More research is needed to understand the relative contribution of genetic factors to children's physical activity. Behavioral scientists need to better understand the psychological, social and environmental factors that interact with genetic factors to propagate gender differences in children's physical activity.

Hormonal exposures may also influence children's physical activity due to their effects on brain development prenatally and on postnatal gender stereotypic play behaviors. A previous review examined the biological mechanisms for which gender differences in children's physical activity may occur; [35] one of which was hormonal influence (the androgenization hypothesis). The androgenization hypothesis suggests that gender differences in young children's rough and vigorous play is the result of greater androgen exposures (primarily testosterone) prenatally in boys. This hypothesis is also supported in animal studies [36] and in studies of congenital disorders of girls who were exposed to high levels of androgens prenatally. [37-39] Girls who were exposed to greater testosterone levels prenatally show greater preference for boy playmates and activities and toys that are stereotypical for boys. They also show lower preference for activities and toys that are stereotypical for girls. Although hormonal effects are possible from prenatal exposures, they don't explain gender differences throughout childhood given that normal endogenous hormonal levels in pre-adolescent children are fairly stable and

similar between boys and girls, until they reach puberty. [39] A more plausible explanation is that prenatal hormonal exposures may have residual effects, primarily on brain development, which influence subsequent preferences for play behaviors in young children. [39,40] The interaction between hormone exposures and environmental factors is not well understood. Studies are needed to examine how socialization of stereotypic behaviors during childhood interacts with these hormonal influences to enhance gender difference in physical activity behaviors. [39] For example, if a boy is pre-disposed towards aggressive play behavior and also socially reinforced for playing aggressively by his parents and peers, then this can result in gender differences in rough and aggressive play behaviors. [40]

Behavioral Basis for Gender Differences in Children's Physical Activity

Specific behavioral differences between boys and girls may also partly explain gender difference in physical activity. Gender differences in activity temperament have been reported. [41] Temperament is defined as a child's behavioral style or trait. [42] A child that tends to react with aggression or is hyperactive may be defined as having an aggressive temperament or a highly active temperament. Boys exhibit higher scores for the activity sub-construct of temperament compared to girls. [41] In addition to gender differences in activity temperament, activity temperament is associated with greater non-resting energy expenditure in children. [43] Thus, activity temperament may mediate the gender to physical activity association. This hypothesis has not

been empirically tested and measurement of activity temperament is challenging due to inconsistent definitions and methodologies. [44] More studies are needed to examine the role of activity temperament in children's physical activity behaviors.

Motor activity proficiency is the mastery of movement skills such as balance and coordination that are necessary to accomplish complex physical activities. The majority of sports require specific and complex motor proficiencies that enable successful execution of sport skills (e.g., throwing a ball accurately, jumping over hurdles, shooting a basketball, pole vaulting etc.). Children who have greater proficiency in motor activities may naturally gravitate towards engaging in physical activities and sports, since participation will be reinforced by their motor competence and successful outcomes. [45,46] In contrast, children with underdeveloped motor competencies may gravitate towards more sedentary behaviors in order to avoid negative social consequences (e.g., teasing, ridicule etc.). [45] Studies have shown that gender differences in motor activity are seen as early as infancy, whereby boys exhibit greater gross and fine motor movements. [44] Among preadolescent children, boys show faster times in running speed and agility, score higher in throwing a ball at a target and have faster response speeds compared to girls. [47] Greater motor proficiency is also associated with higher accelerometer activity counts and percent of time in MVPA and inversely related to percent time in

sedentary behavior among children. [47] Thus, motor proficiency may also partially explain gender differences in children's physical activity.

Psychological Basis for Gender Differences in Children's Physical Activity

Several psychological factors are related to child gender and physical activity. Cognitive factors interact with social and environmental factors to promote or inhibit physical activity behaviors in children. Through social interactions (parents, siblings, and peers), boys and girls can develop different attitudes, perceptions and ideas about their own behavioral capacity and thus have different cognitive predispositions towards physical activity and sports participation. Intentions and perceived behavioral control to be active are associated with higher physical activity levels in children. [48] However, girls report lower intentions to be active, lower perceived behavioral control, and lower sense of competency compared to boys. [49] Boys also show greater self-efficacy, social support and expectations to be active. [50] Thus, it appears that boys may be more likely to engage in physical activity due to more favorable psychological predispositions towards physical activity.

Children's perceived athletic and physical activity competence can be influenced by parental factors such as verbal encouragement. A child's perceived athletic competence is predictive of participation in sports and physical activity, and/or can be the outcome of successful sports performance. [51] Gender differences in perceived physical and athletic competence have been shown. [52,53] Boys tend to show greater perceived competence even for

activities that they do not engage in. Gender stereotypes also interact with perceptions of sports competence. Boys will identify greater perceive competence for physical activities when they are told that a male was performing the activity. [54] Gender difference in perceived sports or physical activity competence can results in gender differences in physical activity given that boys will perceive greater enjoyment and have greater attraction to activities they believe they are good at. [55-57]

Gender differences in psychological correlates of children's physical activity have been reported. [58] For girls, self-efficacy in overcoming barriers, enjoyment of physical education and perceptions of mother's activity were predictive of vigorous activity. [58] For boys, only self-efficacy in overcoming barriers was predictive of vigorous activity. [58] These results support the interpretation that gender-specific psychological correlates of physical activity may partially explain gender differences in children's physical activity. Although many studies have found gender differences in various psychological constructs (e.g., perceived barriers, motivation and enjoyment), [53,59-61] it is not clear whether these gender differences relate to gender differences in physical activity. Two limitations of the majority of studies reviewed, which prohibits inferences of causality, are that they are cross-sectional or (even if prospective) do not specifically test whether the observed cognitive constructs mediate the gender to physical activity relationship. [50,62,63]

Socio-Cultural Basis for Gender Differences in Children's Physical Activity

Social and cultural factors can contribute to gender differences in children's physical activity via socialization of gender-based social norms and behaviors. As part of social learning, children learn and adhere to gender stereotypes concerning the way to dress, speak and act. These stereotypes also extend to physical activity behaviors. Activities labeled for girls tend to be focused on grace and beauty of movements (e.g., ballet), while activities labeled for boys tend to be focused on aggressiveness and power (e.g., football). Boys consistently make more stereotypical gender classifications of sports and physical activities than girls. [64,65] Both children and their parents can also show gender differences in stereotyping of physical activities; [66-68] however, the relationship between gender stereotypes and children's participation in physical activities has not been thoroughly studied. One study showed that girls who were classified as "androgynous or masculine" tended to participate in male-dominant sports (e.g., ice hockey), while boys who were classified as "undifferentiated" tended to participate in feminine-dominant sports (e.g., ballet). [69] Boys and girls will gravitate towards and prefer to participate in physical activities that are labeled for 'male' or 'female', respectively. [70] These behaviors will be further reinforced by the social environments they produce (e.g., little league baseball and girls ballet).

Early socialization to gender roles is indirectly and directly related to child's physical activity. Boys and girls are socialized from birth to behave

differently. Boys and girls are encouraged to play with gender-stereotyped toys as young as 18 months [71] and these behaviors seem to be sustained as children get older. [72] In more traditional households, girls spent more time in total household work compared to boys and in household tasks that are stereotypical for women (e.g., food preparation). [73] Conversely, boys spent more time in more physically demanding tasks such as yard work, compared to girls. Therefore, adhering to gender roles concerning household chores may inadvertently promote greater physical activity in boys. Adherence to gender roles can also be observed during free play time in pre-school settings. Girls tend to spend more time in the 'doll corner' compared to boys. [74] Studies repeatedly show that parental socialization, beliefs and interactions with their children support gender role socialization to physical activity behaviors, and that the parent's gender is a key determinant of the type of socialization. [75,76] For example, fathers not only tend to spend more time playing with their sons, but also engage in more vigorous play when playing with them. [76] In contrast, girls tend to be inhibited by closer adult supervision and stricter rules for play. [77] Parents may have different expectations about their child's physical activity behaviors as well as different perceptions about their child's sports competence, based on their child's gender. A mother's perceived competence of her daughter can predict her daughter's own perceived competence for physical activity. [78] Parental support for physical activity seems to be an important predictor of their child's physical activity. [79,80]

In addition to parental influences, sibling and peer groups can also influence gender differences in physical activity by supporting and reinforcing physical activities that adhere to gender role stereotypes. Girls tend to receive more peer criticism for being overweight while engaging in physical activity compared to boys. [81] Weight criticisms during activity predicts lower enjoyment for sports participation, lower perceived activity compared with peers and lower mild-intensity leisure activity. These observations are in concordance with stereotypes which suggest that girls should not engage in activities that do not embrace aesthetics over skill [82] and enjoyment over competition. [83] Boys are also more likely to express negative statements of girls who are physically active such as "that's disgusting" and "It's nasty" or refer to them as "tomboys" [84]. This shows that children do in fact adhere to the prescriptions of gender roles and that these stereotypes can negatively influence girls' physical activity. Children in the 3rd grade may not yet develop positive or negative attitudes towards physical activity, but evidence suggests that gender stereotypes about physical activity are already present in this age. For example, 3rd grade girls show greater preference for participation in physical activities that have beautiful movements compared to boys. [82] In combination, evidence support that sibling and peers influences can contributes to gender differences in physical activity by maintaining social systems that adhere to gender stereotypes towards physical activity, most of which encourage physical activity among boys and discourage physical activity among girls.

Cultural factors are also important in establishing normative behaviors for boys and girls. Cultural differences in gender roles can moderate gender differences in physical activity. For example, traditional Mexican culture is socially conservative. Traditional Mexican families prefer or are more accepting of values that encourage and maintain clear distinctions and prescriptions of gender roles. [85] These gender roles also extend to differentially support physical activity behavior between men and women. For example, a qualitative study of married Mexican immigrant women living in California identified several cultural barriers for physical activity. [85] Although not exclusive to Mexican culture, Mexican women who live in a traditional family structure are expected to be the primary or sole caretaker of the children. This leaves very little time, energy or motivation for engaging in physical activity. One study participant said "…I really have 5 jobs…take care of these 6 kids…work at the flea market…take care of my husband, my mother, cook for his brothers…that's enough exercise". [85] This statement makes clear that the demands of gender-based family roles can restrict a woman from engaging in physical activity. Women from traditional families lack spousal and family support for engaging in physical activity. [85] One other study examined attitudes, preference and practices towards physical activity in African American, Latino, and Caucasian girls. [86] This study found that there were no ethnic differences in values and beliefs about physical activity and

girls adhered to gender stereotypes for engagement of physical activity, regardless of ethnicity. These contradictory findings need further study.

Acculturation may also be an important moderator of gender differences in children's physical activity. The values prescribed to physical activities can differ based on acculturation levels. American-born children may take part in sports or physical activities primarily for competition and improvement of skills, whereas foreign-born children seem to prefer to participate for social affiliation and wellness. [87] This evidence supports the notion that culture might affect physical activity behavior via its effect on perceptions of purpose and benefits. Studies have shown that acculturation is negatively related to physical activity behaviors and weight status while others report positive associations; a paradox that warrants further investigation. [88,89] How culture differentially affects boys' and girls' physical activity is not well understood. It is likely that cultural norms related to body image, machismo/masculinity, and gender stereotyping can be important factors. [67,90,91] Highly acculturated families may not adhere to gender role stereotypes towards children's physical activity due to the adoption of less traditional stereotypical belief systems; therefore no gender differences in children's physical activity might be observed in this sub-group of families. However, no previous empirical evidence exists to support this hypothesis

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Environmental Basis for Gender Difference in Children's Physical Activity

Environmental factors can reinforce gender differences in children's physical activity. Young children are especially susceptible to environmental influence given that they have relatively little autonomy over their own behaviors. A systematic review identified a total of 150 publications that tested associations between children's and adolescent's physical activity and at least one environmental correlate; most of which were published in the last decade. [92] At the home level, various physical environmental variables were not related to children's physical activity (e.g., availability and access to exercise equipment). In addition, cultural/social environmental variables (e.g., family structure, household size, number of children in the family, dog ownership) were not related to physical activity. Father's physical activity and time spent outdoors were the only home-level environmental variables consistently related to higher physical activity. Other variables not related to physical activity were parenting styles, family/parent socioeconomic status, and mother's physical activity. At the school level, few studies investigated environmental factors related to physical activity; but of those that did, physical activity policies such as time allowed for free play, time spent outdoors and the number of field trips were related to physical activity. At the neighborhood level, availability and accessibility to physical activity programs/facilities, neighborhood safety and neighborhood hazards were consistently related to physical activity. At the city/municipality and region/country level, there were

no factors that were associated with physical activity; likely due to very few studies that examined these associations. Based on this review, only few environmental factors had strong empirical support. This may be attributed partly to the design of the studies reviewed (mostly cross-sectional) and to relatively underdeveloped measurement techniques of environmental factors. Nonetheless, the environmental factors that have been associated with children's physical activity may interact with socio-cultural factors to differentially promote physical activity between genders. For example, parents may have different policies for playing outside for their daughters and sons. It is possible that parents may be more lenient with their sons and more restrictive with their daughters with respect to playing outside and therefore differentially promote more physical activity in their sons. Research is needed to understand how environmental factors interact with social factors to affect gender differences in children's physical activity.

Summary of the Evidence

Scientific evidence shows that gender differences in children's physical activity are persistent. The explanations for these gender differences are likely to be due to many undetermined interactions between biological, behavioral, psychological, socio-cultural, and environmental factors. At each of these levels, there are several candidate variables that can explain gender differences in children's physical activity. If gender differences are due to mostly modifiable factors such as parental socialization and adoption of

stereotypical behaviors, then intervention studies can be designed to target these mediating variables. For example, an intervention might help parents realize that physical activity is equally important for boys and girls and to support physical activity behaviors of their daughters; resulting in increased physical activity in girls. Creating similar opportunities and support for engagement in physical activity may eliminate gender differences in children's physical activity. Research is needed to examine the relative contribution of variables in each of these levels to explain gender differences in physical activity.

Study Rationale

To date, no single study has explored the reasons for gender differences in children's physical activity or implemented an intervention to reduce gender differences. The Trial of Activity in Adolescent Girls (TAAG) showed that activity-related peer social network variables were associated with improvements in physical activity levels, however a comparison group of boys was needed to determine whether such factors differed by gender. [93] This is a limitation observed in other studies. [30] To date, no study has examined and compared gender differences in multilevel factors and examined how those factors might explain gender differences in physical activity. Young children represent a population that is amiable to change since their behaviors are largely dictated by parental and environmental influences. In addition, healthy and physically active lifestyles must be established during

childhood so that these behaviors are more likely to be maintained into adulthood. Understanding the behavioral, psychological, socio-cultural and environmental factors that contribute to gender differences in children's physical activity can assist public health practitioners in developing and implementing physical activity programs that are attractive and effective for both boys and girls.

The purpose of this study was to examine factors at multiple levels that were associated with child's gender and child's MVPA, and to test the mediating effects of those factors on the association between gender and MVPA.

Theoretical framework

Various theories have been developed to explain and predict health behavior, ranging from individual-level to multi-level frameworks (i.e., ecological). [94] Each theory consists of specific constructs that are theorized to affect behavior via specific mechanisms. The utility of health behavior theories in health behavior research can vary based on the goals and scope of the research. For example, if the goal of a study is to understand the individual level factors that predict children's engagement in physical activity, then a value-expectancy theory (e.g., Health Belief Model, Theory of Reasoned Action, and Theory of Planned Behavior) [94] may be used to determine if physical activity behaviors are related to one or more of the proposed constructs of value-expectancies (e.g., perceived risk and perceived benefits).

On the other hand, if the goal is to examine the larger social and environmental factors related to a child's physical activity behaviors, then a multilevel framework is necessary (e.g., ecological models). [95] Thus, theories or models need to be utilized in accordance with the conceptual framework and scope of the research project.

Social Cognitive Theory (SCT) follows the premise that human behavior is determined by interactions between cognitive, behavioral and environmental factors; a process called reciprocal determinism. [96] This means that human behavior is not simply a reaction to external stimuli. It is also the outcome of internal self-regulatory processes that integrate experiential information to predict the occurrence of behavior. There are 11 constructs in SCT. [97] The most commonly used in physical activity research are: 1) environment (factors physically external to the person); 2) behavioral capacity (knowledge and skill to perform the behavior); 3) expectations (anticipatory outcomes of a behavior; 4) self-control (personal regulation of behavior); 5) observational learning (watching actions and outcomes of other people's behaviors); 6) reinforcers (responses that increase or decrease behavior); and 7) self-efficacy (confidence in performing a behavior). SCT evolved from operant learning theory which was expanded to include cognitive constructs to explain human behavior. [96] A traditional behavioral perspective would argue that a young child may learn to play rough with his siblings through social contingencies that reinforce rough play. [98,99] These contingencies are operationalized as the

chaining of antecedents, behaviors, and consequences that reinforce successive approximations of the desired behavior until the behavior is conditioned. [98] As such, a child will gradually learn to play rough based on the reinforcement he/she receives for engaging in specific play behaviors that are defined as rough (e.g., punching and kicking). Evidence supports that past behavior is the strongest predictor of future behavior, [100] and although this is empirically supported, [101] it does not account for much of the complexity of human behavior. For example, a young boy may also learn to play rough by simply observing other children playing rough; a process known as vicarious learning. [96] This form of learning inherently involves cognitive processing of visual information that the observer can use to decide if he/she will engage in the observed behavior. Vicarious learning happens without going through the trial and error phase of experimentation with a new behavior (i.e., without a direct/immediate consequence). Since SCT incorporates cognitive, social and environmental constructs, SCT is the most comprehensive and appropriate theoretical framework to study gender differences in children's physical activity.

The present study calls for a multilevel approach, given the various factors that can influence children's physical activity. Explanations for gender differences in physical activity might be found in proximal and distal factors that differentially reinforce particular physical activity behaviors between genders. The literature review showed that there were several multi-level

factors that may explain gender difference in physical activity; in addition to supporting constructs of SCT. [18,62,63] Children may engage in different play behaviors due to very specific and intentional expectations by the part of the parent, such as playing with gender-stereotyped toys. [71] This results in the learning of gender stereotyped play behaviors that are sustained into older ages. [72] Parent support for physical activity can promote greater self-efficacy and perceived competence in their children, which in turn, will increase physical activity behaviors. However, if parent support differs based on the child's gender, then gender differences in physical activity may result. The present study used the theoretical principals of SCT to guide the measurement and analysis of the multilevel factors that might explain gender differences in children's physical activity.

III. METHODS AND PROCEDURES

Study design

This study used two distinct datasets (*Sample One* and *Sample Two*) to examine the same research question. Data were collected from a cohort of participants in the MOVE/Me Muevo project. Data for the two datasets were collected at two time points: from the MOVE project baseline measures (February to July, 2008) [*Sample One*] and as part of the MOVE project's 1st year follow-up measures (March to August, 2009) [*Sample Two*]. The MOVE project was a 3-year 2-group randomized controlled childhood obesity prevention trial, utilizing recreation centers to target reduction of child BMI through physical activity and dietary changes in children and their families living in San Diego County. Recreation centers were the unit of randomization while measures were taken on individual participants. Thirty recreation centers (consisting of 18 participants in each) were randomized to either the intervention or control condition (15 centers in each group; 271 participants in intervention and 270 in control group). Before randomization, recreation centers were stratified based on census income and size, resulting in four strata. These strata were used to ensure balanced income levels between the treatment groups.

Sample One consisted of cross-sectional data from the MOVE project baseline measures. The MOVE study was not specifically designed to examine the factors that might explain gender differences in children's MVPA.

However, several data that were collected at baseline were of scientific interest and available to examine this research question. At baseline, a total of 198 children (from control group and intervention group) were randomized to seven-day accelerometer measurement. In addition, parents/caregivers completed a survey consisting of various demographic, parenting style, home environment and psychosocial measures.

Sample Two also consisted of cross-sectional data collected during the MOVE project's 1st year follow-up measures. However, only control group participants were recruited to participate in a second set of measures specifically for this study. This was in addition to the measures that were being conducted by the MOVE project. *Sample Two* consisted of 137 control group participants (parent and child). As such, some participants' data are represented in both *Sample One* and *Sample Two* (n=32), but not for all participants since participation in the second set of measures was optional. In order to study several factors identified in the literature review that may explain gender differences in children's MVPA, a new survey was introduced and child physical activity data were also collected (March to August, 2009). Participants in the control group were chosen in order to obtain a study sample that was not influenced by intervention effects of the MOVE project. The survey consisted of several parental self-report behavioral, psychosocial, cultural and environmental measures that were chosen (empirically and theoretically) to explain gender differences in children's physical activity. These instruments

and questions were derived from existing measures or developed based on the literature and recommendations from experts in this topic.

Recruitment and Enrollment Procedures

MOVE participants were recruited within the south San Diego County area through various methods (e.g., fliers, phone calls, community events, referrals etc.). Inclusion criteria were: 1) having a child aged 5-8 years old, 2) living within 1.76 miles from a participating recreation center, 3) planning on living in the area for the next 3 years, and 4) willing to be randomized to intervention or measurement-only control conditions. If the family had more than one eligible child, then the child with the closest birthday to the day of assessment was selected. Exclusion criteria were: 1) child on a medically prescribed diet or with a condition that limits their physical activity and 2) children under the 10^{th} percentile for BMI for age and gender. Recruitment staff contacted potential/interested participants via telephone to conduct an initial eligibility screening survey based on parental self-report. If participants met the screening criteria and were interested in participation, then a consenting visit was schedule with the parent and child. During the consenting visit, recruitment staff provided the parent with written and verbal explanations of all study measures and procedures, and the child was given verbal explanations. Parents and children were given opportunities to ask questions and provided with clarifications when needed. Parents provided written consent to participate and children provided oral assent to participate. The

MOVE study and the present dissertation project were approved by the Institutional Review Boards of San Diego State University and the University of California, San Diego.

Thirty recreation centers were recruited through phone calls and in-person interviews with recreation center directors. Recruitment staff contacted the recreation center directors and provided them with verbal and written explanation of the MOVE study. Recreation center directors that expressed interest in participation were scheduled for a follow-up interview to obtain their written approval to participate in the study.

A total of 1,162 participants were screened for eligibility, 662 met the eligibility criteria based on parent self-report. A total of 565 provided consent/assent and 541 met final eligibility criteria (child BMI ≥10th percentile based on objective measures). A total of 541 participants were measured at baseline. A total of 75 recreation centers were within the target geographic area for recruitment. From these, 30 were chosen and agreed to participate. Inclusion criteria for recreation center participation were: having outdoor facilities and capacity to support youth physical activity programs.

For the follow-up measures (*Sample Two*), control group participants were mailed a study flier and consent form 1-2 months in advance to remind them of their upcoming measures and to explain to them that they had the option of participating in a 'new' study. Within a month before the scheduled measurement visits, parents received a phone call by measurement staff to

remind them of their measurement visit and to give the parents an opportunity to ask any questions about the new study and receive clarifications. Parents were reminded that they were not obligated to participate in these new measures and that there were no repercussions for declining to participate. Parents and their children were asked to attend a family MOVE open house event held at the recreation center that they were assigned to as part of the MOVE project. During this event, parents and children participated in surveys and BMI measures, respectively. An informational booth was set up where a designated staff person was responsible for explaining to parents and their children about the option to participate in the new study measures. Parents were explained that the second study required that they complete a second survey and their child to wear an accelerometer for seven consecutive days. Parents that verbally agreed, were asked to read and sign a new consent form (children gave oral assent) and stay an additional 30-45 minutes to complete the second survey and receive instructions for wearing the accelerometer. Once the survey was completed, parents were given a $10.00 incentive and the child was given a small toy or pen.

Pilot testing of Survey Measures

A parental self-report survey was developed for *Sample Two*, which consisted of several questions and scales. Some measures were taken from previously validated scales or adapted for use in this study, and others were developed through the consultation with dissertation committee members.

Since many measures were only available in English, these were translated to Spanish in order to accommodate study participant's language preference. Translation to Spanish was conducted by a native Spanish speaker. During the month of February (2009), eight MOVE parents (4 English and 4 Spanish speaking) were invited to participate in pilot testing of the draft survey. After completing the survey, parents were asked to provide feedback on question wording, response option format and to give their overall impressions of the survey. This information was used to refine the survey questions and estimate the time needed for completion. Based on information and comments provided by these parents, the survey was further modified. Parents who participated in the pilot testing of the survey were given a $10 incentive. The final survey was estimated to take 20-35 minutes to complete.

Study Measures

Table 2.1 below summarizes all study measures at each level (individual, social etc.) and indicates for which sample each measures was taken (*Sample One* vs. *Sample Two*). As shown in Table 2.1, some measures were common to *Sample One* and *Sample Two* while others were only taken for *Sample Two*.

Table 2.1. Summary of multilevel study measures.

	Measures	*Sample One*	*Sample Two*
	Demographic and Anthropometric		
1.	Age, sex, ethnicity, income etc.	X	X
2.	Child BMI (kg/m^2)	X	X
	Individual level (behavioral)		
3.	Child 7-day PA (accelerometer)	X	X
4.	Child PA behaviors	X	X
5.	Child PA in recreation places or sports facilities	X	
6.	Child preferences for play		X
	Individual level (psychological)		
7.	PA Enjoyment Scale		X
	Family level (parent influence)		
8.	Parent perceptions of child's sport ability		X
9.	Parent acculturation	X	X
10.	Parent rules for child playing outside	X	X
11.	Parent encouragement for child's PA	X	X
12.	Physical Activity Stereotyping Index		X
13.	Parent Activity Support Scale		X
14.	Parent history of sports participation & success		X
15.	Parental gender stereotypes of sport ability		X
16.	Sport Socialization Inventory		X
17.	Bem Sex-Role Inventory (BSRI)		X
18.	Home chores		X
19.	Parenting style for child's PA		X
	Social level (peer influence)		
20.	Peer criticism of child's PA		X
21.	Peer influence for child's PA		X
22.	Number of siblings		X
	Environmental (home)		
23.	Sedentary media in the child's bedroom	X	
24.	PA equipment and facilities in the home	X	X
25.	Child gender stereotyped television shows		X
26.	Child gender stereotyped gift toys		X
	Environmental (community)		
27.	Ease of PA in community		X
28.	Opportunities for PA in the Community		X

PA=Physical Activity

The following section describes each study measure and makes note for which study sample the data were collected (*Sample One* or *Sample Two*). See the **Appendix** section for a sample of each of the study surveys.

Demographics (*Sample One* and *Sample Two*)

Parent and child demographic information were collected during the MOVE study baseline measures. These data were collected via a self-

administered parent survey that took approximately 45-60 minutes to complete. Data collected included parent and child age, parent and child gender, parent and child race and ethnicity, parent income and education levels. Since demographic data represented variables that are constant or are unlikely to change within a year, these baseline data were also used for *Sample Two*. Parent and child age were updated based on date of measurement for *Sample Two*.

Child Body Mass Index. (*Sample One* and *Sample Two*)

Child's BMI was measured at baseline and again for *Sample Two*. Height and weight of children were measured via a height board and portable digital scale (respectively) to the nearest 0.1 centimeter and 0.1 kilogram, respectively. Participants were asked to remove their shoes and empty pockets before the measures. Each measure was taken twice and the average of the two was used for analyses. Study staff underwent training to standardize collection procedures of these measures and inter-rater reliability was conducted on a random subset (10%) of measures to check for data quality. Child's BMI (kg/m^2), BMI percentiles for age and gender, and BMI z-scores were calculated using the SAS program and 2000 reference data available from the CDC at: http://www.cdc.gov/nccdphp/dnpa/growthcharts/resources/sas.htm.

Child Physical Activity (*Sample One* and *Sample Two*)

Child's habitual physical activity was measured at baseline and again for *Sample Two*. The ActiGraph accelerometer (Model GT1M) was used to measure child's physical activity. This model is a uni-axial accelerometer which measures body movement in the vertical plane. The dimensions of this unit were 3.8 x 3.7 x 1.8cm and weighs approximately 27 grams. The ActiGraph accelerometer has been tested and validated in child studies using metabolic assessments and prescribed sets of locomotor activities as the criterion measures; achieving fairly strong correlation estimates [102] Activity data obtained from accelerometers are expressed as counts per unit of time (e.g., counts per minute). These data are then used in prediction equations to generate summary estimates of time in various activity intensities based on metabolic equivalent (METs) cut points for energy expenditure estimates of physical activity. Various prediction equations have been developed, each with their own strengths and limitations. [102] Some studies recommend using ≥3 METs, while others recommend ≥4 or ≥4.5 METs to define the lower cut points for moderate intensity activity. This study used the recommendations of Freedson et al., (2005) [102] to estimate children's time in MVPA. These recommendations included using age-specific cut-points and 4.5 METs for the lower cut point of moderate intensity activity.

Wearing instructions were identical for both *Sample One* and *Sample Two*. Children were instructed to wear the accelerometer over the right hip

bone area of the body using a flexible belt. Parents received verbal and written instructions and children received verbal instructions as to the appropriate use of the accelerometer. In addition, during the measurement session the child was asked to demonstrate that he/she could properly put on the accelerometer. Children were instructed to wear the accelerometer for seven consecutive days, during all waking hours except when engaging in water-based activities (e.g., bathing or swimming). Accelerometers were distributed to participants during the family open house events held at the recreation centers.

Accelerometer retrieval methods differed between *Sample One* and *Sample Two*. In *Sample One*, MOVE study staff picked up accelerometers after the seventh day of measurement at participant homes. In *Sample Two*, parents were given a padded pre-stamped envelope and instructed to mail back the accelerometer when their child completed the seven days of measurement. During the seven-day measurement window, study staff called parents on the third and sixth day to check-in and ask them if their child was complying with the accelerometer measurement and to advise the parents to make any necessary adjustments if their child was not complying with the measurement protocol. Parents were contacted by study staff one more time if the accelerometer was not received within a week of having been mailed. Accelerometers were picked up at participant homes (or alternate location) if the parent kept forgetting to mail back the accelerometer. When

accelerometers were returned, data from each accelerometer were downloaded to a computer to determine compliance via the Meter Plus software (Version 4). Compliance criteria for wearing accelerometer was defined as a minimum of three weekdays and one weekend day of wearing accelerometer for at least ten hours per day. Exceptions were made when a child engaged in water-based activities which prevented them from achieving ten hours of wearing time (e.g., swimming). In such cases, adherence criteria were reduced to eight hours of wearing time in the day that the child engaged in water-based activities. Accelerometers were initialized the same day they were to be distributed and set to start recording data at 3am on the following day. Accelerometers for set to record activity data at 30 second intervals (aka epochs). This epoch length was selected to maintain consistency with how baseline data were collected and is considered appropriate for children. [103] Parents were also given a seven-day accelerometer diary and instructed to write down when and for what reasons their child did not wear the accelerometer during the measurement period. If the minimum compliance criteria were not met, then the participant was asked to re-wear the accelerometer for the necessary days needed to meet the criteria. See the **Appendix** section for a sample of the accelerometer diary.

Parent Acculturation (*Sample One* and *Sample Two*)

Parent acculturation was measured using a previously validated instrument. [104] This instrument was developed and tested in a sample of 363

Hispanics and 228 non-Hispanic whites aged between 15 to 75 years who were similar in socio-demographic characteristics. The instrument consisted of a 12-item self-administered questionnaire that measures three constructs: language use, media use and ethnic social relations. In the validation study, [104] the alpha coefficient was 0.88. The correlation coefficients ranged from 0.70 to 0.84 compared to other acculturation measures (e.g., generation status). For the MOVE study, only eight of the twelve items were selected and the answer choices were modified so that non-Spanish speaking individuals could also answer the questions. For example, the answer choices were changed from "Only in Spanish" to "Only in another language". These data were also used for *Sample Two* given that acculturation status was not expected to change in a year's time.

Sedentary Media in the Child's bedroom (*Sample One*)

Information about the presence of various sedentary media in the home (e.g., television, computer etc.) was collected at baseline. This measure was adapted from the 'Active Where' survey developed for the Active Where study. [105] The average intra-class correlations for this measure were 0.87 and α=0.93. From a list of six items, parents were asked to indicate the total number of items present in their child's bedroom.

Child's Physical Activity Behaviors (*Sample One and Sample Two*)

Child's engagement in physical activity behaviors was assessed by asking the parent to indicate how many days per week their child plays or

participates in team sports, physical activity classes, physical education at school, and active transport to and from school. This measure was also adapted from the 'Active Where' survey developed for the Active Where study. [105] The intra-class correlations for this measure were 0.75 and α=0.85.

Parent Rules for Playing Outside (*Sample One* and *Sample Two*)

Parent rules for their child playing outside were assessed using eight items. The question stem was "Do you have following rule for your child…" Response options for each item were 'yes', 'no', or 'sometimes'. This measure was also adapted from the 'Active Where' survey developed for the Active Where study. [105] The intra-class correlations for this measure were 0.71 and α=0.83.

Child Activity in Recreation Places or Sports Facilities (*Sample One*)

Child activity in recreation places or sports facilities was assessed by asking the parent to indicate how often in a typical week their child was active in various facilities away from home. Response options ranged from 'Never' to '5-7 times per week'. This measure was also adapted from the 'Active Where' survey developed for the Active Where study. [105] The intra-class correlations for this measure were 0.74 and α=0.86.

Parental Encouragement for Child's Physical Activity and Reduced Sedentary Behavior (*Sample One* and *Sample Two*)

Parents were asked to report how often in a typical week an adult member encourages their child to be physically active and provides

instrumental support for physical activity and encourage their child to be less sedentary. This measures was developed for the PACE study (http://famprevmed.ucsd.edu/pacedocs/PAS.pdf). Response options ranged from 'Never' to 'every day'. In *Sample Two*, the respondent was also asked to answer a second set of identical items to represent the 'other' parent's encouragement (if applicable).

Activity Equipment and Facilities in the Home (*Sample One* and *Sample Two*)

Parents were asked to report whether activity toys, equipment and facilities were available and used by their child the home. Response options were 'Not available', 'Available but never use' and 'Available and use'. This measure was also adapted from the 'Active Where' survey developed for the Active Where study. [105] The intra-class correlations for this measure were 0.71 and α=0.83.

Physical Activity Gender Stereotypes (*Sample Two*)

The Physical Activity Stereotyping Index (PASI) was developed to measure the extent to which children, parents and teachers label physical activities according to gender. [64] This instrument was developed using 12 expert judges, 90 children aged 4-7 yrs old, 90 parents and 90 teachers living in Knox County, Tennessee. The final instrument was composed of a 24-item self-administered questionnaire (8 male, 8 female and 8 gender-neutral physical activities) with a 5 point Likert-type response format (written for adults and pictorial for children). Parents were asked to categorize each physical

activity into one of five categories based on perceived gender-appropriateness of each activity. Response options were: a) a lot more for boys; b) a little more for boys; c) equally for boys and girls; d) a little more for girls; and e) a lot more for girls (coded as 2, 1, 0, 1, 2, respectively). [106] This instrument had a test-retest reliability of r=0.77 for children, r=0.94 for parents and r=0.95 for teachers. In addition, construct validity was assessed by comparing scores between two groups of expert judges. Judges did not differ in their scoring of gender specific physical activities and the inter-rater correlations were 0.98 for males and 0.82 for female activities. Although the PASI was also developed for children, resource limitations only allowed for administration of this measure on the parent. For the present study, only 12 items were selected in order to keep the overall survey length within 35 minutes. Items were selected to represent each of the three constructs (4 gender neutral, 4 for boys, and 4 for girls).

Parent Activity Support (*Sample Two*)

Parent's activity-related support for their child was developed and tested in a sample of 180 non-Hispanic White mothers and fathers of 7-9 yr old girls. [79] Based on exploratory and confirmatory factor analysis, two factors were identified: logistic support (three items) and explicit modeling (four items). Internal consistency coefficients were as follows: fathers' logistic support α=0.74; fathers' explicit modeling α=0.69; mothers' logistic support α=0.61;

and mothers' explicit modeling α=0.75. In addition, greater activity support (from either construct) was related to their daughter's physical activity.

Physical Activity Enjoyment (*Sample Two*)

The Physical Activity Enjoyment Scale (PACES) was developed to measures adult's enjoyment of physical activity [107] and then modified and tested in a sample of 1,797 adolescent girls. [108] This revised scale contains 16 items consisting of bipolar and in-between statement for enjoyment of physical activity. The rating scale for each item ranged from 1="Disagree a lot" to 5="Agree a lot". Results showed that the PACES consisted of a single factor representing enjoyment and that PACES was related to MVPA and sports participation. Since only the parent participated in the study survey, PACES was modified so that it measured '*parental perceptions'* of their child's enjoyment (a proxy measure of the child's enjoyment). For example, the item stem was re-written so that instead of "When I am active…" the statement was "When your child is active…" Also, each item was re-worded as follows: "I enjoy it" was replaced with "He/she enjoys it". Response options were also changed to 'yes' or 'no'.

Parental Perceptions of Child's Sport Ability and Gender Stereotypes of Sports Ability (*Sample Two*)

A short survey was used to assess mothers' perceptions of their child's sport ability (2 items) and gender-stereotypes of sports ability (3 items). [109] This instrument was developed in a sample of 1,500 mothers and their 11-12

year old children. Each item on the scales used a 5-point Likert-type response format. Internal consistency scores for perceptions of child's sport ability and gender-stereotypes of sports ability were α=0.91 and α=0.60, respectively. In previous studies, mother's perception of their child's physical competence was related to their child's self-perception of physical competence (r=0.43) and actual performance (r=0.52). [78]

Sport Socialization (*Sample Two*)

The Sports Socialization Inventory was developed to assess child influence from family, peers and teachers to engage in sport activities. [110] The constructs included: active sport involvement, values toward sport, family influence, teachers' influence, friends' influence, and opportunity set. This measure had a test-retest reliability of 0.89 and has also been translated into Spanish, with a test-retest reliability of 0.95. [111] Since this measure was developed for use in children and since not all of the constructs may be relevant for the current project, this instrument was modified to change the wording so that parents could respond to questions pertaining to their child. In addition, only subsets of questions were selected based on consultations with experts to reduce the overall survey length.

Sex Role Ideology (*Sample Two*)

The Sex Role Ideology Scale was developed to measure the extent to which an individual prescribes to traditional gender roles for women and men. [112] This measure consisted of 30 items of gender-stereotypic statements such

as “The best thing a mother can teach her daughter is what it means to be a girl” or progressive statements such as “A married woman should feel free to have men as friends”. The response options ranged from “Strongly disagree” to “Strongly agree”. This survey was administered in a sample of adults with a test-retest reliability of r=0.87 and a split-half reliability ranging from 0.57 to 0.91 depending on the sampling restrictions. Only a sub-set of 6 items were used in order to reduce participant burden.

In addition to using previously validated measures, several single-item and multi-item measures were developed specifically for use in *Sample Two*. No single study has attempted to examine the factors that explain gender differences in children’s physical activity in one multivariate and multilevel analysis. Therefore, it was necessary to develop topic specific measures that were complimentary to the theoretical domains and scope of this project. Below is a description and justification for each of the new measures.

Number of Days Child Lives with Parent

A single-item question was used to measure how many days per week the child lives with the caregiver. The item wording was “How many days a week does your child live with you?” This information was used as a potential covariate in analyses.

Parent’s Type of Dwelling

The parent was asked to select the type of dwelling that best described where they lived (e.g., house, apartment, condo etc.). This information was

used to infer the possible spatial limitations that the child encounters in their home to engage in physical activity. For example, a child who lives in a house may have more space to be active compared to a child who lives in an apartment complex. This variable was considered as a possible covariate in analyses.

Number of Siblings

Parents were asked to indicate if their child was an only child (yes or no). If they answered no, then they were asked to report the gender and age of their child's other sibling(s). Research has shown that the number of children in the home is related to children's physical activity. [113]

Parent History of Sports Participation and Success in Sports

Parents were asked four questions pertaining to their childhood participation in sports and how well they did in sports. Parents who were successful athletes in their childhood may be more likely to encourage their children to participate in sports. [114]

Peer Criticism for Physical Activity

Two items were used to assess whether the child has been criticized by their peers for engaging in physical activity and for being too heavy or fat. Parents answered 'yes' or 'no' to each of the two statements. Research has shown that girls tend to receive more peer criticism for engaging in physical activity compared to boys. [81]

Home Chores

A check-list of 11 items was used to determine the number and types of home chores that the parent expects their child to do. This information was an indicator of how traditional the parent is with respect to gender roles. Research has shown that the types of home chores that boys and girls are expected to do may influence physical activity due to the nature of the chore (e.g., yard work vs. preparing food). [73]

Parent Leniency or Restrictiveness towards Playing Outside and Inside the Home

Six items were used to assess a parent's style towards their child's play outside and inside the house. Parents who are more restrictive may inadvertently promote less physical activity in their child. Research has shown that parents tend to be more restrictive with girls compared to boys. [77]

Child Preference for Play

A seven-item questionnaire was used to assess parental perceptions of their child's preference for active or sedentary play. These items measured the general play preference of their child (e.g., alone vs. with friends). Research has shown that boys and girls differ in the types of play behavior such as playing with dolls, playing alone and preferences to play with peers. [72,73]

Child Exposures to Television Shows and Gender Labeling of Shows

Parents were asked to write down the top three favorite television shows that their child likes to watch. This information was used to assess the

extent to which the child is exposed to and prefers gender-stereotyped television shows. For example, a girl may like to watch a program that reinforces feminine stereotypes such as dressing up and going shopping and a boy may like to watch a program that reinforces fighting and aggression. Research has shown that television shows can reinforce gender-role stereotypes. [115] Each TV show was classified as “more for boys”, “more for girls” or “gender neutral” based on the criteria shown in Table 2.2.

Holiday Gift Toys and Gender Labeling of Toys

Parents were asked to write down three toys that their child received during the last holiday season. This information was used to identify the family socialization of their children through toys. Research has shown that parents encourage their children to play with stereo-typical toys. [71,72] Criteria for labeling toys based on gender are shown in Table 2.2.

Table 2.2. Criteria for classification of gender stereotyped TV shows and toys.

TV SHOWS	**More for Boys**	**More for Girls**	**Gender Neutral**
Main Characters	Action Figures/Heroes	Dolls	Fictional characters
Content/Theme	Action Aggressive Behavior Building/Tools Sci Fi/Scary Sports	Emotional Nurturing Performing Arts Relationships	Educational Cartoons - General
Examples	Transformers Drake & Josh How Its Made Ghost Hunters	Hannah Montana High School Musical Dancing with Stars Curious George	Sponge Bob Animal Planet
TOYS			
Type	Sports Action Figures Video Games (action)	Dolls Baking/Makeup Video Games (girls)	Educational Group games
Examples	Basketball Spiderman Figure PS3 - Tony Hawk	Barbie Cooking kit PS3 - Hannah M.	Board games Science kit

Power and Sample Size Calculations

There are currently no standardized formulas to calculate the sample size required for mediation analysis. However, a study was conducted to provide empirical estimates of sample sizes needed to achieve 80% power for the most common mediation analyses. [116] In this paper, 166 studies were reviewed which tested various mediators. The effect sizes were defined as follows: a small effect size was "S=0.14"; an intermediate effect size between small and medium was "H=0.26"; a medium effect size was "M=0.39"; and a large effect size was "L=0.59". For example, an "HM path" denotes an intermediate-to-medium path for α and β, respectively. A mediation analysis framework was proposed in order to evaluate the variance explained by each of the proposed explanatory variables and to test for a significant reduction in the gender effects (i.e., reduced p-value and point estimate of gender) after entering the proposed explanatory variables in a single mediation model. Baseline physical activity data (accelerometer) from the MOVE study were used to estimate the effect size for gender differences in MVPA. The mean difference in daily MVPA between boys and girls was 11 minutes (73.58 - 62.51= 11.07). The average standard deviation was 22.84 minutes. Using the Cohen's *d* standardized effect size formula (M_1-M_2/Std), the standardized effect size was 0.48 for the difference between gender and MVPA. This effect size was considered moderate to high, which is large enough to allow for the statistical evaluation of meaningful mediation effects of other variables. The

sample size obtained for *Sample One* was 178 participants. Based on the different conditions presented in the summary table of the previous mediation analysis study, [116] *Sample One* would have 80% power to test for 'intermediate mediation' effects (HH; 0.26 & 0.26, respectively). *Sample Two* consisted of collecting new data during the follow-up measures of the MOVE study. Due to resource limitations and feasibility considerations, the target sample size was 120 participants. This sample would have 80% power to test for 'medium-to-intermediate mediation' effects (MH; 0.39 & 0.26, respectively).

Data Management

Data for *Sample One* and *Sample Two* underwent nearly identical data management procedures. Survey and anthropometric data were verified, coded and entered. For *Sample One*, a randomly selected sample of 10% and 20% of cases (survey and anthropometric data, respectively) were verified for entry errors. For *Sample Two*, all data were verified for entry errors. After these procedures, data files for survey, child anthropometrics and accelerometer data were merged to create two datasets (one for *Sample One* and one for *Sample Two*).

Accelerometer data were downloaded to a Windows-based computer system and stored in designated participant folders. Once all data were collected and downloaded, the MAHUFEE program was used to select valid days for each participant (MAHUFEE is available at http://www.mrc-epid.cam.ac.uk/Research/Programmes/Programme_5/InDepth/Programme%2

05_Downloads.html). During this step, criteria for a valid day were ≥540 minutes (9 hours) of wear time or ≥480 minutes (8 hrs) in days that water-based activities were indicated in the accelerometer diary. Valid day criteria were reduced from 10 hrs to 9 hrs during this step given that evening and night-time data were also included when participant data were screened for compliance during measurement. Therefore, it is possible that children who were initially classified as compliant may no longer be compliant once evening wear data are removed. For this reason and to maximize the study sample, valid day criteria were lowered to 9 valid hours per day. A non-valid hour was defined as 20 minutes or more of consecutive zero counts. Activity count data were scored and classified into activity intensities (sedentary, light, moderate, vigorous and moderate-to-vigorous) based on age-specific cut-points derived from a prediction equation for children. [102]

> *"METs = 2.757 + (0.0015 * counts/minute) – (0.08957 * age(yr)) – (0.000038 * counts/minute * age(yr))"*

A table of these cut-points was developed based on recommendations by an expert (personal communication with Patty Freedson on 11/07/2008) [see **Appendix** section]. Cut points were calculated for each age group to the nearest tenth (e.g., 6.6, 6.7, 6.8, 6.9, 7.0). Using the statistical program STATA (version 10), data were further processed to remove evening wear data starting at 11pm and ending at 5:59am. [117] This was done to standardize wearing time, given that some children wore the accelerometer while sleeping or late at night. Summary estimates for each activity intensity were calculated

by summing all the minutes in each intensity for all valid days and dividing by the number of valid days. Valid days included up to five weekdays and two weekend days. Thus, the total number of valid days ranged from four (three weekdays and one weekend day) to seven (five weekdays and two weekend days). After these procedures, data were exported to PASW (version 17) for merging and analysis with survey data.

Data Analysis

The analyses of *Sample One* and *Sample Two* data were identical, with the exception that *Sample One* had fewer explanatory variables examined. The descriptions for statistical analyses in the following sections refer to both study samples.

Descriptive Statistics

All variables of interest were sorted to check for potential outliers and entry errors. Means and standard deviations, minimum and maximum values were computed for continuous data (e.g., child's age and MVPA minutes per day). Frequencies were tabulated for categorical data (e.g., child's gender, ethnicity, income groups) to assess data distributions. Histograms with tests for normality and skewness were used to evaluate the normality assumption of the criterion variable (MVPA minutes per day). Mathematical transformations (such as log and square root) were conducted in order to improve data distributions and skewness and kurtosis values.

Categorical variables such as parent education and income were collapsed into fewer categories in order to achieve close to equal distributions between categories. For example, participants were asked to select from twelve different income categories. These were collapsed to four categories and eight education categories were collapsed to five categories.

Data Reduction

The study surveys consisted of various single-item and multiple item scales. Several survey items were summed into a single summary variable, as intended by the instrument developers. For example, the number of sedentary media in the child's bedroom, the number of house chores and the number of play equipment in the home were summed to create the following single summary variables: total sedentary media in the child's bedroom, total number of house chores, and total play equipment in the home, respectively. Other multi-item scales first underwent tests for scale psychometrics before collapsing items into single summary variables.

Psychometrics

This study used several previously validated scales (e.g., parent support for child's physical activity and Physical Activity Stereotyping Index). However, several of these scales were modified to accommodate *Sample Two*. These modifications included: 1) reduction of the number of items, 2) re-wording of items and 3) translation to Spanish. These changes necessitated re-evaluating the psychometric properties of the scales. Test-retest reliability

was not possible to assess because some measures were only administered once or were administered a year apart. Exploratory factor analysis was conducted to determine if the scales maintained their respective factor loadings compared to the original scales, and (for new scales) to determine if scales in fact represented latent constructs. Exploratory factor analysis was conducted according to recommendations by DeVellis (2003). [118] The cut-point used to define a unique factor (or latent construct) was an eigenvalue >1. Item loadings >0.40 were considered sufficiently high to belong in a factor. However, any item that loaded roughly equally onto two or more factors (regardless of effect size) was excluded from the scale. In nearly all factor analyses the oblique (Promax) rotation method was used in order to determine correlations between factors, given that this method is considered a hybrid between Orthogonal and Oblique and the results are more generalizable (than Oblimin) while still accounting for the correlation between the factors. [119] In some occasions other rotation methods were used to maintain consistency with how the scales were originally developed. Once items were identified to represent latent variables from the results of exploratory factor analysis, the reliability of those items was evaluated via Cronbach's alpha test of internal consistency. An alpha coefficient of ≥0.80 was considered acceptable.

Bivariate Analyses

Each explanatory variable was independently tested for its association with gender and MVPA. Continuous variables were tested for associations

with child gender via linear regression (gender was the independent variable in the models). Similarly, continuous data were tested for associations with MVPA via linear regression (MVPA minutes per day was the dependent variable in the models). Linear regression was used in order to more easily generate standardized effect estimates and standard errors needed for the α and β paths in PRODCLIN mediation analysis. The standardized beta coefficients and 95% confidence intervals for the effect estimates were used to evaluate the magnitude and statistical significance of each association tested. In some cases, data distributions of some variables were very skewed or consisted of several categories that could not be included as continuous variables in linear regression analysis. Those data were dichotomized or treated as categorical data in Chi-square analysis. Gender differences in child MVPA were tested via Analysis of Variance (ANOVA) given that the sample size was different between genders.

Mediation Analysis

A mediator is defined as a third variable that is in the causal pathway between two variables. For example, an intervention (X) may show a significant increase in children's physical activity (Y); therefore, X causes Y (denoted as τ). However, a behavioral intervention (X) must work through several intermediate factors (M) before achieving change in physical activity (Y). For example, an intervention (X) may increase perceived competence (M; denoted as α path) which then leads to a change in physical activity (Y;

denoted as β path). Therefore, accounting for the effects of the mediator (M) reduces the direct path correlation between X and Y (denoted as τ'). This conceptual framework is depicted in Figure 2.1. [116] For this study, the association between child's gender and MVPA denotes the X to Y relationship (τ). Based on pilot data, the standardized effect size of τ was 0.48 for the gender difference in MVPA. The purpose of this study was to explain away this effect size with several mediating variables. It is understood that the gender to MVPA association may not be causal since it was presented in the context of a cross-sectional study. Therefore, the mediation analysis framework was used only to achieve the study goal of explaining the gender to MVPA association; without making any inferences about causality or 'true' mediation. The results of linear regression analysis were used to derive standardized α and β coefficients to be used in mediation analysis.

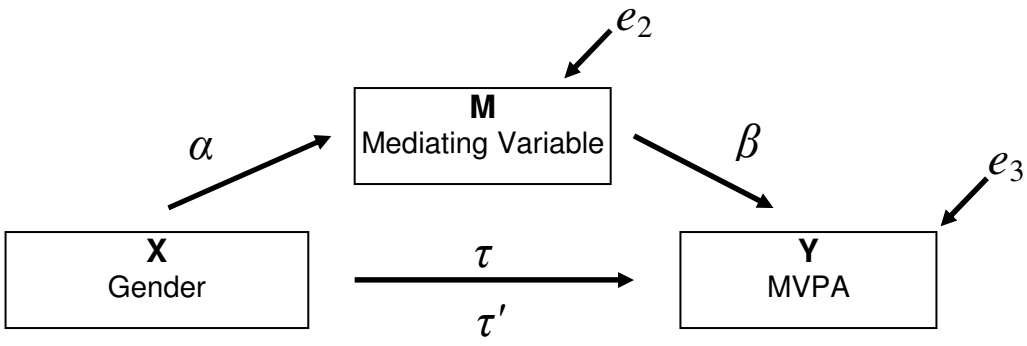

Figure 2.1. Single Mediator Model

As described in a previous study, [116] several mediation analyses have been developed; each with strengths and weaknesses. The PRODCLIN method does not rely on the distribution of the product of two normally

distributed random variables (α and β), such as the Sobel method; and thus chosen as the primary mediation analysis for this study. [120] PRODCLIN is a program that is freely available for download (http://www.public.asu.edu/~davidpm/ripl/Prodclin/). [116] In PRODCLIN analysis, the values for α-hat and β-hat and the Type 1 error rate are entered directly into the program to generate a statistical test of mediation. The critical values are then outputted along with the corresponding confidence intervals. A significant mediation effect is shown when the confidence intervals do not include zero.

Multivariate Hierarchical Linear Regression- Secondary Analyses

Secondary analyses consisted of testing for the combined effects of variable groups (blocks) to predict MVPA and to determine the specific effects of each variable group (block) on changing the effect estimates of child's gender. Variable groups (blocks) were selected based on the results of bivariate analyses. Variables associated with gender and/or MVPA and those with a correlation coefficient $r \geq 0.1$ and a 95% confidence interval which did not include zero were included as independent variables in a multivariate hierarchical linear regression. Variable blocks were entered in accordance with the multilevel framework (e.g., individual, family, peer, etc).

Interactions and Stratifications

Results from bivariate analysis between each explanatory variable and MVPA were also tested for interactions with gender and ethnicity. Analyses

were stratified by gender and ethnicity, regardless of the statistical significance of the interaction term.

IV. RESULTS

Demographics and Anthropometrics

Table 3.1 shows the demographic and anthropometric characteristics of caregivers. Caregivers were mostly young overweight females with middle-to-high acculturation levels and 40% self-identified as Hispanic. The majority of caregivers lived in a house (73.3%) and nearly all children lived with the caregiver seven days per week (97.4%). About half (51.7%) of children had at least one sibling, 24.1% had two siblings and 12.9% had none. Of those that had at least one sibling, 63.4% had an older sibling. Table 3.2 shows the demographic and anthropometric characteristics of children. Children's mean age ranged from 6 to 8 years old and there were more females in both *Sample One* and *Sample Two*. The prevalence of overweight and obesity appeared to be greater in *Sample Two* compared to *Sample One*.

Table 3.1. Caregiver demographic and anthropometric characteristics.

	Sample One **N=167**	***Sample Two*** **N=116**
Variable	**Mean ± SD**	**Mean ± SD**
Age (yrs)	37.7 ± 6.1	n/a
BMI (kg/m^2)	28.3 ± 6.1	n/a
Language/media use acculturation (range 1-5)	3.9 ± 1.5	n/a
Ethnic relations acculturation (range 1-3)	1.7 ± 0.3	n/a
	N (%)	**N (%)**
Gender (female)	154 (92.2)	112 (96.6)
Ethnicity (Hispanic)	66 (39.5)	45 (38.8)
Income (dollars)		
$0-$2,000	41 (25.8)	22 (20.4)
$2,001-$3,500	35 (22.0)	22 (20.4)
$3,501-5,000	31 (19.5)	12 (11.1)
$5,001+	52 (32.7)	52 (48.1)
Education		
Middle school or less	26 (15.6)	n/a
High school	24 (14.4)	n/a
Some college	43 (25.7)	n/a
College graduate	45 (26.9)	n/a
Post-graduate	29 (17.4)	n/a

Table 3.2. Child demographic and anthropometric characteristics.

	Sample One **N=167**	***Sample Two*** **N=116**
Variable	**Mean ± SD**	**Mean ± SD**
Age (years)	6.6 ± 0.7	8.1 ± 0.7
BMI (kg/m^2)	17.2 ± 3.3	18.6 ± 3.9
BMI percentile	67.1 ± 25.8	72.9 ± 22.4
	N (%)	**N (%)**
Gender (female)	111 (66.5)	63 (54.3)
Ethnicity (Hispanic)	77 (46.1)	50 (43.1)
BMI categories		
Normal	115 (68.9)	70 (60.3)
Overweight	27 (16.2)	22 (19.0)
Obese	25 (15.0)	24 (20.7)

Child Physical Activity

Compliance to wearing the accelerometer was very good. For *Sample One*, compliance was 89.8% (178 out of 198 complied with wearing the

accelerometer). Out of 178, only 11 did not meet the minimum criteria to be included in the analysis; resulting in a final sample size of 167. For *Sample Two*, compliance was 97% (133 out of 137). Out of 133, only 17 did not meet the minimum criteria to be included in analysis; resulting in a final sample size of 116.

Accelerometer data showed slightly skewed distributions for both *Sample One* and *Sample Two*. In *Sample One*, the skewness was 0.90 and kurtosis was 2.03; while the Kolmogorov-Smirnov and Shapiro-Wilk tests for normality were statistically significant ($p<0.01$); indicating non-normality. In *Sample Two*, the skewness was 0.96 and Kurtosis was 1.92; while the Kolmogorov-Smirnov and Shapiro-Wilk tests for normality were also statistically significant ($p<0.05$); indicating non-normality. After square root transformation, the data met all criteria for normality in both *Sample One* and *Sample Two*. Skewness and Kurtosis were all <1, the Kolmogorov-Smirnov and Shapiro-Wilk tests for normality were non-significant ($p>0.05$) and the histograms appeared approximately normally distributed. See figure 3.1 below for histograms.

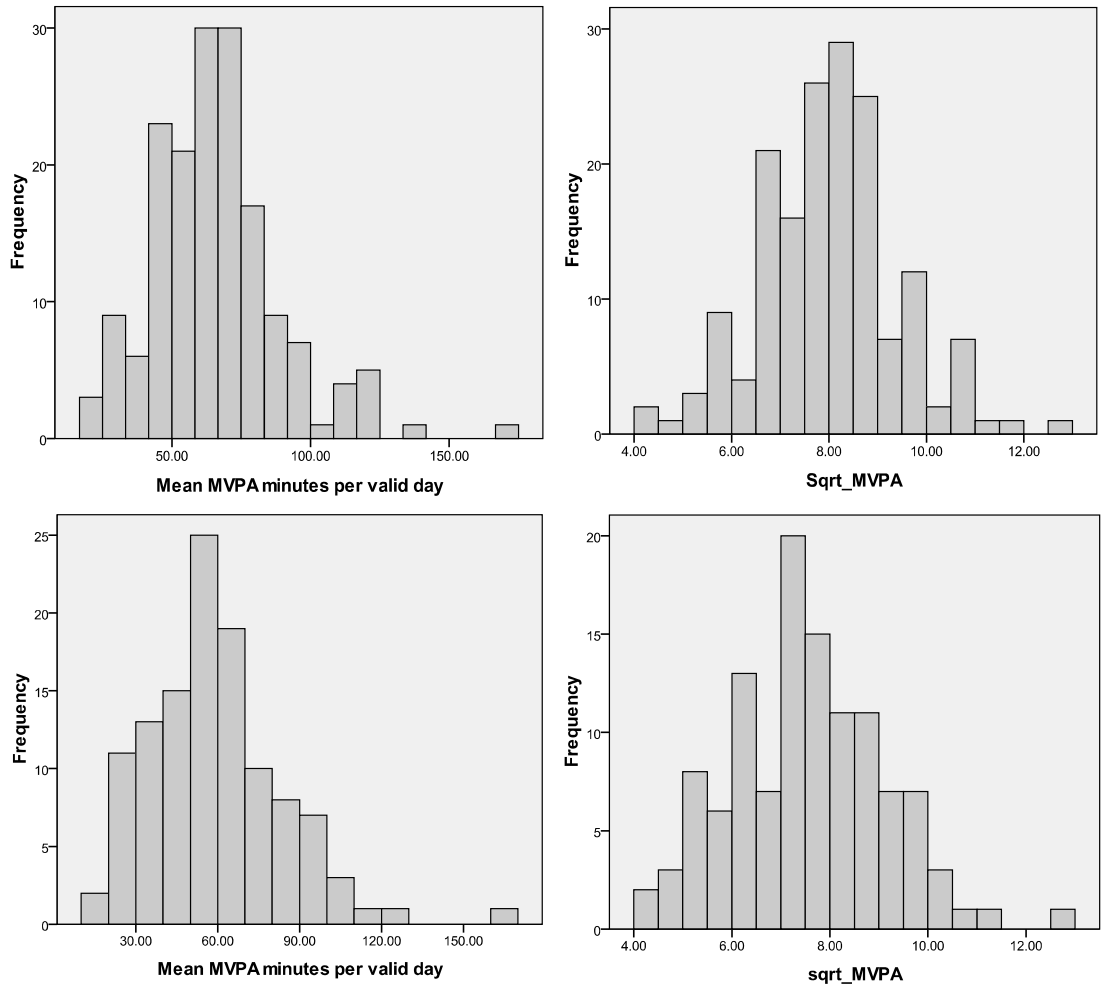

Figure 3.1. Histograms of accelerometer data for *Sample One* (top row) and *Sample Two* (bottom row), before (left column) and after (right column) square root transformations.

Table 3.3 below shows that (on average) children met the physical activity guidelines of at least 60 minutes per day of MVPA. However, when daily data were tabulated only 9 children (5.4%) achieved at least 60 minutes of MVPA on all 7 days in *Sample One* and only 6 children (5.2%) achieved at least 60 minutes of MVPA on all 7 days in *Sample Two***.**

Table 3.3. Child means and standard deviations of minutes per day spent in MVPA for *Sample One* and *Sample Two*.

	n	Minimum	Maximum	Mean	Std. Deviation
Sample One	167	17.7	167.3	66.2	23.3
Sample Two	116	16.6	160.2	59.2	24.4

Scale Descriptives, Item Reduction, Reliability and Scale Psychometrics

Parent Acculturation. Table 3.4 shows that the majority of parents used English as the sole or primary language and very few used both English and another language. The results of exploratory factor analysis showed that the eight acculturation variables loaded to two distinct factors (Figure 3.2). Factor 1 was defined as a language use and media use acculturation construct and factor 2 was defined as an ethnic relations acculturation construct. Factor 1 and 2 were negatively correlated, whereby greater English use and English media use was associated with less ethnic relations of people with different ethnic backgrounds. The mean of items 1-6 was calculated to generate one single variable representing Language and Media use acculturation (range 0-5). The mean of items 7-8 was calculated to represent an ethnic relations acculturation variable (range 1-3). The internal consistency of items 1-6 was α=0.99 and for items 7-8 was α=0.83. Independent samples t-tests indicated that caregivers who identified as Hispanic/Latino had a significantly lower English language and English media use acculturation score (2.7±1.4) compared to caregivers who identified as non-Hispanic/Latino (4.8±0.5), $p<0.01$. No statistically significant ethnic differences were observed for the ethnic relations variable ($p=0.11$).

Table 3.4. Frequency and means for parent acculturation items.

	Other language	Other language more than English	Both equally	More English than other language	Only English	
	N (%)	N (%)	N (%)	N (%)	N (%)	Mean ± SD
Language you speak	24 (14.4)	16 (9.6)	17 (10.2)	23 (13.8)	87 (52.1	3.8±1.5
Language you read	23 (13.8)	16 (9.6)	7 (4.2)	29 (17.4)	92 (55.1)	3.9±1.5
Language spoken at home	28 (16.8)	15 (9.0)	13 (7.8)	17 (10.2)	94 (56.3)	3.8±1.6
Language spoken with friends	26 (15.6)	16 (9.6)	8 (4.8)	23 (13.8)	94 (56.3)	3.9±1.5
Language of TV programs you watch	18 (10.8)	13 (7.8)	10 (6.0)	19 (11.4)	107 (64.1)	4.1±1.4
Language of radio programs you listen to	23 (13.8)	14 (8.4)	8 (4.8)	11 (6.6)	111 (66.5)	4.0±1.5

	Mostly from different ethnicity	About half and half	Mostly from same ethnicity	
	N (%)	N (%)	N (%)	Mean ± SD
Your close friends are…	20 (12.0)	70 (41.9)	77 (46.1)	1.7±0.3
The persons you visit or who visit you are…	18 (10.8)	54 (32.3)	95 (56.9)	1.7±0.3

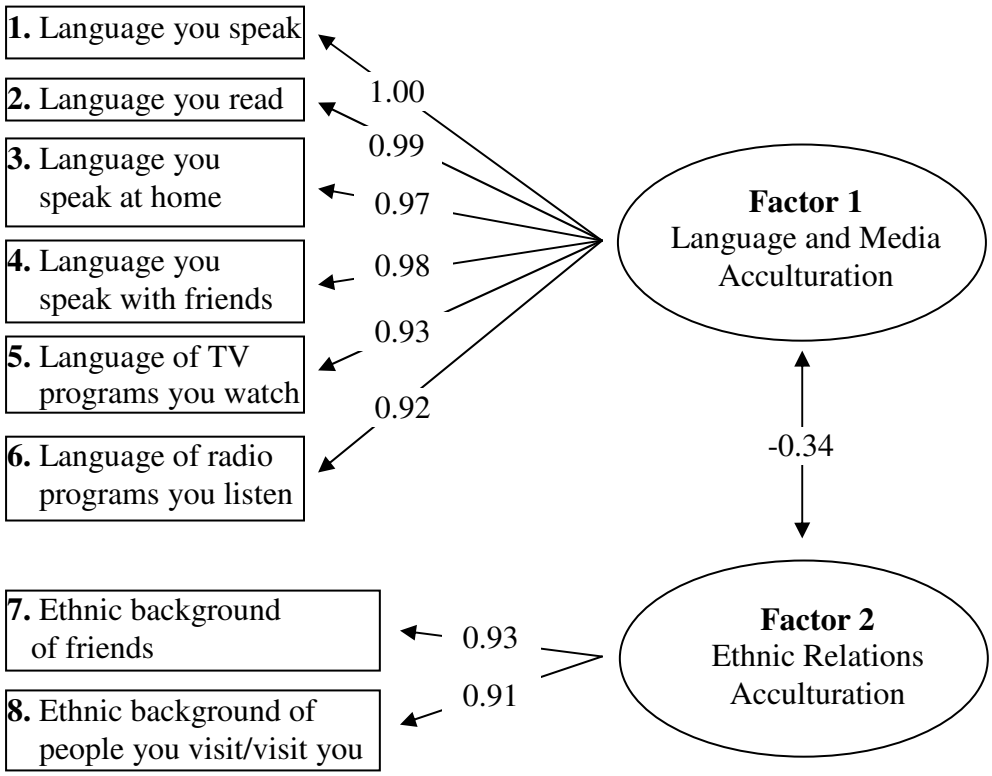

Figure 3.2. Factor loadings and inter-factor correlations of the parent acculturation scale.

Sedentary Media in Child's Bedroom. The mean number of total sedentary media in the child's bedroom was 1.8±1.5 (range 0-7). Eighteen

percent of children did not have any sedentary media in their bedroom and 36% had at least one item. The most common items were music players (radio and CD player) and televisions, where 53% and 48.9% of children had at least one of these items, respectively.

Child Physical Activity, Sports Participation and Active Transport. Items concerning child's engagement in physical activity, participation in team sports, physical education and active transport (to and from school) were combined to reduce the number of items. Table 3.5 below shows that children were engaging in physical activity for at least 60 minutes per day on average 4 days week. However, participation in team sports, physical education classes and active transport was low.

Table 3.5. Child physical activity, sports participation and active transport.

	Sample One **N=167**	***Sample Two*** **N=116**
Variable	**Mean ± SD**	**Mean ± SD**
During the past 7 days/typical week how many days was child physically active for at least 60 minutes per day.	4.3 ± 1.9	n/a
Not counting PE, how many days did child play team sports/physical activity classes.	1.0 ± 1.1	1.8 ± 1.7
Days per week child has PE at school.	2.1 ± 1.6	2.3 ± 1.5
Days per week child rode bike to/from school.	0.1 ± 0.7	
Days per week child walked to/from school.	1.4 ± 2.0	1.3 ± 2.0
In the last 12 months, how many different sports child participated in.	1.8 ± 1.6	2.0 ± 1.4

Rules for Playing Outside. Results showed that on average parents had 7.1±1.0 total rules (range 2-8) [*Sample One*] and 6.8±1.4 rules (range 2-8) [*Sample Two*]. The majority of rules were endorsed by parents (>90%).

Child Activity in Recreation Places or Sports Facilities. Results showed that few children engaged in daily physical activity or almost daily in recreation

centers, commercial facilities, school playgrounds, beach/lake and in neighborhood areas (Table 3.6). Children engaged in more frequent physical activity in parks and playground. On average, children engaged in physical activity at recreation/sport facilities less than once per week; mean of all items 1.2±0.4 (range 0.9-2.1).

Table 3.6. Frequency of child participation in physical activity at recreation places and sports facilities in a typical week.

	Never	**<1/wk**	**1-2/wk**	**3-4/wk**	**5-7/wk**
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**
Public recreation center	70 (41.9)	49 (29.3)	36 (21.6)	11 (6.6)	1 (0.6)
Other recreation center (YMCA)	112 (67.1)	24 (14.4)	25 (15.0)	5 (3.0)	1 (0.6)
Commercial facilities (studio)	116 (69.5)	23 (13.8)	22 (13.2)	6 (3.6)	0 (0)
School grounds (after-school)	76 (45.5)	18 (10.8)	34 (20.4)	21 (12.6)	18 (10.8)
School grounds (weekends)	128 (76.6)	23 (13.8)	11 (6.6)	2 (1.2)	3 (1.8)
Parks/playgrounds	8 (4.8)	48 (28.7)	88 (52.7)	19 (11.4)	4 (2.4)
Walking/biking trails	42 (25.1)	68 (40.7)	37 (22.2)	13 (7.8)	6 (3.6)
Beach/lake	44 (26.3)	93 (55.7)	28 (16.8)	1 (0.6)	1 (0.6)
Neighborhood (field)	88 (52.7)	25 (15.0)	30 (18.0)	14 (8.4)	10 (6.0)
Yard/apartment complex	15 (9.0)	20 (12.0)	35 (21.0)	33 (19.8)	64 (38.3)
Friend's/relatives home	30 (18.0)	55 (32.9)	59 (35.3)	17 (10.2)	6 (3.6)

Parent Encouragement of Child's Physical Activity and Sedentary Behavior. Results of exploratory factor analysis showed that the scale consisted of two correlated factors (parent encouragement of physical activity and parent encouragement for less sedentary behavior) [Figure 3.3]. The internal consistency of the items for Factor 1 was α=0.73 (*Sample One*) and α=0.80 (*Sample Two*). For Factor 2 the internal consistency was α=0.82 (*Sample One*) and 0.88 (*Sample Two*). Two summary variables were created by calculating the mean for the items that loaded to each factor. The mean for

parent encouragement for physical activity was 2.0±0.96 (*Sample One*) and 2.0±0.96 (*Sample Two*) and the mean for parent encouragement for less sedentary behavior was 2.22±1.38 (*Sample One*) and 2.26±1.46 (*Sample Two*) [possible ranges were 0-4]. For the 'other' caregiver, the means were 1.72±1.06 and 1.97±1.58 for encouragement for physical activity and less sedentary behavior, respectively.

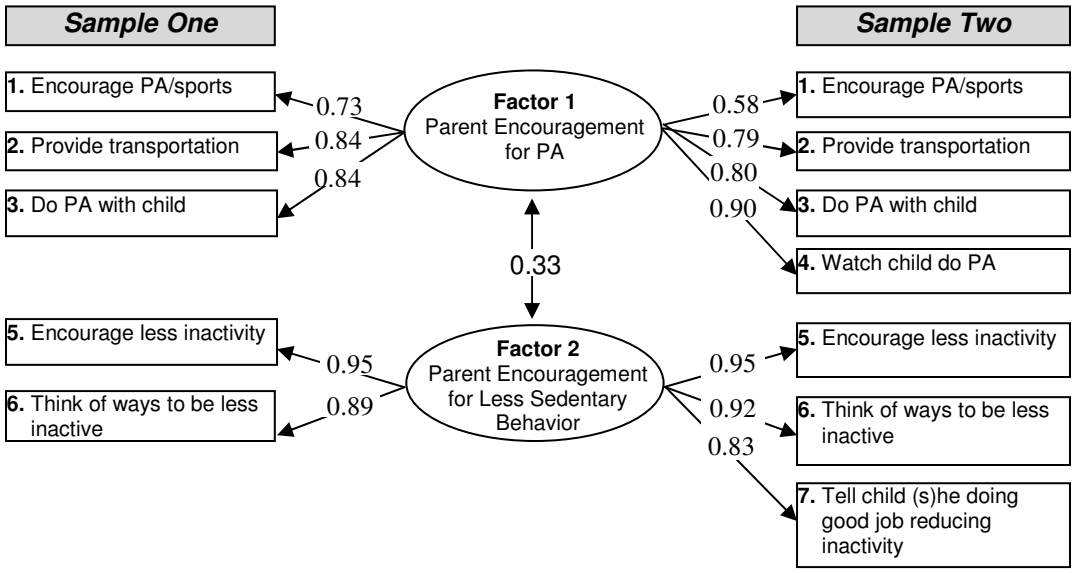

Figure 3.3. Factor loadings inter-factor correlations for parental encouragement for child's physical activity and less sedentary behavior scale.

Physical Activity Equipment and Facilities in the Home. The mean number of total physical activity equipment and facilities available and used in the child's home was 3.9±1.84 (*Sample One*) and 4.2±2.0 (*Sample Two*). The internal consistency of the items was α=0.61 (*Sample One*) and α=0.67 (*Sample Two*). In *Sample One*, the most frequently used play items were bicycles/tricycles and the least was water equipment. In *Sample Two*, the most

frequently used play items were sports equipment such as ball and bats and the least was water equipment (Table 3.7).

Table 3.7. Physical activity equipment and facilities in the child's home that are available and used by the child.

	Sample One	***Sample Two***
	Yes (%)	Yes (%)
Bike, tricycle…	137 (82.0)	92 (79.3)
Basketball hoop	35 (21.0)	34 (29.3)
Sports equipment (balls, bats…)	123 (73.7)	94 (81.0)
Roller skates, skateboard…	114 (68.3)	80 (69.0)
Loose play equipment (jump rope, hula hoop…)	97 (58.1)	77 (66.4)
Fixed play equipment (swing set, play house…)	63 (37.7)	40 (34.5)
Water equipment (canoe, boogie board…)	30 (18.0)	31 (26.7)
Swimming pool	57 (34.1)	36 (31.0)

Physical Activity Stereotyping. In general, caregivers tended to label physical activities according to gender; especially ballet, baseball, cheerleading, boxing, softball, and basketball (Table 3.8). Results of exploratory factor analysis showed that the 12 sport and physical activity items loaded onto two correlated factors (gender stereotype and gender neutral) [Figure 3.4]. Based on these results, two variables were created by summing the coded responses (0, 1, 2) to create a gender stereotype index and a gender neutral index score. [106] The internal consistency of the five gender stereotype items was α=0.72 and α=0.80 for the seven gender neutral items. For this study, only the gender stereotyping index score was used in analyses. The mean gender stereotyping index score was 3.8±2.5 (range 0-10).

Table 3.8. Frequency of parent responses to gender-labeling of physical activities.

	A lot more for boys	A little more for boys	Equally for boys and girls	A little more for girls	A lot more for girls
	N (%)	N (%)	N (%)	N (%)	N (%)
Ballet	0	0	35 (30.2)	38 (32.8)	43 (37.1)
Baseball	24 (20.7)	27 (23.3)	63 (54.3)	2 (1.7)	0
Bowling	4 (3.4)	4 (3.4)	107 (92.2)	1 (0.9)	0
Soccer	4 (3.4)	8 (6.9)	103 (88.8)	1 (0.9)	0
Bicycling	2 (1.7)	1 (0.9)	112 (96.6)	0	1 (0.9)
Cheerleading	1 (0.9)	0	17 (14.7)	41 (35.3)	57 (49.1)
Boxing	13 (11.2)	21 (18.1)	78 (67.2)	2 (1.7)	2 (1.7)
Volleyball	1 (0.9)	1 (0.9)	103 (88.8)	10 (8.6)	1 (0.9)
Swimming	1 (0.9)	0	114 (98.3)	1 (0.9)	0
Softball	7 (6.0)	7 (6.0)	64 (55.2)	24 (20.7)	14 (12.1)
Basketball	7 (6.0)	15 (12.9)	92 (79.3)	2 (1.7)	0
Swings	2 (1.7)	0	107 (92.2)	5 (4.3)	2 (1.7)

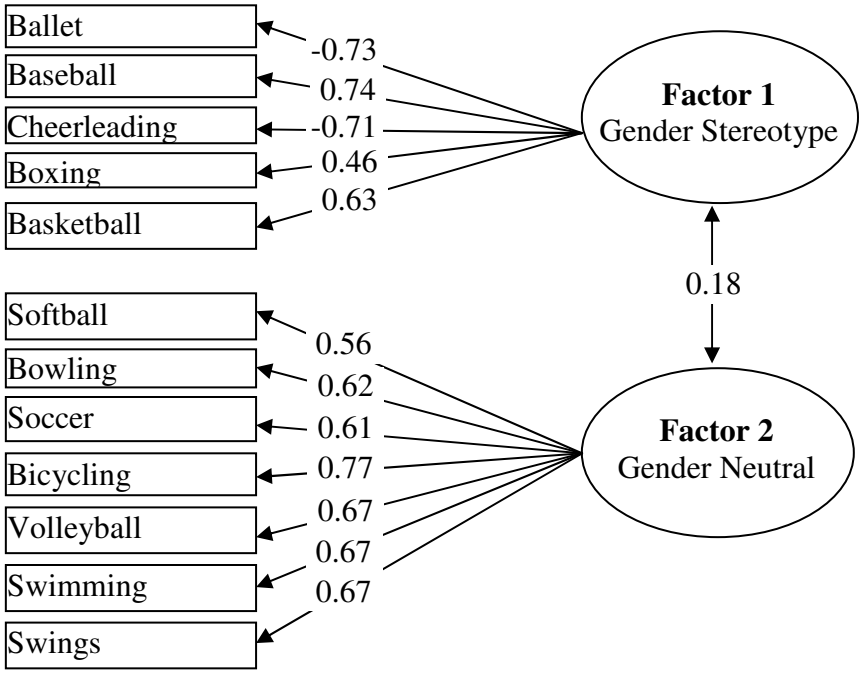

Figure 3.4. Factor loadings and inter-factor correlations for the Physical Activity Stereotyping Index.

Parent Support for Child's Physical Activity. In general, parents tended to endorse support for child's physical activity and exercise (Table 3.9). Results of exploratory factor analysis showed that items loaded onto two correlated factors (parent explicit modeling and logistic support for physical

activity) [Figure 3.5]. The internal consistency for explicit modeling was α=0.79 and α=0.92 for logistic support. Item scores were summed to create two variables representing explicit modeling and logistic support. The mean score for explicit modeling was 3.1±1.0 (range 0-4) and for logistic support 2.2±1.1 (range 0-3). Results from Spearman's rho correlation showed that explicit modeling was positively correlated with logistic support (r=0.19, p=0.04).

Table 3.9. Frequency of parent responses to parent support for child's physical activity.

	No	**Sometimes**	**Yes**
Enjoy exercise and PA	3 (2.6)	34 (29.3)	79 (68.1)
Often organize family outings for PA	10 (8.6)	43 (37.1)	63 (54.3)
Enroll my child in sports	18 (15.5)	15 (12.9)	83 (71.6)
Exercise or am physically active	11 (9.5)	36 (31.0)	69 (59.5)
Drive my child to sporting events	24 (20.7)	16 (13.8)	76 (65.5)
Often watch my child perform sports	23 (19.8)	15 (12.9)	78 (67.2)
Use my behavior to encourage PA	14 (12.1)	32 (27.6)	70 (60.3)

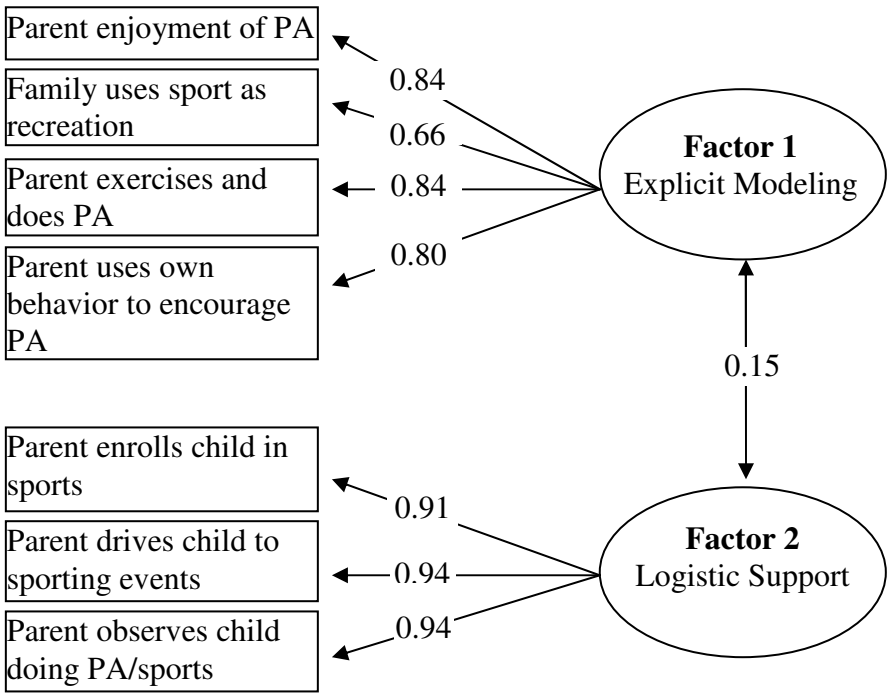

Figure 3.5. Factor loadings and inter-factor correlations of the Parent Support for Child's Physical Activity scale.

Child Physical Activity Enjoyment. Nearly all caregivers indicated that their child enjoys physical activity (98.3%), finds it pleasurable (96.5%), and feels that it is very exciting (83.%). Eighty-two percent of caregivers endorsed all three enjoyment items.

Parent Childhood Participation in Sports and Success in Sports. In general, caregivers indicated low participation, success and athleticism in sports when they were a child; however 89% indicated that they liked to play active games such as hide and go seek and soccer (Table 3.10). The internal consistency of all four items was α=0.73. The internal consistency increased to α=0.80 when item #3 was excluded. A summary index variable was created by

summing all the 'yes' responses of items 1, 2, and 4. Results showed that 48.3%, 19.8%, 10.3% and 21.6% of caregivers endorsed 0, 1, 2, and 3 total items, respectively.

Table 3.10. Frequency of 'yes' responses to participation in sports and success in sports when parent was a child.

When I was a child, I…	**Yes (%)**
Participated in many sports.	57 (49.1)
Won many sport awards such as medals and trophies.	34 (29.3)
Liked to play many active games such as hide and go seek, bicycling, soccer, etc.	103 (88.8)
Was the most athletic person of my friends.	31 (26.7)

Parent Perceptions of Child's Sports Ability. Results of parental perceptions of their child's sports ability were as follows: "not at all good/not so good"=6.9%, "Neither good or bad"=30.2%, "Somewhat good"=38.8%, and "Very good"=24.1%.

Parent Gender Stereotypes of Sport and Athletic Ability. Results showed that parents tended to respond mostly gender neutral to questions about sports ability, importance to do well in sports and usefulness of athletic ability between male and females (Table 3.11). Exploratory factor analysis showed that all three items loaded onto one factor (gender stereotypes of sport/athletic ability) [Figure 3.7]. The internal consistency of all three items was α=0.56 and the alpha increased to 0.65 when item #3 was excluded from the analysis. The mean of items 1 and 2 was computed for each participant to represent a single item of gender stereotypes of sport and athletic ability. The mean score for gender stereotypes was 3.2±0.5 (range 2-5).

Table 3.11. Frequency of responses of parent gender stereotypes of sports and athletic ability.

	Females much better	Females somewhat better	Equal for females/ males	Males somewhat better	Males much better	
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**Mean±SD**
In general, how would you compare the athletic ability of males and females?	0	2(1.7)	91 (78.4)	18 (15.5)	5 (4.3)	3.2±0.5
	More important for females	**Somewhat more important for females**	**Equally important for females/ males**	**A little more important for males**	**More important for males**	
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**Mean±SD**
In your opinion, is it more important for females or males to do well in sports?	0	4 (3.4)	97 (83.6)	9 (7.8)	6 (5.2)	3.2±0.5
	More useful for females	**A little more useful for females**	**Equally useful for females/ males**	**A little more useful for males**	**More useful for males**	
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**Mean±SD**
In general, how would you compare the usefulness of athletic ability for females and males?	0	1 (0.9)	103 (88.8)	11 (9.5)	1 (0.9)	3.1±0.4

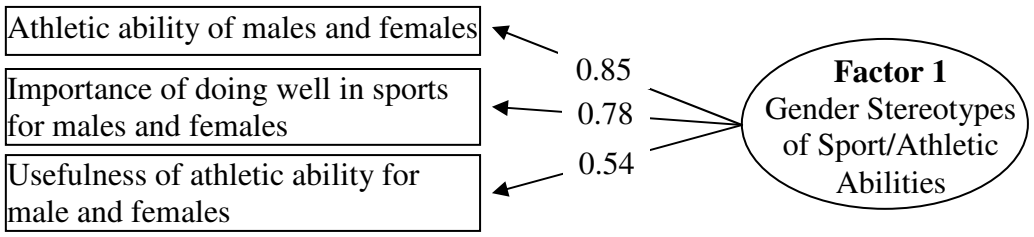

Figure 3.6. Factor loadings for parent stereotypes of sport and athletic ability of males and females.

Parent Values Towards Child's Sport Ability and Participation, and Parent's Participation in Sports. Parents showed greater endorsement of values towards their child's participation in sports, but less towards their child being good in sports (Table 3.12). In addition, parents reported moderate participation in sports themselves and with their child. Exploratory factor

analysis showed two correlated factors (parent values of child's sports participation and parent's sports participation) [Figure 3.7]. Two variables were created by calculating the means of items 1 and 2 and 3 and 4. The mean parent values score was 2.4±0.8 (range 1-5) and for parent participation in sports 3.2±1.0 (range 1-5).

Table 3.12. Frequency of parent responses to child's sports ability and parent's sports participation.

How important is it to you that your child…	**Very much**	**A lot**	**Somewhat**	**Not much**	**Not at all**	
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**Mean±SD**
Be good in sports	11 (9.5)	34 (29.3)	54 (46.6)	15 (12.9)	2 (1.7)	2.7±0.9
Play sports	39 (33.6)	44 (37.9)	24 (20.7)	7 (6.0)	2 (1.7)	2.0±1.0
In the past year, how much did you…	**All the time**	**A lot**	**A little bit**	**Not much**	**Not at all**	
	N (%)	**N (%)**	**N (%)**	**N (%)**	**N (%)**	**Mean±SD**
Play sports	9 (7.8)	14 (12.1)	45 (38.8)	21 (18.1)	27 (23.3)	3.4±1.2
Play sports with your child	7 (6.0)	25 (21.6)	50 (43.1)	28 (24.1)	6 (5.2)	3.0±1.0

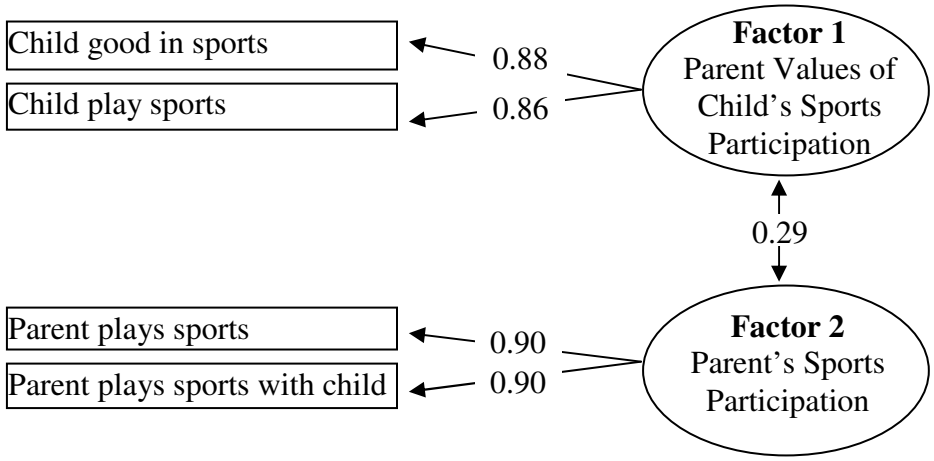

Figure 3.7. Factor loadings and inter-factor correlations for child's sports ability and parent's sports participation scale.

Gender Role Stereotypes. Parents tended to disagree with gender role stereotype statements (Table 3.13). Exploratory factor analysis showed that items loaded onto two negatively correlated factors (gender role stereotypes and gender role neutral) [Figure 3.8]. The internal consistency of the four gender role stereotype items was α=0.63 and for the two gender neutral items α=0.52. A mean score was computed for the items that loaded onto each factor. Parents had a mean gender neutral score of 3.2±0.7 (range 1-4) and a gender stereotypes score of 1.9±0.6 (range 1-3.5).

Table 3.13. Frequency of responses to gender role stereotypes.

	Strongly disagree	**Disagree**	**Agree**	**Strongly agree**	
	N (%)	**N (%)**	**N (%)**	**N (%)**	**Mean±SD**
The husband should be regarded as the legal representative of the family in all matters of law.	45 (38.8)	46 (39.7)	14 (12.1)	11 (9.5)	1.9±0.9
A woman should have exactly the same freedom of action as a man.	4 (3.4)	9 (7.8)	42 (36.2)	61 (52.6)	3.4±0.8
A woman is not truly fulfilled until she has been a mother.	32 (27.8)	58 (50.4)	17 (14.8)	8 (7.0)	2.0±0.8
A married woman should feel free to have men as friends	6 (5.2)	16 (13.8)	60 (51.7)	34 (29.3)	3.1±0.8
Woman's work and man's work should be fundamentally different in nature.	45 (38.8)	50 (43.1)	17 (14.7)	4 (3.4)	1.8±0.8
When a man and a woman live together, she should do the housework and he should do the heavier chores.	37 (31.9)	51 (44.0)	18 (15.5)	10 (8.6)	2.0±0.9

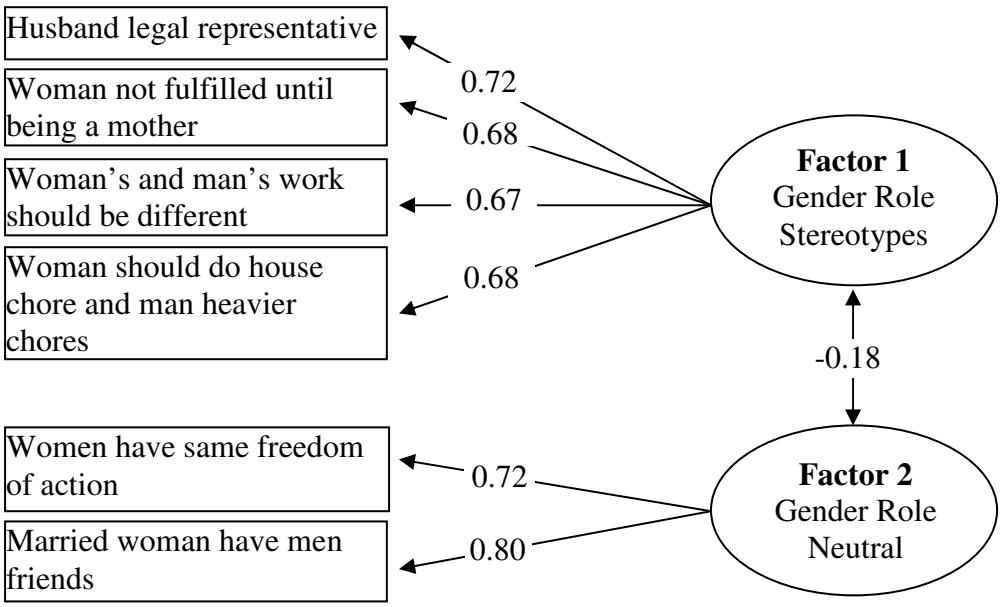

Figure 3.8. Factor loadings and inter-factor correlations for gender roles stereotypes scale.

Criticism for Physical Activity and Being Overweight. The majority of parents reported that their child was not criticized or made fun of when he/she participated in physical activities (87.1%) or for being too fat when he/she participated in physical activities (94.0%).

Household Chores. The most frequent household chore that parents expected their child to do was clean his/her bedroom and the least frequent was washing and drying the dishes (Table 3.14). A summary variable was created by summing the 'yes' responses for 9 of the 11 items. Two items were not included since they were not applicable to some participants (clean the yard and walk the dog). The internal consistency of the nine items was α=.70. The mean number of household chores was 5.3±2.1 (range 0-9).

Table 3.14. Frequency of chores that parents expect their child to do at home.

	Yes (%)
Wash the dishes	34 (29.3)
Dry the dishes and put them away	34 (29.3)
Vacuum or sweep the floors	61 (52.6)
Take out the trash	69 (59.5)
Clean the yard (if applicable)	48 (48.0)
Walk the dog (if applicable)	30 (55.6)
Help prepare food	59 (50.9)
Clean the table after dinner	101 (87.1)
Make his/her bed	90 (77.6)
Help do the laundry	53 (45.7)
Clean his/her bedroom	108 (93.1)

Parenting Style towards Child's Physical Activity Behaviors. In general, parents reported lenient parenting styles towards their child's physical activity (Table 3.15). Parents tended to report greater encouragement for their child's decision making, considered themselves somewhat protective, but allowed their child to play outside without supervision. Results of exploratory factor analysis showed that the six items loaded onto three factors (parent leniency for child's PA, parent protectiveness of child, and parent restrictive of child's PA in the home) [Figure 3.9]. Based on these results, two variables were created to represent parent leniency for child's PA (mean of items 1, 3 and 5) and parent protectiveness of child (mean of items 2 and 4). The mean score for parent leniency was 3.2±0.5 (range 1-4), the mean score for parent protectiveness was 3.1±0.6 (range 1.5-4), and the mean score for parent restrictiveness of child's PA at home was 1.9±0.8 (range 1-4).

Table 3.15. Parent responses to questions pertaining to parenting styles towards their child's physical activity.

	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree	
	N (%)	N (%)	N (%)	N (%)	Mean±SD
In general, I encourage my child to make his/her own decisions.	4 (3.4)	6 (5.2)	68 (58.6)	38 (32.8)	3.2±0.7
I am very protective with my child.	2 (1.7)	14 (12.1)	62 (53.4)	38 (32.8)	3.2±0.7
I allow my child to play outside the house with their friends.	13 (11.3)	12 (10.4)	59 (51.3)	31 (27.0)	2.9±0.9
I must always supervise my child when he/she is playing outside the house.	6 (5.2)	29 (25.0)	48 (41.4)	33 (28.4)	2.9±0.9
I allow my child to play inside the house	3 (2.6)	2 (1.7)	37 (31.9)	74 (63.8)	3.6±0.7
My child must be very quiet when he/she plays inside the house	35 (30.2)	58 (50.0)	18 (15.5)	5 (4.3)	1.9±0.8

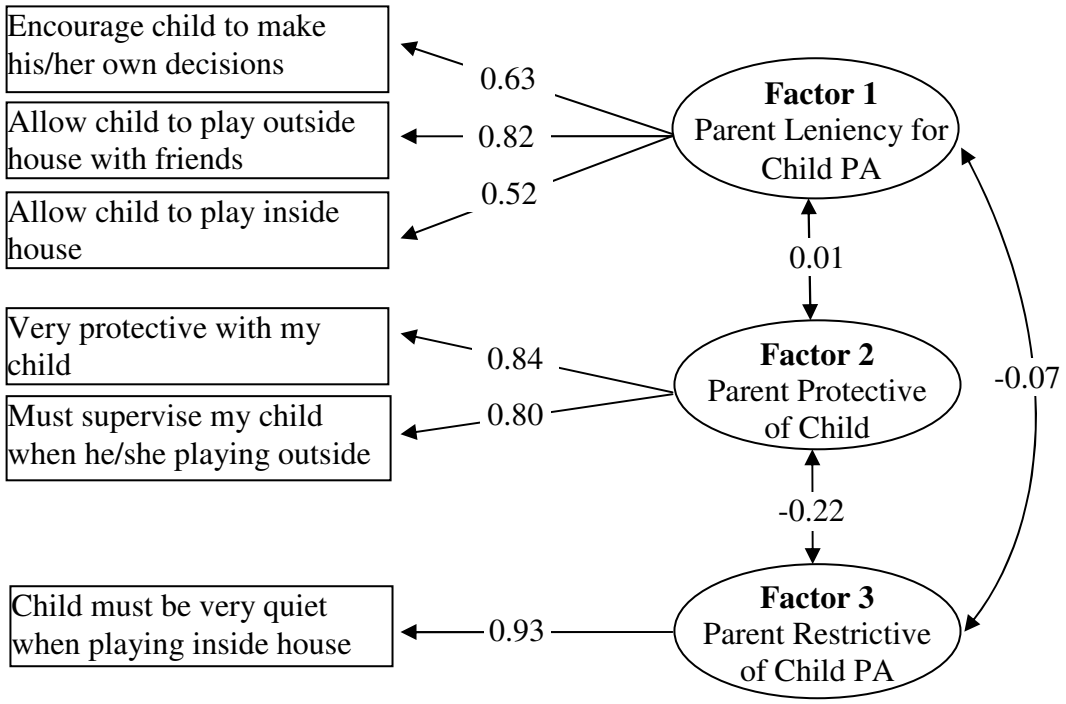

Figure 3.9. Factor loadings and inter-factor correlations for the parenting styles for children's physical activity scale.

Child Preference and Social Influence for Physical Activity. In general, parents reported that their child prefers to play active games, play with friends and with their siblings (Table 3.16). Exploratory factor analysis showed that the seven items loaded onto three factors (child preference for sedentary behavior, child peer influence for physical activity, and child preference to play alone) [Figure 3.10]. Three variables were created to represent each of the three constructs by summing the respective items for each factor. The mean score for each of the summary variables were 1.9±0.6 (range 1-4), 3.1±0.6 (range 1-4), 2.3±0.5 (range 1.33-4), for child preference for sedentary behavior, child peer influence for physical activity, and child preference to play alone, respectively.

Table 3.16. Frequency of parent responses to child's preference and social influence for physical activity.

	Strongly disagree	**Somewhat disagree**	**Somewhat agree**	**Strongly agree**	
	N (%)	**N (%)**	**N (%)**	**N (%)**	**Mean±SD**
In general, my child prefers to sit and watch television rather than play active games.	36 (31.0)	42 (36.2)	34 (29.3)	4 (3.4)	2.1±0.9
In general, my child prefers to play with dolls or action figures, rather than active play.	37 (31.9)	64 (55.2)	13 (11.2)	2 (1.7)	1.8±0.7
My child's friends are very physically active.	3 (2.6)	23 (19.8)	64 (55.2)	26 (22.4)	3.0±0.7
My child's friends like to play outside.	2 (1.7)	13 (11.2)	69 (59.5)	32 (27.6)	3.1±0.7
My child likes to play with his/her siblings (if applicable).	1 (1.0)	4 (3.9)	44 (42.7)	54 (52.4)	3.5±0.6
My child would rather play alone than with friends.	64 (55.2)	36 (31.0)	9 (7.8)	7 (6.0)	1.7±0.9
My child would rather play alone than with his/her siblings (if applicable).	45 (43.7)	43 (41.7)	7 (6.8)	8 (7.8)	1.8±0.9

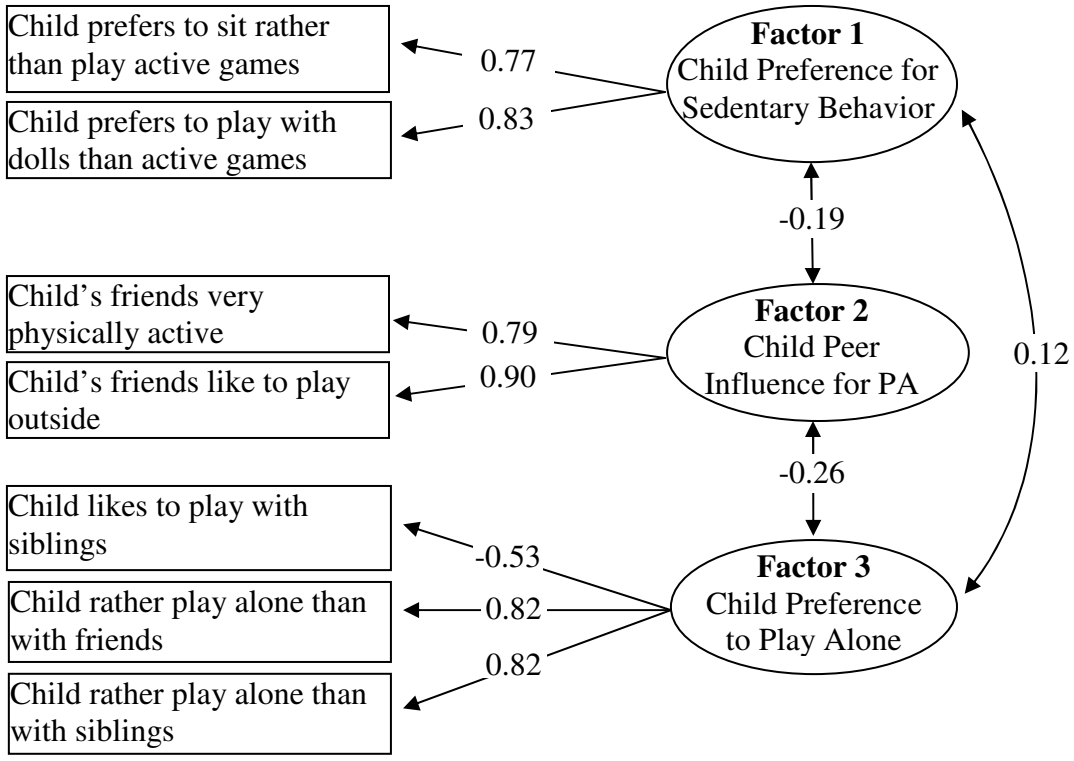

Figure 3.10. Factor loadings and inter-factor correlations for the child preference and social influence for physical activity scale.

Opportunities for Physical Activity in the Community. Table 3.17 shows that parents generally tended to endorse easy access and having opportunities for physical activity in several community environments. Exploratory factor analysis showed that items loaded onto three factors (Figure 3.11). Items 1-4 loaded onto one factor (ease of physical opportunities in community environments). Item 5 loaded onto one factor and item 6 loaded almost equally onto two factors. Items 7 and 8 loaded onto one factor. Two summary variables were created by calculating the mean for items 1 to 4 and 7-8, respectively. Items 5 and 6 were not included in any summary variable. The mean 'ease of participation in community environments' was 3.4±0.6

(range 1.5-4) and the mean 'opportunities for physical activity in community environments' was 2.6±0.5 (range 1-3). The internal consistency for items 1-4 was α=0.78. The means for items 5 and 6 were 2.5±0.6 (range 1-3) and 2.6±0.5 (range 1-3), respectively.

Table 3.17. Frequency of ease of participation and opportunities for physical activity in community environments.

How easy or difficult is it for your child to participate in the physical activities he/she likes…	**Very difficult**	**Somewhat difficult**	**Somewhat easy**	**Very easy**	
	N (%)	**N (%)**	**N (%)**	**N (%)**	**Mean±SD**
At school	2 (1.7)	13 (11.2)	28 (24.3)	72 (62.6)	3.5±0.8
At the park	1 (0.9)	9 (7.8)	39 (33.6)	67 (57.8)	3.5±0.7
At the recreation center	5 (4.3)	20 (17.4)	35 (30.4)	55 (47.8)	3.2±0.9
In your community	4 (3.4)	15 (12.9)	36 (31.0)	61 (52.6)	3.3±0.8

How many opportunities are there for your child to participate in the physical activities he/she likes…	**No opportunities**	**Few opportunities**	**Many opportunities**	
	N (%)	**N (%)**	**N (%)**	**Mean±SD**
At the school	6 (5.2)	48 (41.7)	61 (53.0)	2.5±0.6
At the park	3 (2.6)	44 (37.9)	69 (59.5)	2.6±0.5
At the recreation center	10 (8.7)	40 (34.8)	65 (56.5)	2.5±0.7
In your community	7 (6.0)	30 (25.9)	79 (68.1)	2.6±0.6

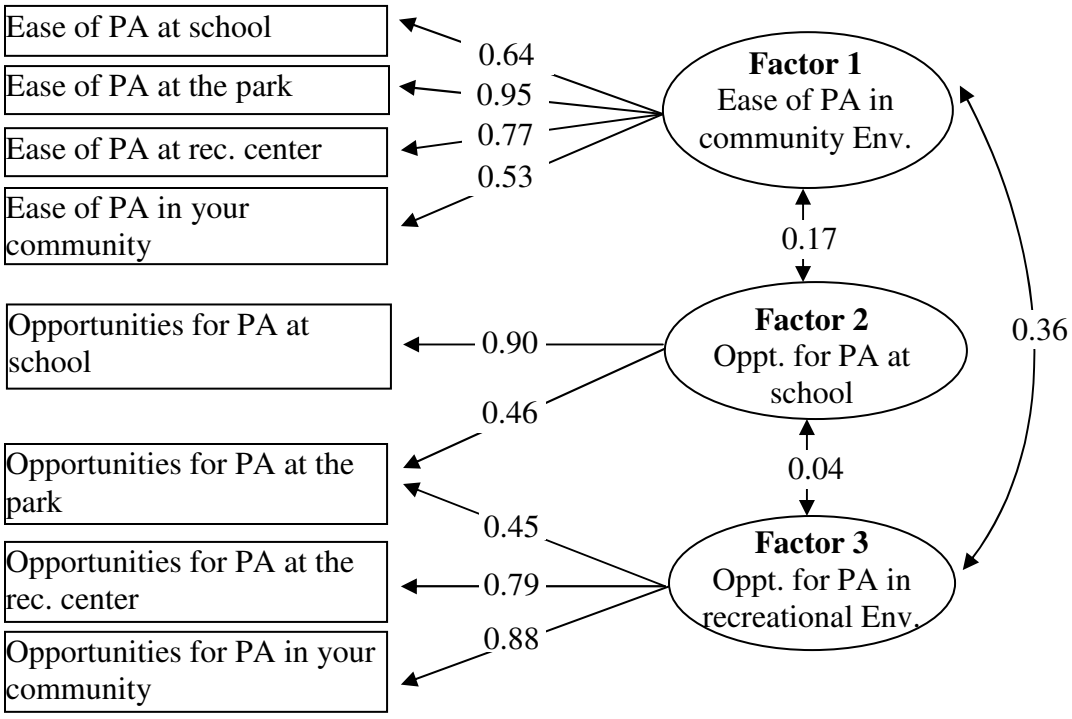

Figure 3.11. Factor loadings and inter-factor correlations for the child's ease of participation and opportunities for physical activity in community environments.

Gender Stereotyping of TV shows and Toys. Table 3.18 shows that the TV shows that children watched tended to be gender neutral but the toys that children were given as holiday gifts tended to be gender stereotyped. Table 3.19 shows that 64.7% of children watched one or more television shows that was considered stereotypical for their gender and 88% of children received toys that was stereotypical for their gender. The mean number of both gender stereotyped TV shows and gender stereotyped toys was 2.5±2.4 (range 0-6).

Table 3.18. Frequency of gender stereotyped TV shows and toys.

	More for girls	Gender neutral	More for boys	Not applicable
	N (%)	N (%)	N (%)	N (%)
TV show 1	28 (24.1)	43 (37.1)	22 (19.0)	23 (19.8)
TV show 2	27 (23.3)	37 (31.9)	27 (23.3)	25 (21.6)
TV show 3	30 (25.9)	40 (34.5)	20 (17.2)	26 (22.4)
Toy 1	34 (29.3)	17 (14.7)	36 (31.0)	29 (25.0)
Toy 2	30 (25.9)	21 (18.1)	40 (34.5)	25 (21.6)
Toy 3	24 (20.7)	23 (19.8)	31 (26.7)	38 (32.8)

Table 3.19. Number of gender stereotyped TV shows watched and gift toys received.

	Gender stereotyped TV shows	Gender stereotyped toys
N	N (%)	N (%)
0	41 (35.3)	13 (12.0)
1	40 (34.5)	35 (32.4)
2	30 (25.9)	38 (35.2)
3	5 (4.3)	22 (20.4)

Bivariate Analyses

Gender, MVPA and Demographics. Results of bivariate analyses showed that there were no significant gender differences in any of the following: child's age (in years; p=0.99), child's ethnicity (p=0.95), child's BMI z-score (p=0.73), number of siblings (p=0.71) and parent's income (p=0.92). Older children and those with a greater BMI z-score were found to have significantly lower MVPA (r=-0.36, p<0.01 and r=-0.22, p=0.02, respectively). However, MVPA was not significantly associated with child's ethnicity (p=0.65) and parent's income (p=0.41).

Gender and MVPA Associations with Exploratory Constructs. Table 3.20 shows the results of bivariate regression analyses for each exploratory

construct and child's gender and MVPA. Results show that only parent explicit modeling of physical activity was significantly related to both child's gender and MVPA. Most variables were not statistically related to either gender or MVPA or only significantly related to gender or MVPA (but not both). Thus, these results did not support the need for mediation analysis (as was originally proposed).

Table 3.20. Bivariate associations between exploratory variables and child's gender and MVPA.

	Sample One **N=167**		***Sample Two*** **N=116**	
Measures	**Gender**	**MVPA**	**Gender**	**MVPA**
Individual level (behavioral)	**β**	**β**	**β**	**β**
Mean days child PA for 60 minutes	-0.07	0.10		
Mean non-PE PA days	0.17*	0.09	-0.12	0.02
Days of PE at school	0.07	0.05	0.03	0.21*
Days ride bike to/from school	xxx	xxx		
Walking to/from school (none vs. any days)	-0.01	-0.01	-0.14	0.12
Number of sports/PA classes in last year	0.11	0.13†	-0.01	0.02
Child activity in recreation/sports facilities	-0.13	0.14†		
Child preferences for sedentary behavior			-0.08	-0.18†
Child preference to play alone			-0.11	0.04
Individual level (psychological)				
Physical activity enjoyment			xxx	xxx
Family level (parent influence)				
Parental perceptions of child's sport ability			-0.03	0.19*
Parent language acculturation	0.005	0.05		
Parent ethnic relations acculturation	-0.09	0.09		
Total rules for child playing outside	-0.05	-0.07	0.01	0.05
Parent encouragement for child's PA	0.06	0.05	-0.01	0.16†
Parent encouragement for less sed behavior	-0.01	-0.04	-0.12	0.01
Parent encouragement for child's PA (2)			-0.08	0.04
Parent encouragement for less sed behavior (2)			-0.13	-0.06
Physical activity stereotyping			0.15†	0.08
Parent explicit modeling			-0.21*	0.24**
Parent logistic support			-0.09	0.07
Parent history of sports participation & success			xxx	xxx
Parental gender stereotypes of sport ability			0.10	-0.11
Parent value towards child's PA			-0.09	-0.10
Parent frequency of sports participation in past year			-0.001	-0.28**
Parent gender-role stereotypes			0.10	0.02
Home chores			-0.03	-0.06
Parent leniency towards child PA			-0.08	-0.01
Parent protectiveness towards child PA			-0.03	-0.06
Parent restrictive of child PA in home			xxx	xxx
Social level (peer influence)				
Peer criticism of child's activity			-0.11	0.07
Peer influence for PA			-0.15	-0.07
Environmental level (home)				
Sedentary media in the child's bedroom	0.10	0.05		
Activity equipment and facilities in the home	-0.16*	0.04	-0.10	0.22*
Child gender stereotyped of television shows			-0.13	0.01
Child gender stereotyped of gift toys			0.19	0.17†
Total TV and toys			0.03	0.06
Environmental level (community)				
Ease of PA in community			-0.15	0.04
Opportunities for PA in the Community			-0.07	0.12

Gender (1=female, 2=male), † p<0.1 * p<0.05, **<0.01, xxx=data distributions too skewed.

Multivariate Hierarchical Regression Analysis

Sample One. Secondary analyses consisted of multivariate hierarchical linear regression analysis (dependent variable was sqrt MVPA). Independent variables were selected based on a correlation coefficient ≥0.1 and a 95% confidence interval not including zero (i.e., statistically significant). These variables were entered into a hierarchical linear regression model and grouped based on their multilevel category (i.e., individual, family etc.). Results showed that the overall association between gender and MVPA was reduced by 22.7%, after adjusting for various multilevel covariates (β=0.22 reduced to β=0.17) [Table 3.21]. Twenty-five percent of the variance in MVPA was explained by all variables in the model. Child's gender explained 5% of the variance in MVPA, demographic variables explained an additional 16% of variance, and individual level variables explained an additional 4% of variance. Child's age was consistently and negatively related to MVPA, and the effect size was 58% greater than child's gender (β=0.41 vs. β=0.17, respectively). Greater frequency of child participation in recreation places and sports facilities was associated with greater MVPA and the effect size was comparable to child's gender. None of the family level, social level or community environmental level variables met the criteria to be included in the multilevel analysis.

Table 3.21. Hierarchical linear regression of predictors of MVPA: *Sample One* (n=167).

		Standardized β			
	R^2 Change	**Block 1**	**Block 2**	**Block 3**	**Block 4**
R^2=0.05					
Child's gender (reference=female)		0.22**	0.16*	0.17*	0.17*
***Demographics* R^2=0.21**	**0.16**				
Child's age (yrs)			-0.40**	-0.41**	-0.41**
Ethnicity (reference=non-Hispanic)			-0.07	-0.01	-0.002
Child's BMI z-score			0.10	0.09	0.10
***Individual level (behavioral)* R^2=0.25**	**0.04**				
Mean non-PE PA days				0.03	0.03
Number of sports/PA classes in last year				0.07	0.06
Child activity in recreation/sports facilities (days)				0.18*	0.17*
Family level (parent influence)					
n/a					
Social level (peer influence)					
n/a					
***Environmental level (home)* R^2=0.25**	**0**				
Activity equipment/facilities in the home					0.03
Environmental level (community)					
n/a					

* p<0.05, **<0.01

Sample Two. Results showed that the overall association between gender and MVPA was not changed after adjusting for various multilevel covariates (β=0.21 changed to β=0.22) [Table 3.22]. Thirty-five percent of the variance in MVPA was explained by all the variables in the model. Child's gender explained 4% of the variance in MVPA, demographic variables explained an additional 17% of variance, individual level variables explained an additional 6% of variance, family level variables explained an additional 7% of variance, and the single home environment variable did not explain additional variance. Child's age was consistently and negatively related to MVPA, and the effect size was 33% greater than child's gender (β=0.33 vs. β=0.22, respectively). More days of child participation in physical education per week was associated with greater MVPA and the effect size was

comparable to child's gender. None of the social level or community environmental level variables met the criteria to be included in the multilevel analysis. Child gender stereotyped toys met the criteria to be included in the analysis but was subsequently excluded due to missing data (8 missing). Results did not differ substantially based on the inclusion of this variable. However, the gender effects were slightly reduced due to its effect on lowering the sample size of the regression model.

Table 3.22. Hierarchical linear regression of predictors of MVPA: *Sample Two* (n=116).

		Standardized β				
	R^2 Change	**Block 1**	**Block 2**	**Block 3**	**Block 4**	**Block 5**
R^2=0.04						
Child's gender (ref=female)		0.21*	0.20*	0.18*	0.22*	0.22*
***Demographics* R^2=0.21**	**0.17**					
Child's age (yrs)			-0.36**	-0.34**	-0.33**	-0.33**
Ethnicity (reference=non-Hispanic)			0.02	-0.02	-0.02	0.01
Child's BMI z-score			-0.19*	-0.19	-0.11	-0.09
***Individual level (behavioral)* R^2=0.27**	**0.06**					
Days of PE per week				0.22*	0.20*	0.21*
Child preference for sedentary behavior				-0.15	-0.11	-0.09
***Family level (parent influence)* R^2=0.34**	**0.07**					
Parent support for child's PA					0.04	0.02
PA stereotyping index					0.04	0.05
Parent explicit modeling for PA					0.17	0.15
Parent frequency of PA in past year					-0.08	-0.07
Parent perceptions of child's sport ability					0.10	0.09
Social level (peer influence)						
n/a						
***Environmental level (home)* R^2=0.35**						
Activity equipment/facilities in the home						0.11
Environmental level (community)						
n/a						

* p<0.05, **<0.01

Interactions

Sample One. Regression analyses were used to test for gender interactions for each of the associations shown in Table 3.20. No significant gender interactions were found for any of the variables (Table 3.23). However,

gender differences appeared in stratified analyses. The age-related decrease in MVPA appeared to be greater for girls than for boys.

There was no significant ethnicity interaction for the association between gender and MVPA (β=0.12, p=0.23). In stratified analysis, gender was not significantly associated to MVPA among non-Hispanic children (β=0.12, p=0.25); however gender was significantly associated with MVPA among Hispanic children (β=0.35, p=0.002).

Table 3.23. Results of gender interactions for select associations with MVPA in linear regression: *Sample One* (n=167).

	Gender Interaction		Girls	Boys
	β	p-value	β	β
Child's age (yrs)	0.14	0.83	-0.42**	-0.36**
Ethnicity (reference=non-Hispanic)	0.17	0.16	-0.07	0.16
BMI z-score	-0.10	0.40	0.14	0.03
Mean non-PE PA days	0.10	0.94	0.05	0.08
Number of sports/PA classes in last year	-0.08	0.55	0.15	0.04
Child activity in recreation/sports facilities (days)	0.01	0.96	0.17	0.17
Activity equipment/facilities in the home	-0.18	0.31	0.14	-0.04

* p<0.05, **<0.01

Sample Two. Regression analyses were used to test for gender interactions for each of the associations shown in Table 3.20. Results showed no significant gender interactions for: 1) days of PE and 2) PA gender stereotyping (Table 3.24). There were significant gender interactions for: 1) child preference for sedentary behavior, 2) parent perception of child's sport ability, 3) parent support for child's PA, 4) parent explicit modeling for PA, 5) parent frequency of participation in sports, and 6) activity equipment/facilities in the home. Among girls, participating in more days of PE per week was significantly associated with greater MVPA, but not for boys. Among boys,

lower preference for sedentary behavior, greater parent perceptions of child's sports ability, greater parent support for child's PA, greater parent explicit modeling of PA, less parent frequency of participating in sports, and greater number of physical activity equipment/facilities in the home were significantly associated with MVPA, but not for girls.

There was no significant ethnicity interaction for the association between gender and MVPA (β=0.09, p=0.56). In stratified analysis, gender was not significantly associated with MVPA among non-Hispanic children (β=0.16, p=0.21); however gender was marginally significantly associated with MVPA among Hispanic children (β=0.28, p=0.05).

Table 3.24. Results of gender interactions for select associations with MVPA in linear regression: *Sample Two* (n=116)

	Gender Interaction		Girls	Boys
	β	p-value	β	β
Child's age (yrs)	1.23	0.24	-0.54**	-0.22
Ethnicity (reference=non-Hispanic)	0.09	0.56	-0.11	0.01
BMI z-score	0.01	0.95	-0.23	-0.18
Days of PE per week	-0.22	0.25	0.35**	0.09
Child preference for sedentary behavior	-0.69	0.02	0.06	-0.35*
Parent perceptions of child's sport ability	0.46	0.04	0.03	0.36**
Parent support for child's PA	0.55	0.02	-0.07	0.36**
PA stereotyping index	-0.21	0.31	0.16	-0.05
Parent explicit modeling for PA	0.56	0.04	0.11	0.44**
Parent frequency of sports in past year	-0.53	0.06	-0.17	-0.39**
Activity equipment/facilities in the home	0.57	0.01	0.01	0.43**

* p<0.05, **<0.01

Exploratory Analysis

Ethnicity Interactions. Analyses were conducted to examine ethnicity differences between each association with gender shown in Table 3.20. Table 3.25 shows that among non-Hispanics, girls received greater parental explicit

modeling for PA than boys and parents of girls reported more frequent participation in sports, compared to parents of boys. No other variables differed by gender or between ethnic groups.

Sample One. The associations examined in Tables 3.21 and 3.22 were tested for interactions by ethnicity. Results showed that participation in sports/PA classes was associated with greater MVPA among Hispanics but not among non-Hispanics (Table 3.26). Child participation in recreation/sports facilities was associated with greater MVPA among Hispanics but not among non-Hispanics.

Sample Two. No significant ethnicity interactions were noted. However, stratified analyses showed that among non-Hispanics, lower BMI z-score, greater parental perceptions of child's sports ability, greater parental explicit modeling for PA, lower parental frequency of participation in sports, and greater availability/use of PA equipment/facilities in the home were all related to MVPA (Table 3.27).

Table 3.25. Stratified bivariate analyses by child's ethnicity.

	Sample One **N=167**		***Sample Two*** **N=116**	
	Independent Variable: Gender			
Measures	**Non-Hisp**	**Hisp**	**Non-Hisp**	**Hisp**
Individual level (behavioral)				
Mean days child PA for 60 minutes	-0.12	-0.02		
Mean non-PE PA days	0.18	0.16	-0.01	-0.24†
Days of PE at school	0.02	0.13	-0.06	0.13
Days ride bike to/from school	xxx	xxx		
Walking to/from school (none vs. any days)	-0.04	0.03	-0.17	-0.11
Number of sports/PA classes in last year	0.07	0.17	0.33	0.38
Child activity in recreation/sports facilities	-0.14	-0.12		
Child preferences for sedentary behavior			-0.24†	0.19
Child preference to play alone			-0.16	-0.08
Individual level (psychological)				
Physical activity enjoyment			xxx	xxx
Family level (parent influence)				
Parental perceptions of child's sport ability			0.06	-0.14
Parent language acculturation	0.03	0.003		
Parent ethnic relations acculturation	-0.19	0.02		
Total rules for child playing outside	-0.02	-0.07	0.10	-0.09
Parent encouragement for child's PA	0.13	0.01	0.13	-0.19
Parent encouragement for less sed behavior	0.09	-0.13	-0.15	-0.10
Parent encouragement for child's PA (2)			0.05	-0.22
Parent encouragement for less sed behavior (2)			-0.15	-0.12
Physical activity stereotyping			0.07	0.26†
Parent explicit modeling			-0.27*	-0.14
Parent logistic support			0.04	-0.22
Parent history of sports participation & success			xxx	xxx
Parental gender stereotypes of sport ability			0.06	0.15
Parent value towards child's PA			-0.11	-0.06
Parent frequency of sports in past year			-0.33**	0.24†
Parent gender-role stereotypes			0.06	0.15
Home chores			-0.05	-0.02
Parent leniency towards child PA			-0.01	0.08
Parent protectiveness towards child PA			0.04	-0.15
Parent restrictive of child PA in home			xxx	xxx
Social level (peer influence)				
Peer criticism of child's activity			-0.08	-0.15
Peer influence for PA			-0.13	-0.18
Environmental level (home)				
Sedentary media in the child's bedroom	0.04	0.15		
Activity equipment and facilities in the home	-0.14	-0.12	-0.03	-0.20
Child gender stereotyped of television shows			-0.10	-0.16
Child gender stereotyped of gift toys			0.15	0.26
Total TV and toys			0.04	0.03
Environmental level (community)				
Ease of PA in community			-0.07	-0.25†
Opportunities for PA in the Community			0.09	-0.23

Gender (1=female, 2=male), † p<0.1 * p<0.05, **<0.01, xxx=data distributions very skewed.

Table 3.26. Ethnicity interaction and stratified analyses for select bivariate associations: *Sample One* (n=167)

	Ethnicity Interaction		Non-Hisp	Hisp
Dependent Variable: MVPA	**β**	**p-value**	**β**	**β**
Child's age (yrs)	0.31	0.63	-0.47**	-0.36**
BMI z-score	0.10	0.46	0.06	0.18
Mean non-PE PA days	0.18	0.98	-0.02	0.21
Number of sports/PA classes in last year	0.24	0.06	0.006	0.31**
Child activity in recreation/sports facilities (days)	0.49	0.04	-0.02	0.32**
Activity equipment/facilities in the home	0.25	0.17	-0.05	0.17

* p<0.05, **<0.01

Table 3.27. Ethnicity interaction and stratified analyses for select bivariate associations: *Sample Two* (n=116)

	Ethnicity Interaction		Non-Hisp	Hisp
Dependent Variable: MVPA	**β**	**p-value**	**β**	**β**
Child's age (yrs)	-0.31	0.79	-0.34**	-0.39**
BMI z-score	0.22	0.14	-0.31*	-0.08
Days of PE per week	0.02	0.94	0.20	0.25
Child preference for sedentary behavior	-0.09	0.77	-0.17	-0.20
Parent perceptions of child's sport ability	-0.19	0.38	0.26*	0.10
Parent support for child's PA	0.04	0.88	0.14	0.19
PA stereotyping index	-0.27	0.15	0.19	-0.08
Parent explicit modeling for PA	-0.004	0.99	0.24*	0.24
Parent frequency of sports in past year	0.23	0.41	-0.33**	-0.24
Activity equipment/facilities in the home	-0.09	0.67	0.24*	0.17

* p<0.05, **<0.01

V. DISCUSSION

Summary of Findings

Gender differences in children's physical activity were not fully explained by the multilevel factors examined. Boys remained significantly more active even after controlling for demographic, individual level behaviors, parenting factors, and home environmental factors. Compared to other factors, demographic factors (child's age, ethnicity and BMI z-score) explained the most variance in child's MVPA (16-17% of variance). Mediation analyses were not conducted due to little evidence of mediation effects for any of the variables examined. Gender appeared to moderate associations between some parental factors and MVPA, but these results were not consistent across datasets. Among Hispanics gender differences in MVPA were apparent but not for non-Hispanics.

Participant Demographics

Parents who participated in this study were nearly all female (92-96% for *Sample One* and *Sample Two*). This homogeneity may have influenced the study findings. Parents who live with a spouse or partner may share parenting styles and behaviors or may have very different parenting styles and behaviors to that of their spouse or partner. Two parents can exhibit up to three different combinations of parenting styles; such that both parents may be strict, both parents may be lenient, or one parent may be strict and one parent may be

lenient. These different combinations of parenting styles can have very different effects on children's physical activity behaviors. The present study did not obtain information from the other parent/caregiver. Therefore, information obtained by only one parent may be incomplete or biased. Two parents may answer the same questions very differently. For example, one parent may endorse greater value towards their child's participation in sports while the other parent may endorse an opposite response. This study found that parents of girls reported greater explicit modeling than parents of boys. This might be a result of a response bias, given that most of the parent participants were female. It is possible that fathers may report greater modeling of physical activity for boys than for girls, but this cannot be confirmed in this study. Previous studies have shown that mothers report greater logistic support for physical activity than fathers, but fathers report greater explicit modeling; however, both methods were positively related to their daughter's physical activity. [79] In addition, greater child physical activity was reported when at least one parent reported higher overall support. [79] Therefore, it is unclear if study findings might be different if survey data were collected from both parents. Future studies should examine the extent to which responses might differ based on parent's gender and how study findings might be influenced by those differences.

Anthropometric results showed that, on average, parents were overweight (BMI=28.3 kg/m^2) and 15-20.7% of children were obese. These

results are comparable to national data on adult and childhood obesity. In the present study, the prevalence of adult obesity was 35.2%, compared to 34% in the general U.S. population. [121] The prevalence of childhood obesity among 6-11 year old children was 17%. [122] Thus, it appears that the obesity prevalence of the present study samples were representative of the general U.S. population.

Child Physical Activity

In the present study, 33% and 24% (*Sample One* and *Sample Two*, respectively) of children engaged in 60 minutes or more of MVPA on at least 5 days and only 5.4% and 5.2% (*Sample One* and *Sample Two*, respectively) on all 7 days. In a large U.S. sample of children who wore accelerometers for seven days, the prevalence of meeting the physical activity guidelines on 5 or more days per week was 42%. [3] It appears that fewer children in the present study were meeting the physical activity guidelines than previously reported in others studies. [3] However, the results of this study are not directly comparable to other studies given that the previous study used a different model of accelerometer (ActiGraph 7164), a longer epoch length (60 seconds) and a lower MET value (3 METS) for the lower threshold of moderate intensity physical activity. It is not clear whether different accelerometer models may result in different results. A higher epoch length (i.e., 60 vs. 30 seconds) will results in activity counts of different intensities being combined within the same epoch timeframe; thus, increasing measurement error. Also, a lower

MET threshold (i.e., 3 MET vs. 4.5 MET) will increase the number of children who achieve moderate intensity activity. In this study, activity data were collected using a uni-axis accelerometer (ActiGraph GT1M) at 30 second epochs and the lower threshold for moderate intensity was 4.5 METs. This may partially explain why more children achieved greater minutes of MPVA and a greater proportion met the physical activity guidelines in a previous study. [3] Research should aim to establish standardized methodologies for collecting physical activity data in children using accelerometers in order to compare results between studies and/or to establish guidelines for reporting physical activity data so that they can be compared to other studies. For example, researchers may agree to collect physical activity data in the shortest epoch length (5 seconds) and to report activity summaries as counts per minute. In addition, researchers can report results based on the same MET values to define activity intensity categories. These strategies will result in the ability to compare results across studies.

Gender Differences in MVPA and Meeting the Physical Activity Guidelines

On average, boys engaged in 10.9 (73.45 vs. 62.58) and 11.1 (65.19 vs. 54.10) more minutes of MVPA per day than girls (*Sample One* and *Sample Two*, respectively); a difference of 14.8% and 17%, respectively. If these differences were maintained for an entire week, boys may accumulate roughly 77 more minutes of MVPA in just seven days. These differences in physical activity between genders may have health implications; however, without

accounting for sedentary time and energy intake it is not possible to derive conclusions about whether or not these gender differences in physical activity may lead to differences in health outcomes. Studies show that pre-pubescent children may have similar energy intake demands due to very similar lean body mass, skeletal mass and body fat. [123] Only until adolescents do gender differences in energy intake begin to appear, largely due to increased muscle mass in boys and social pressures for dieting in girls. [124] Thus, it is conceivable that any potential health benefits that boys may have gained as preadolescents would be offset by greater energy intake in adolescents and a decrease in MVPA as they become older. [3]

A total of 44.6% of boys and 27% of girls met the physical activity guidelines of ≥60 minutes of MPA on at least 5 days per week. By comparison, a recent study showed that 48% of boys and 35% of girls met the physical activity guidelines. [3] Boys averaged 73 daily minutes of MPA and girls averaged 62 daily minutes of MPA. By comparison, boys averaged 95 minutes and girls averaged 75 minutes of MPA in another study. [3] This translates to 22 minutes and 13 minutes of lower MPA among boys and girls (respectively) in the present study compared to the previous study. Again, differences in methodologies limit comparability between studies, but if these differences were true, then they may have important public health implications given that both prevalence estimates (present study and the comparison study) [3] are below 50%. Children who do not meet the guidelines report lower

psychological and physical quality of life, independent of weight status. [125] Thus, it is possible that low physical activity levels are contributing to progressively poorer quality of life in children and that gender differences in physical activity can lead to gender differences in psychological and physical health outcomes. Intervention studies and physical activity promotion programs should target increasing the proportion of children who met the physical activity guidelines and reducing these gender differences.

Psychometrics of Study Measures

This study used a combination of previously validated scales and new scales. In general, the results of exploratory factor analysis supported that the scales had adequate psychometric properties. Items usually loaded in distinct and definable latent constructs and confirmed the scale constructs as originally developed or intended. For example, the parent support for physical activity scale (Figure 3.5) showed very similar factor loadings compared to the original results as when the scale was developed. [79] In fact, the factor loadings were stronger for both parent logistic support and explicit modeling in the present study that in the original study. [79] This is especially encouraging given that this measure was translated to Spanish and implemented in a multiethnic sample of parents for this study. Re-evaluating the psychometric properties of previously validated scales was necessary given that most scales were translated to Spanish and/or some of the items and answer choices were re-worded. In addition, new scales were developed which demonstrated

acceptable psychometric properties. For example, a scale was developed to measure parenting style towards their child's physical activity. This new scale showed three distinct constructs based on exploratory factor analysis and the internal consistency of items was acceptable. These results represent a contribution to children's physical activity research. The scales used for this study (modified scales and new scales) can be used in future studies to further explore their construct validity and to determine if the measures are important correlates of children's physical activity. The Spanish translated measures are of particular interest for use in research of Latino and/or Spanish speaking communities.

In most cases the internal consistency of items was acceptable (e.g., α=0.72 for physical activity stereotypes) or adequate (e.g., α>0.80 for parent acculturation). By themselves, these statistical criteria are insufficient evidence for the construct validity of scales. Exploratory factor analysis provides information about the underlying latent construct of a given set of items and Cronbach's alpha provides information about the inter-item correlations. Additional scrutiny may require that these measures also relate to a criterion variable (gold standard) and/or to relate to other variables in an expected theoretical manner. For example, parents' acculturation levels differed by ethnicity. Hispanic/Latino parents had a lower English language and English media use acculturation score (2.7±1.4) compared to caregivers who identified as non-Hispanic/Latino (4.8±0.5), $p<0.01$. This adds further support for the

construct validity of the acculturation measure. Some study measures were significantly related to children's MVPA (e.g., parent explicit modeling for physical activity), in the expected direction. However, other measures were not related to child's MVPA. Researchers should consider these results as well as methodological and measurement issues when deciding to use the measures from this study.

Children's MVPA was the criterion measure by which concurrent validity was assessed for many of the multilevel variables. A greater number of days of physical education at school, greater parent perceptions of child's sports ability, greater parent explicit modeling, lower parent frequency of sports participation in the past year, and greater number of physical activity equipment/facilities in the home were all related to greater child's MVPA (Table 3.20). Although promising and in the expected directions, these results may not be valid given the increased risk of type 1 error due to multiple comparisons (i.e., false positive findings). In *Sample Two*, a total of 26 bivariate analyses were conducted. In order to increase the confidence of these findings, a Bonferroni correction must be made to the standard p-value cutoff of $p<0.05$. The smallest p-value was observed between the association for parent explicit modeling and MVPA ($p=0.009$). The Bonferroni corrected p-value cutoff would be 0.0019 (0.05/26). Thus, given the new p-value cutoff, none of the bivariate correlations would be statistically significant after adjusting for the multiple comparisons. Caution should also be taken with

using significance level as the sole criteria to assess the importance of associations, given that statistical significance is strongly influenced by sample size in correlation analysis. In Table 3.20, some of the correlation coefficients could be classified as either small (r=0.14) or intermediate (r=0.26), based on mediation analysis criteria discussed in an earlier section. In many cases, the size of the correlation may be more important given that it represents the level covariance (or shared variance) between the variables, and a more meaningful metric than a p-value. There are currently no established criteria by which one can judge the importance of correlation coefficients. In general, (irrespective of the significance value) the larger the correlation coefficient, the more meaningful the association is. In addition, interpretation of correlations must take into account the methods used to collect the data. In the present study, self-report predictors of physical activity were correlated with objectively measured MVPA. Previous studies have shown that correlation coefficients between self-report physical activity data and self-reports of determinants of physical activity are often higher than correlations obtain between self-report determinants and objectively measured physical activity (i.e., accelerometers). [126,127] The higher correlations between two self-report measures may be due to 'shared method variance'. [126] The results of this study were derived from two separate methods (parent self-report and objective measures of child's physical activity), this may partially explain why most of the correlations observed were relatively small (i.e., most were r<0.1).

Additional psychometric assessments of the survey measures may include split-half reliability, confirmatory factor analysis and use of other reliability and validity assessments (e.g., test-retest, comparison to objective measures of the same construct, predictive ability to future behaviors etc.). Futures studies should aim to use more objective measure of the multilevel factors examined in this study. For example, instead of obtaining parent report of their modeling and support for their child's physical activity, direct observation methods may be used to capture this information.

Some measures elicited parent responses that resulted in 'ceiling' effects. For example, the mean number of rules for playing outside was 7 from a possible range of 0-8 and 98.3% of parents indicated that their child enjoyed physical activity. These results may be due to poor question wording, poor item selections to represent a construct, poor response options (i.e., dichotomous), and tendency to give socially desirable answers. Items must be carefully worded so that they elicit an appropriate distribution of responses. In most case, items that might be considered as being 'heavily charged' would elicit extreme responses. For example, the gender-role stereotype measure contained statements about gender roles that may be considered sexist and may no longer be applicable to many individuals; in which case those items may have elicited adverse emotional reactions from study participants. For example, 78% of parents indicated that they disagreed or strongly disagreed to the statement… "A woman is not truly fulfilled until she has been a mother".

In order to obtain better discrimination and variability from some of the scales, items should be worded so that they elicit a wider range of responses. This can be achieved by wording items so that they also capture intermediate levels of endorsements. Related to this, item response options may not have been adequate for some scales. Dichotomous response options (yes vs. no) may not be representative of the phenomenon under study. These may be difficult for participants to answer because they require that the participant think of scenarios where the phenomenon never or always occurs.

The specific context in which the survey is administered may also influence the results. For example, parents may tend to respond with socially desirable answers if they feel that they may appear to be a 'bad parent'. Almost all rules for playing outside were endorsed ≥90% of the time. Parents may have felt compelled to indicate that they did have all or most of the rules in order to appear to be a good parent. A solution to this problem might be to change response options to a Likert-type format so that respondents can pick a response option that is more realistic to them and possibly be more truthful.

In summary, most scales met statistical criteria to support the presence of latent constructs, but few constructs were correlated to an objective measure of MVPA. More research is needed to document the construct validity of the measures used in this study.

Association between Multilevel Factors and Child's Gender and MVPA

Results of bivariate associations (Table 3.20) showed that only one variable (parent explicit modeling of physical activity) was related to both child's gender and MVPA. Few other variables were either related to child's gender or MVPA, but not to both. These results were contrary to the study hypothesis that several multilevel factors would be related to both gender and MVPA. Consequently, the primary study analysis to test the mediation effects of multiple variables was not justified.

There are several explanations for these findings. First and foremost, this study was powered to test for an α and β path of intermediate-to-intermediate and medium-to-intermediate strengths, respectively. These estimates were based on the findings of a comprehensive literature review and statistical simulations of mediation analyses for various sample sizes. [116] The sample size of *Sample One* was determined by available data from the MOVE study's baseline measures. The sample size for *Sample Two* was estimated based on both statistical and feasibility considerations. It is possible that both studies were underpowered to detect the proposed associations. It appeared that correlation coefficients of $r \geq 0.15$ were usually statistically significant; however almost no single variable was associated with both gender and MVPA at this level. The sample size required to test for significant associations between dichotomous and continuous outcomes may vary given that the effect size is often lower for dichotomous vs. continuous variables. [128]

For example, it is possible that a larger sample size was necessary to detect gender differences in the various explanatory variables of interest given that gender is dichotomous. The results in Table 3.19 support this interpretation since a total of eight variables were either marginally or statistically related to MVPA, while only two variables were related to child's gender (*Sample Two*). Future studies should consider this information in estimation of study sample size to test for mediation effects.

Another explanation for these findings is that parent self-report measures might contain too much measurement error which reduced the ability to detect significant associations. It is well known that self-report measures can introduce bias and can be inaccurate methods for assessing behaviors. Parents were asked to report on various psychological and behavioral aspects about themselves and of their child. A parent may not be able to accurately report on their child's participation in specific physical activities during physical education given that they are not present to observe this behavior. In some cases parents may not be good proxies of child behaviors or child psychological factors. Parents were asked to indicate what they thought about their child's motivation for physical activity and preference for play. These constructs may be best measured by directly interviewing the child or by direct observation child behaviors.

Despite the limitations mentioned above, it is still surprising that only one variable was associated with both child's gender and MVPA. The scientific

literature points towards several consistent factors that are related to both child's gender and MVPA. For example, gender differences have been noted for self-efficacy, social support and expectations to be active; [50] each of which can mediate the gender and physical activity relationship. Gender differences in perceived physical and athletic competence may also explain gender differences in physical activity. Boys tend to show greater perceived competence and greater perceive competence is related to greater physical activity. [55] Several social support measures were included in this study such as parent support for child's physical activity, parent explicit modeling for physical activity, parent logistic support for child's physical activity, and peer and sibling influence on physical activity. From these, only parent explicit modeling for physical activity was related to both gender and MVPA. Also, parent perception of child's sport ability was positively related to MVPA but not gender. It was expected that perceptions of sport ability would be different for boys and girls. One explanation might be that parents don't perceive any gender differences in their children's sports ability. However, difference in sport ability may become apparent if objective measure were used (e.g., directly observation).

Secondary Analyses

Due to the mostly null effects observed from bivariate analyses, mediation analyses were not conducted. Instead, hierarchical linear regression was used to test the relative contribution of variable groups (blocks) to explain

the variance in MVPA and their influence on the gender effects (Tables 3.21 and 3.22). Results showed that the variance explained by gender was 4-5%. In contrast, the additional variance explained by the combination of demographic factors was 16-17%. Not surprisingly, child's age was a consistent and strong predictor of lower MVPA. This finding is consistent with other studies that show age-related decline in children's physical activity. [3] The most interesting finding was that the standardized beta estimate of gender was reduced by 21.7%, after adjusting for various multilevel covariates (β=0.22 [95% CI: 0.21, 1.1] reduced to β=0.17 [95% CI: 0.09, 0.95]) [*Sample One*, Table 3.21]. This suggests that part of the variance in MVPA explained by gender was reduced when accounting for these covariates. The reduction in the gender effect was seen only with demographic variables (age, ethnicity and BMI z-score) [β=0.22 reduced to β=0.16]. After other individual, social and home environmental variable were included in the model, the effect of gender slightly increased (β=0.16 to β=0.17). Thus it appears that demographic factors explain about 22% of the gender to MVPA association, leaving 78% of the effects still unexplained.

In *Sample Two* (Table 3.22), the effects of gender were reduced by 14% after controlling for days of physical education per week. These findings are different from those of *Sample One* (described above). The best explanations for this discrepancy is that *Sample One* and *Sample Two* did not have the same participants, were of different sample sizes and included

different variables in the models; therefore the results of each study are not directly comparable. Only 32 participants had data for both *Sample One* and *Sample Two*.

Gender Interactions

Gender may be a moderator of the association between a particular variable and MVPA. This hypothesis was not supported in *Sample One* (Table 3.23) but it was supported in *Sample Two* (Table 3.24). In *Sample Two*, gender interactions were noted for: 1) child preference for sedentary behavior, 2) parent perception of child's sport ability, 3) parent support for child's PA, 4) parent explicit modeling for PA, 5) parent frequency of participation in sports, and 6) activity equipment/facilities in the home. Among girls, participating in more days of PE per week was significantly associated with greater MVPA, but not for boys. Among boys, but not for girls, lower preference for sedentary behavior, greater parent perceptions of child's sports ability, greater parent support for child's PA, greater parent explicit modeling of PA, less parent frequency of participating in sports, and greater number of physical activity equipment/facilities in the home were significantly associated with MVPA. These findings offer some insight into the factors that differentially influence physical activity behaviors between boys and girls. Boys and girls may differ in the way they respond to internal (psychological) and external (environmental) factors; which in turn affects their physical activity behaviors. The interactions showed that girls may derive particular benefits from participating in physical

education classes. In contrast, boys seem to benefit from greater parent support, modeling and availability of sports and physical activity facilities in the home. These findings are in agreement with studies that show that boys and girls respond differently to physical activity interventions. A physical activity intervention among 8-12 year old children showed that boys had a greater increase in daily accelerometer counts compared to girls (110% vs. 40%, respectively) and a greater increase in minutes per day of MVPA (+18.1 vs. +2.7 minutes, respectively). [129] In a school-based intervention (Aventuras para Niños), girls tended to show greater increases in MVPA compared to boys in organized activities (unpublished data). Gender differences in response to interventions or health promotion efforts may be explained by several factors. For example, self-efficacy has been shown to be a consistent positive correlate of children's physical activity. [19] and boys tend to report greater self-efficacy for physical activity. [63] If boys had greater self-efficacy for physical activity, compared to girls, then they may be more likely to use active toys and equipment that is available in the home; thus being more physically active. This explanation however cannot be confirmed in the present study since children's self-efficacy was not measured. Other factors that may explain the gender interactions are child's motivation, enjoyment and perceptions of their own physical competence; each of which may be different between boys and girls. These explanations should be evaluated in futures studies. As a direct test of mediation was not conducted, these results are not sufficient to suggest

that these variables explain the gender difference in MVPA. More research is needed to understand the reasons that boys and girls differ in their response to parental and social influence.

Ethnicity interactions

The results were stratified by ethnicity. Formal tests of interactions were conducted to determine if associations differed by ethnicity. Exploratory analyses of ethnicity interactions were carried out since gender was significantly associated with MVPA among Hispanic children (β=0.35, p=0.002) but not non-Hispanic children (β=0.12, p=0.25). This suggests that there may be particular cultural and/or social factors among Hispanics that contribute to gender differences in children's physical activity. This hypothesis was not fully supported since no gender differences exited in any of the multilevel factors among Hispanics. Further analysis however did show that participation in sports/PA classes was associated with greater MVPA among Hispanics but not among non-Hispanics. Child participation in recreation/sports facilities was associated with greater MVPA among Hispanics but not among non-Hispanics. It appears that Hispanic children derive particular benefits from participating in sports/PA classes and recreation/sports facilities. This might be partially explained by ethnic differences in values and purpose towards participating in sports. [87]

Strengths and Limitations

Strengths. This study used an objective (outcome) measure of child's physical activity. Accelerometers are an unobtrusive, valid and feasible method of measuring children's physical activity. [130] The results derived from accelerometer data supported previous research for gender differences in physical activity, indicating that few children are meeting the physical activity guidelines. These results support the validity and reproducibility of this physical activity measure. This study used two datasets to investigate the same research question. This approach allowed for the comparison of findings between datasets and facilitated conclusions to be drawn based on the consistency of findings. Variables selected to be studied as potential mediators were derived from a comprehensive review of the literature, a specified theory (SCT) and a multilevel framework. This supported the use of multivariate and multilevel analyses to study the independent and combined effects of potential mediating variables. Lastly, the psychometric properties of most scales were found to be adequate. This is promising especially since measures were modified to accommodate Spanish speaking participants.

Limitations. The null effects of this study may be attributed to several factors. Although power, effect size and sample size estimates were considered based on data from empirical estimates, it appears that both studies may have been underpowered to detect significant associations. The response options and format of some questions may not have been optimal.

Only one caregiver per family participated in the study survey. This may have limited the accuracy of their responses and/or have introduced some biases. Combining information from both parents (when applicable) may be a more accurate and comprehensive approach. Although various factors were studied as potential mediators, it is possible that not all important factors were included. More specific and objective measures were needed to examine the reasons that boys are more active than girls. For example, although the parent reported on the frequency of their child's participation in physical education, this does not provide any information about the duration and contextual factors that influence their child's physical activity. Measurement of social and environmental factors such as teacher supervision and availability of active play equipment during recess, physical education time (via direct observation), and perceptions of neighborhood safety may be important in future research aiming to investigate gender differences in physical activity. Lastly, in order to test the true mediating effects, a prospective study design is warranted. This is because the time sequence of associations needs to be established. For example, it may be hypothesized that due to a child's gender a parent may offer different types of support and this support leads to gender differences in children's physical activity. It may be possible to test this hypothesis via an experimental design. Boys and girls with similar physical activity levels may be randomly assigned to different parental support conditions, where one group receives parent support based on the child's gender and the other group

receives similar parent support regardless of child's gender. This intervention might then determine if differential parent support actually influences gender differences in children's physical activity. This is only one example of how intervention studies may be specifically designed to test the effects of multilevel factors on gender differences in children's physical activity.

Recommendations for Future Research and Practice

The results of this study demonstrate that gender differences in children's physical activity are persistent. After examining many multilevel factors, no single variable or group of variables appeared to significantly explain away gender differences. Explanations for these gender differences can be inferred from the results of individual studies. However, evidence drawn from multiple individual studies is difficult to aggregate since it precludes testing a single multivariate and multilevel model. Future research should: 1) focus on improved exposure measures (i.e., use direct observation) and continue to use objective outcome measurement (i.e., accelerometers), 2) use measurement techniques that can link activity data with specific psychological, behavioral and environmental factors (e.g., the SOPLAY method), 3) use prospective study designs to examine the temporal sequence and mediation effects of various factors, and 4) use qualitative methods to study specific psychological and social phenomenon that contribute to gender differences in physical activity.

Gender differences in children's physical activity are important for tailoring of interventions since tailoring may reduce gender differences in response to interventions. As described earlier, boys and girls may show differential responses to a physical activity intervention, usually favoring boys. Thus, an intervention would need to tailor interventions strategies to specifically target motivational factors that may be important for girls such as improving body image, self-esteem and socialization. For boys, important motivational factors may be improving sports performance. Based on the results of this study, an intervention would also need to promote greater physical education participation among girls and increase availability of physical activity equipment in the home among boys. Public health practitioners should consult the scientific literature to identify intervention strategies that are effective for both boys and girls. Mass communications campaigns should consider tailoring physical activity messages so that they appeal to both boys and girls. Physicians, nurses, health educators and exercise specialists need to pay close attention to the needs of girls and motivate girls to be more physically active. School teachers, physical activity instructors and school administrators need to ensure that girls have equal opportunities for physical activity and sports, and that promotion strategies reinforce physical activity among girls. Parents may also need to receive counseling focused on reducing barriers towards physical activity of girls, increasing logistic support, increasing modeling, and increasing availability of

active toys and activity equipment among girls. Lastly, cultural factors must also be considered when designing and implementing physical activity interventions since ethnic differences in values and gender stereotypes towards physical activity may contribute to gender differences in children's physical activity.

Concluding Statements

Although this study did not identify specific factors that explained gender differences in children's physical activity, results of stratified analyses based on child's gender and ethnicity support the need for further research to examine why boys and girls may differ in their response towards social factors and why gender differences in children's physical activity appear to be more pronounce among Hispanics. Based on current evidence of correlates of children's physical activity, the gender interactions may be the result of gender differences in motivational factors such as child's self-efficacy, enjoyment and perceived competence. This study contributes to research of children's physical activity by further documenting the construct validity of several previously validated measures that correlate with children's physical activity, and by presenting preliminary construct validity of newly developed measures. The challenge of future research will be to accurately identify and measure the factors that contribute to gender differences in children's physical activity and then to ensure that health promotion strategies and physical activity interventions are equally effective for both boys and girls. Little has been done

to date to directly address this challenge, but there are many opportunities to do so given the amount of available evidence concerning gender differences in factors that influence children's physical activity and given the ability to directly test research questions and research hypotheses with existing data or experimental studies.

APPENDIX

SAMPLE ONE SURVEY MEASURES

Parent and Child Demographics

1. Do you think of your child as being Latino, Hispanic, Mexican/Mexican American,
   or of Spanish origin?
   ☐$_1$ Yes
   ☐$_0$ No

2. Which of the following best describes your child …(*Check ALL that apply.*)
   o$_A$ White
   o$_B$ Black or African American
   o$_C$ Asian
   o$_D$ Native Hawaiian or other Pacific Islander
   o$_E$ American Indian or Alaska Native
   o$_F$ Other, specify: _____
   o$_G$ Don't know

3. What is your date of birth?
   __ __ - 1 9 __ __
   Month Year

4. What is your marital status?
   ☐$_1$ Married
   ☐$_2$ Divorced
   ☐$_3$ Widowed
   ☐$_4$ Separated
   ☐$_5$ Never been married
   ☐$_6$ Living as married or living together

5. What is the highest grade you COMPLETED in school? (*Please check ONE.)*
   ☐$_1$ Never attended school or only some elementary
   ☐$_2$ Elementary through 6th grade
   ☐$_3$ Middle School (Secondary)
   ☐$_4$ High School (Preparatory)
   ☐$_5$ 1-2 yrs of College, including Community & Technical colleges
   ☐$_6$ 3-4 yrs of College
   ☐$_7$ College graduate
   ☐$_8$ Post graduate work

6. How many children under age 18 live in your household?
   _____ Number of children

7. How many adult family members live in your household, including yourself and children over 18 years of age?
   _____ Number of adults

8. Which of the following best describes your family's monthly income before taxes
   from all sources?
   - ☐1 less than $500
   - ☐2 $501-1000
   - ☐3 $1001-1500
   - ☐4 $1501-2000
   - ☐5 $2,001-2,500
   - ☐6 $2,501-3,000
   - ☐7 $3,001-3,500
   - ☐8 $3,501-4,000
   - ☐9 $4,001-4,500
   - ☐10 $4,501-5,000
   - ☐11 $5,001 or more
   - ☐888 I don't know

9. How many people including yourself, were supported by this income during the past year?
   _____ Number of people

10. Do you think of <u>yourself</u> as being Latino, Hispanic, Mexican/Mexican American, or of Spanish origin?
    - ☐1 Yes
    - ☐0 No

11. Which of the following best describes <u>you</u>… *(Check <u>ALL</u> that apply.)*
    - O A White
    - O B Black or African American
    - O C Asian
    - O D Native Hawaiian or other Pacific Islander

O_E American Indian or Alaska Native

O_F Other, specify: _____

O_G Don't know

Caregiver Acculturation

The following questions ask about the languages you speak and use. If you speak any language(s) other than English, think about that language when answering the following questions.

1. In general, what language(s) do you speak? Do you speak....
   - $\square_1$ only another language,
   - $\square_2$ another language more than English,
   - $\square_3$ both equally,
   - $\square_4$ more English than another language, or
   - $\square_5$ only English?
2. In general, in what language(s) do you read? Do you read...
   - $\square_1$ only another language,
   - $\square_2$ another language more than English,
   - $\square_3$ both equally,
   - $\square_4$ more English than another language, or
   - $\square_5$ only English?
3. What language(s) do you usually speak at home?
   - $\square_1$ only another language,
   - $\square_2$ another language more than English,
   - $\square_3$ both equally,
   - $\square_4$ more English than another language, or
   - $\square_5$ only English?
4. What language(s) do you usually speak with your friends?
   - $\square_1$ only another language,
   - $\square_2$ another language more than English,
   - $\square_3$ both equally,
   - $\square_4$ more English than another language, or
   - $\square_5$ only English?
5. In what language(s) are the T.V. programs you usually watch…
   - $\square_1$ only another language,
   - $\square_2$ another language more than English,
   - $\square_3$ both equally,
   - $\square_4$ more English than another language, or
   - $\square_5$ only English?
6. In what language(s) are the radio programs you usually listen to…
   - $\square_1$ only another language,
   - $\square_2$ another language more than English,

- ☐3 both equally,
- ☐4 more English than another language, or
- ☐5 only English?

7. Would you say your close friends are…
   - ☐1 mostly from the same ethnic backgrounds as you,
   - ☐2 mostly from a different ethnic backgrounds than you,
   - ☐3 or about half and half?
8. Would you say that in general, the persons you visit or who visit you are…
   - ☐1 mostly from the same ethnic backgrounds as you,
   - ☐2 mostly from a different ethnic backgrounds than you,
   - ☐3 or about half and half?

Your Home Environment

Please write in the total number of the following non-portable electronic devices that are in your child's bedroom. Include all those that work, whether or not they are used regularly. If none, write zero (0).

		Total # in home	# in child's bedroom
1.	TVs		
2.	VCR or DVD players or recorder (like TiVo, DVR, Sonic Blue)		
3.	Music players (like radio, CD or tape players, stereo system)		
4.	Desktop computers		
5.	Video game players that hook up to a TV (like Play Station, X-Box)		
6.	Active video game devices, like Dance Dance Revolution or Wii		

Your Child's Physical Activity Behaviors

Physical Activity is any activity that increases your child's heart rate and makes your child get out of breath some of the time. Physical Activity can be done in sports, playing with friends, or walking to school. Some examples of physical activities are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball, surfing, jumping rope, playing 4-square and playing hopscotch.

Select the answer that best applies to your child.		Number of Days							
		0	1	2	3	4	5	6	7
	Not counting school physical education (PE) classes, how many days per week does your child play or practice team sports?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
	Not counting school PE classes, how many days per week does your child have physical activity classes or lessons not with the team sport (like martial arts, dance, tennis)?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
	How many days per week does your child have PE class at school?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5		
	During the past 7 days, how many days did your child ride his/her bike to and from school?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5		
	During the past 7 days, how many days did your child walk to school?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5		
	During the past 7 days, how many days did your child walk from school?	☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5		

During the past 12 months, how many different sports or physical activity classes or
lessons has your child participated in outside of school?

- ☐ 0 None
- ☐ 1 1
- ☐ 2 2
- ☐ 3 3
- ☐ 4 4
- ☐ 5 5 or more

Do you have the following rules for your child? (*Please check ONE answer for each rule.)*

		Yes	No	Sometimes
1.	Do homework before going out	☐1	☐0	☐2
2.	Stay close to or within sight of the house/parent	☐1	☐0	☐2
3.	Do not go into the street	☐1	☐0	☐2
4.	Do not go places alone	☐1	☐0	☐2
5.	Stay within the neighborhood	☐1	☐0	☐2
6.	Wear a helmet (when biking, skateboarding, etc.)	☐1	☐0	☐2
7.	Wear protective clothing (like knee pads when biking, skateboarding, etc.)	☐1	☐0	☐2
8.	Avoid strangers	☐1	☐0	☐2

In a typical week, how often is your child physically active in each of the places listed below?

		Never	Less than once a week	1-2 times a week	3-4 times a week	5-7 times a week
a.	The nearest public recreation center	☐0	☐1	☐2	☐3	☐4
b.	Other public recreation centers (YMCA, Boys and Girls Club)	☐0	☐1	☐2	☐3	☐4
c.	Commercial facilities (private gym/studio, batting cages, etc.)	☐0	☐1	☐2	☐3	☐4
d.	School grounds (after-school only)	☐0	☐1	☐2	☐3	☐4
e.	School grounds (weekends only)	☐0	☐1	☐2	☐3	☐4
f.	Parks or playgrounds	☐0	☐1	☐2	☐3	☐4
g.	Walking/hiking/biking/ trails	☐0	☐1	☐2	☐3	☐4
h.	Beach or lake	☐0	☐1	☐2	☐3	☐4
i.	Neighborhood (e.g., vacant lot/field)	☐0	☐1	☐2	☐3	☐4
j.	Our yard or apartment complex	☐0	☐1	☐2	☐3	☐4
k.	Friend's or relatives home	☐0	☐1	☐2	☐3	☐4

During a typical week, on how many days does an adult member of your household?

(Please check ONE box for each question.)

		Never	1-2 days	3-4 days	5-6 days	Every day
a.	Watch your child participate in physical activity or play sports?	☐0	☐1	☐2	☐3	☐4
a.	Encourage your child to do physical activity or play sports?	☐0	☐1	☐2	☐3	☐4
b.	Provide transportation so your child can go to a place where he or she can do physical activity or play sports?	☐0	☐1	☐2	☐3	☐4
c.	Do a physical activity or play sports with your child?	☐0	☐1	☐2	☐3	☐4
g.	Encourage your child to spend less time being inactive?	☐0	☐1	☐2	☐3	☐4
h.	Help your child to think of ways to reduce the time he or she spends on inactive habits?	☐0	☐1	☐2	☐3	☐4
k.	Tell your child that he or she is doing a good job reducing inactive habits?	☐0	☐1	☐2	☐3	☐4

Please indicate if the following items are available in your home, yard, or apartment complex, and if so, whether your child uses each item.

	Not available	Available but never use	Available and use
Bike, tricycle, kiddy car, or big wheel	☐0	☐1	☐2
Basketball hoop	☐0	☐1	☐2
Sports equipment (like balls, racquets, bats, sticks, Frisbees)	☐0	☐1	☐2
Roller skates, roller blades, skateboard, scooter	☐0	☐1	☐2
Loose play equipment (like jump rope, hula hoop, pogo stick, bean bags)	☐0	☐1	☐2
Fixed play equipment (like swing set, play house, jungle gym, trampoline)	☐0	☐1	☐2
Water equipment (like canoe, row boat, kayak, surf board, boogie board, windsurf board, water skis)	☐0	☐1	☐2
Swimming pool	☐0	☐1	☐2

STUDY TWO SURVEY MEASURES

We need your help to make our study a success. Your honest answers to the questions in this survey are very important to us. This will not take too long to complete. Remember…

- We want to know what you think,
- Try to answer all the questions
- There are no right or wrong answers, and all of your responses are kept strictly confidential. we will not share any personal information with anyone outside the study

Many of the questions are about "**your child**". Please remember to think about_____ when answering these questions.

Please use a '**check mark'** or an **'X**' to indicate your responses.

Like this ☑ or ☒

SECTION A

1. How many days a week does your child live with you? _____ days per week.

2. Please check the type of dwelling that best describes where you and your child live

		Check only ONE
1.	House	☐1
2.	Apartment complex	☐2
3.	Condo	☐3
4.	Farm house	☐4
5.	Converted garage	☐5
6.	Trailer home	☐6

3. Is your child an only child? ☐1 Yes if yes, please skip to **Section B**.
   ☐0 No if no please answer the following questions

4. Please indicate the gender and age of all other children under 18 years old that live in your household.

Child	Boy	Girl	Age
1.	☐1	☐0	
2.	☐1	☐0	
3.	☐1	☐0	
4.	☐1	☐0	
5.	☐1	☐0	
6.	☐1	☐0	
7.	☐1	☐0	
8.	☐1	☐0	
9.	☐1	☐0	
10.	☐1	☐0	

SECTION B

Physical Activity is any activity that increases your child's heart rate and makes your child breathe heavily some of the time. Physical Activity can be done in sports, playing with friends, or walking to school. Some examples of physical activities are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball, surfing, jumping rope, playing 4-square and playing hopscotch.

Select the answer that best applies to your child.		Number of Days							
		0	1	2	3	4	5	6	7
1.	Not counting school physical education (PE) classes, how many days per week does your child play or practice team sports?	☐0	☐1	☐2	☐3	☐4	☐5	☐6	☐7
2.	Not counting school PE classes, how many days per week does your child have physical activity classes or lessons not with team sport (like martial arts, dance, tennis)?	☐0	☐1	☐2	☐3	☐4	☐5	☐6	☐7
3.	How many days per week does your child have PE class at school?	☐0	☐1	☐2	☐3	☐4	☐5		
4.	During the past 7 days, how many days did your child **walk to** and **from school**?	☐0	☐1	☐2	☐3	☐4	☐5		

		Total Number of Sports					
		None	1	2	3	4	5 or more
5.	During the past 12 months, how many different sports or physical activity classes or lessons has your child participated in outside of school?	☐0	☐1	☐2	☐3	☐4	☐5

SECTION C

Do you have the following rules for your child? (*Please check ONE answer for each rule.)*

		Yes	No	Sometimes
1.	Do not play outside the house without permission	☐1	☐0	☐2
2.	Stay close to the house	☐1	☐0	☐2
3.	Stay within sight of mom or dad	☐1	☐0	☐2
4.	Do not go into the street	☐1	☐0	☐2
5.	Do not play outside the house alone	☐1	☐0	☐2
6.	Stay within the neighborhood	☐1	☐0	☐2
7.	Wear a helmet (when biking, skateboarding, etc.)	☐1	☐0	☐2
8.	Wear protective clothing (like knee pads when biking, skateboarding, etc.)	☐1	☐0	☐2

SECTION D

During a typical week, on how many days do **YOU**...
(Please check ONE box for each question.)

		Never	1-2 days	3-4 days	5-6 days	Every day
1.	Watch your child participate in physical activity or play sports?	☐0	☐1	☐2	☐3	☐4
2.	Encourage your child to do physical activity or play sports?	☐0	☐1	☐2	☐3	☐4
3.	Provide transportation so your child can go to a place where he or she can do physical activity or play sports?	☐0	☐1	☐2	☐3	☐4
4.	Do a physical activity or play sports with your child?	☐0	☐1	☐2	☐3	☐4
5.	Encourage your child to spend less time being inactive?	☐0	☐1	☐2	☐3	☐4
6.	Help your child to think of ways to reduce the time he or she spends on inactive habits?	☐0	☐1	☐2	☐3	☐4
7.	Tell your child that he or she is doing a good job reducing inactive habits?	☐0	☐1	☐2	☐3	☐4

8. Does your child's **other** parent live in the same household (father or mother)?

☐0 No if no, please skip to **Section E**.

☐1 Yes if yes, please complete this next section.

During a typical week, on how many days does the **other parent**...

(Please check ONE box for each question.)

		Never	1-2 days	3-4 days	5-6 days	Every day
1.	Watch your child participate in physical activity or play sports?	☐0	☐1	☐2	☐3	☐4
2.	Encourage your child to do physical activity or play sports?	☐0	☐1	☐2	☐3	☐4
3.	Provide transportation so your child can go to a place where he or she can do physical activity or play sports?	☐0	☐1	☐2	☐3	☐4
4.	Do a physical activity or play sports with your child?	☐0	☐1	☐2	☐3	☐4
5.	Encourage your child to spend less time being inactive?	☐0	☐1	☐2	☐3	☐4
6.	Help your child to think of ways to reduce the time he or she spends on inactive habits?	☐0	☐1	☐2	☐3	☐4
7.	Tell your child that he or she is doing a good job reducing inactive habits?	☐0	☐1	☐2	☐3	☐4

SECTION E

Please indicate if the following items are available in your home, yard, or apartment complex, and if so, whether **your child** uses each item.

		Not available	Available but never use	Available and use
1.	Bike, tricycle, kiddy car, or big wheel	☐0	☐1	☐2
2.	Basketball hoop	☐0	☐1	☐2
3.	Sports equipment (like balls, racquets, bats, sticks, frisbees)	☐0	☐1	☐2
4.	Roller skates, roller blades, skateboard, scooter	☐0	☐1	☐2
5.	Loose play equipment (like jump rope, hula hoop, pogo stick, bean bags)	☐0	☐1	☐2
6.	Fixed play equipment (like swing set, play house, jungle gym, trampoline, slide)	☐0	☐1	☐2
7.	Water equipment (like canoe, row boat, kayak, surf board, boogie board, windsurf board, water skis)	☐0	☐1	☐2
8.	Swimming pool	☐0	☐1	☐2

SECTION F

Think about the activities shown in the pictures below. Please indicate with a 'check mark' your opinion about which gender each activity is for.

		A lot more for boys	A little more for boys	Equally for boys and girls	A little more for girls	A lot more for girls
1.	 Dancing	☐2	☐1	☐0	☐1	☐2
2.	 Baseball	☐2	☐1	☐0	☐1	☐2
3.	 Bowling	☐2	☐1	☐0	☐1	☐2
4.	 Soccer	☐2	☐1	☐0	☐1	☐2
5.	 Bicycling	☐2	☐1	☐0	☐1	☐2
6.	 Cheerleading	☐2	☐1	☐0	☐1	☐2

7.	 Boxing/Martial Arts	☐2	☐1	☐0	☐1	☐2
8.	 Volleyball	☐2	☐1	☐0	☐1	☐2
9.	 Swimming	☐2	☐1	☐0	☐1	☐2
10.	 Softball	☐2	☐1	☐0	☐1	☐2
11.	 Basketball	☐2	☐1	☐0	☐1	☐2
12.	 Swings	☐2	☐1	☐0	☐1	☐2

SECTION G

Please read each statement and answer 'yes' or 'no' to each.

		Yes	No	Sometimes
1.	I enjoy exercise and physical activity	☐1	☐0	☐2
2.	I often organize family outings that involve physical activity (e.g., going for a walk or a bike ride, going ice skating).	☐1	☐0	☐2
3.	I enroll my child in sports and other physical activities (e.g. dance, hiking club).	☐1	☐0	☐2
4.	I exercise or am physically active on a regular basis.	☐1	☐0	☐2
5.	I drive my child to sporting events such as practices, games or meets.	☐1	☐0	☐2
6.	I often watch my child perform in sporting events (e.g., watch your child perform at a dance recital or a swim meet).	☐1	☐0	☐2
7.	I use my behavior to encourage my child to be physically active.	☐1	☐0	☐2

SECTION H

These questions are about <u>your child's enjoyment of physical activity</u>. Please read each statement and use a 'check mark' to indicate whether you agree or disagree with each statement.

	When my child does physical activity, he/she…	Yes	No
1.	Enjoys it	☐1	☐0
2.	Feels bored	☐1	☐0
3.	Dislikes it	☐1	☐0
4.	Finds it pleasurable	☐1	☐0
5.	Feels that it's not fun at all	☐1	☐0
6.	Feels that it's very exiting	☐1	☐0

SECTION I

These questions are about **your <u>childhood</u> physical activity**. Please read each statement and indicate 'yes' or 'no' to each statement.

		Yes	No
1.	When I was a child, I participated in many sports.	☐1	☐0
2.	When I was a child, I won many sport awards such as medals and trophies.	☐1	☐0
3.	When I was a child, I liked to play many active games such as hide and go seek, bicycling, soccer, etc.	☐1	☐0
4.	When I was a child, I was the most athletic person of my friends.	☐1	☐0

SECTION J

The following section is about your child's ability to play sports. Please read each statement and pick the answer choice that best describes your opinion.

		Not at all good	Not so good	Neither good or bad	Somewhat Good	Very good
1.	In general, how good is your child in sports?	☐1	☐2	☐3	☐4	☐5
		Not at all well	Not so well	Neither well or poor	Somewhat Well	Very well
2.	How well is your child doing in sports this year? Check here if he/she did not play sports this year ☐7	☐1	☐2	☐3	☐4	☐5

SECTION K

Please read the following questions and put a check next to the answer that best reflects your opinion.

		Females much better	Females somewhat better	Equal for females & males	Males somewhat better	Males much better
1.	In general, how would you compare the athletic ability of males and females?	☐1	☐2	☐3	☐4	☐5
		More important for females	Somewhat more important for females	Equally important for female & males	A little more important for males	More important for males
2.	In your opinion, is it more important for females or males to do well in sports?	☐1	☐2	☐3	☐4	☐5
		More useful for females	A little more useful for females	Equally useful for female & males	A little more useful for males	More useful for males
3.	In general, how would you compare the usefulness of athletic ability for males and females	☐1	☐2	☐3	☐4	☐5

SECTION L

Please read each statement and pick the answer choice that best reflects your opinion for each.

		Very much	A lot	Somewhat	Not much	Not at all
1.	How important is it to you that your child be good in sports?	☐1	☐2	☐3	☐4	☐5
2.	How important is it to you that your child plays sports?	☐1	☐2	☐3	☐4	☐5
3.	In the past year, how much do YOU play sports?	☐1	☐2	☐3	☐4	☐5
4.	In the past year, how much do YOU play sport with your child?	☐1	☐2	☐3	☐4	☐5

SECTION M

Please read each statement and pick the answer choice that best reflects your opinion for each.

		Strongly Disagree	Disagree	Agree	Strongly Agree
1.	The husband should be regarded as the legal representative of the family group in all matters of law	☐1	☐2	☐3	☐4
2.	A woman should have exactly the same freedom of action as a man.	☐1	☐2	☐3	☐4
3.	A woman is not truly fulfilled until she has been a mother.	☐1	☐2	☐3	☐4
4.	A married woman should feel free to have men as friends.	☐1	☐2	☐3	☐4
5.	Woman's work and man's work should not be fundamentally different in nature.	☐1	☐2	☐3	☐4
6.	When a man and a woman live together, she should do the housework and he should do the heavier chores.	☐1	☐2	☐3	☐4

SECTION N

Please read each statement and indicate 'yes' or 'no' to each one.

		Yes	No
1.	In the last year, my child has told me that he/she was criticized or made fun of when he/she participated in physical activities?	☐1	☐2
2.	In the last year, my child has told me that he/she was criticized or made fun of for being 'too heavy or fat' when he/she participated in physical activities?	☐1	☐2

SECTION O

From the list below, please indicate whether or not your child is expected to do each household chore.

		Yes	No
1.	Wash the dishes	☐1	☐0
2.	Dry the dishes and put them away	☐1	☐0
3.	Vacuum or weep the floors	☐1	☐0
4.	Take out the trash	☐1	☐0
5.	Clean the yard (if you don't have a yard check here ☐7)	☐1	☐0
6.	Walk the dog (if you don't have a dog check here ☐7)	☐1	☐0
7.	Help prepare food	☐1	☐0
8.	Clean the table after dinner	☐1	☐0
9.	Make his/her bed	☐1	☐0
10.	Help do the laundry	☐1	☐0
11.	Clean his/her bedroom	☐1	☐0

SECTION P

Please answer how much you agree or disagree with each statement.

		Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
1.	In general, I encourage my child to make his/her own decision.	☐1	☐2	☐3	☐4
2.	I am very protective with my child.	☐1	☐2	☐3	☐4
3.	I allow my child to play outside the house with their friends.	☐1	☐2	☐3	☐4
4.	I must always supervise my child when he/she is playing outside the house.	☐1	☐2	☐3	☐4
5.	I allow my child to play inside the house.	☐1	☐2	☐3	☐4
6.	My child must be very quiet when he/she plays inside the house.	☐1	☐2	☐3	☐4

SECTION Q

For the following question, please answer how much you agree or disagree with each statement.

		Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree
1.	In general, my child prefers to sit and watch television rather than play active games.	☐1	☐2	☐3	☐4
2.	In general, my child prefers to play with dolls or action figures, rather than active play.	☐1	☐2	☐3	☐4
3.	My child's friends are very physically active.	☐1	☐2	☐3	☐4
4.	My child's friends like to play outside.	☐1	☐2	☐3	☐4
5.	My child likes to play with his/her siblings. *If your child does not have any siblings check here* ☐7	☐1	☐2	☐3	☐4
6.	My child would rather play alone than with friends.	☐1	☐2	☐3	☐4
7.	My child would rather play alone than with his/her siblings. *If your child does not have any siblings check here* ☐7	☐1	☐2	☐3	☐4

SECTION R

Think about the activities and sports your child **likes** to do. How **easy or difficult** is it for your child to participate in the activities he/she likes to do in the following places?...

		Very Difficult	Somewhat Difficult	Somewhat Easy	Very Easy
1.	At school	☐1	☐2	☐3	☐4
2.	At the park	☐1	☐2	☐3	☐4
3.	At the recreation center	☐1	☐2	☐3	☐4
4.	In your community	☐1	☐2	☐3	☐4

Think about the activities and sports your child **likes** to do. How **many opportunities** are there for your child to participate in the activities he/she likes to do in the following places?...

		There are NO opportunities	There are FEW opportunities	There are MANY opportunities
1.	At school	☐1	☐2	☐3
2.	At the park	☐1	☐2	☐3
3.	At the recreation center	☐1	☐2	☐3
4.	In your community	☐1	☐2	☐3

SECTION S

Please write down the top 3 television shows or programs that your child likes to watch.
In order of preference.
1. _____
2. _____
3. _____

SECTION T

Did your child receive any toys as holiday gifts?

☐$_1$ Yes If yes, please complete the next question.
☐$_0$ No If no, then stop here.

Please write down 3 toys that your child receive during the previous holiday season. Please be specific or write the type of toy.

1. _____
2. _____
3. _____

END OF SURVEY
Thank You!

For office Use Only:
Participant
ID:_____

ACTIVITY METER DIARY

Dates to be worn: From: ___/___/___ To: ___/___/___

mm dd yyyy mm dd yyyy

Directions for parents:

In the diary below, please write the time your child puts on the activity meter and the time he/she takes it off each day. If your child does not wear the activity meter or takes it off, please write down the reason why he/she took it off in the **comments** section for that day.

Here is an Example of how to fill it out

DAY	TIME ON	TIME OFF	Comments
1	7am	8:15pm	He took it off for 1 hour to take a bath
2	6:30am	7:45pm	He took it off for 1 hour to swim in the pool

ACTIVITY DIARY			
DAY	TIME ON	TIME OFF	Comments
1			
2			
3			
4			
5			
6			
7			

Summary table of age-specific cutpoints for accelerometer counts.				
	Sedentary	Moderate	Vigorous	Very Vigorous
Age		4.5 MET	6 MET	9 MET
5.2	100	1696	2848	5151
5.3	100	1708	2863	5173
5.4	100	1720	2879	5196
5.5	100	1732	2894	5218
5.6	100	1744	2909	5240
5.7	100	1756	2925	5263
5.8	100	1768	2941	5285
5.9	100	1781	2956	5308
6.0	100	1793	2972	5331
6.1	100	1806	2988	5354
6.2	100	1818	3004	5377
6.3	100	1830	3021	5400
6.4	100	1843	3037	5424
6.5	100	1856	3053	5447
6.6	100	1869	3069	5471
6.7	100	1882	3086	5495
6.8	100	1895	3103	5519
6.9	100	1908	3120	5543
7.0	100	1921	3136	5568
7.1	100	1934	3154	5592
7.2	100	1947	3171	5617
7.3	100	1961	3188	5641
7.4	100	1974	3205	5666
7.5	100	1988	3222	5691
7.6	100	2001	3240	5717
7.7	100	2015	3257	5742
7.8	100	2029	3275	5768
7.9	100	2043	3293	5793
8.0	100	2057	3311	5819
8.1	100	2070	3328	5845
8.2	100	2084	3347	5871
8.3	100	2099	3365	5897
8.4	100	2113	3383	5924
8.5	100	2128	3402	5951
8.6	100	2142	3420	5977
8.7	100	2157	3439	6005
8.8	100	2171	3458	6032
8.9	100	2186	3477	6059
9.0	100	2201	3496	6087
9.1	100	2216	3516	6115
9.2	100	2231	3535	6143

9.3	100	2246	3554	6171
9.4	100	2261	3574	6199
9.5	100	2275	3594	6228
9.6	100	2292	3614	6256
9.7	100	2308	3634	6285

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