The association between parent and child variables and physical activity and sedentary behaviors in Puerto Rican children

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THE ASSOCIATION BETWEEN PARENT AND CHILD VARIABLES
AND PHYSICAL ACTIVITY ANDSEDENTARY BEHAVIORS
IN PUERTO RICAN CHILDREN

by

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DEDICATION

This dissertation is dedicated in memory of my grandfather, Mariano Muñoz Santini, who raised me and showed me the path that leads to education and how to be a better person.

I also dedicate this work to the person who has been by my side all these years, and in a way also has earned this degree. Ivys Fernandez Pastrana, thank you.
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Studies with diverse populations including Caucasians, African-Americans, Asians, and Latinos have contributed important information about factors that may contribute to childhood obesity. However, the studies on Latino children have not examined how specific child and parent factors may be related to physical activity (PA) or sedentary behaviors (SB). Research investigations into these correlates or possible determinants of PA and SB in Latino children have only included children from Mexican American backgrounds.

This dissertation consists of two studies designed to address the gaps in knowledge about these factors and their interaction with PA and SB in a specific group of Latino children. Data were obtained by direct evaluation of 75 children and their parents living on the Island of Puerto Rico. Objective measures, via accelerometry, were used to assess PA and SB, and questionnaires were used to obtain parental perceptions and beliefs about PA and SB. Child’s body composition was measured and used as a fitness component, along with a motor proficiency battery. Study 1 examined the relation between children’s fitness levels and level of motor skills, parental beliefs and
perceptions of health status and children’s PA and SB. Results showed that time spent in
SB and moderate to vigorous intensity PA (MVPA) was associated with parents’
intentions of reducing TV time and their perception of their child’s body weight. Study 2
undertook a more specific analysis of the mechanism(s) of these associations, specifically
attempting to understand the possible moderation effect of certain constructs on the
association between predictors of PA and SB. Results indicated that the strength of age as
a predictor of MVPA and SB levels of Latino children may be moderated by the parent’s
perception of influence, which in itself may be influenced by the parent’s level of
education. Parental perceptions and intentions are modifiable factors, which suggests that
working with the family is an important area to explore in future interventions to reduce
obesity risk in this population.
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LIST OF ABBREVIATIONS

MVPA ................................................................................................. Moderate-to-vigorous physical activity
PA .............................................................................................................. Physical Activity
SB........................................................................................................ Sedentary behaviors
SES....................................................................................................... Socio economic status
INTRODUCTION

In the last two decades, obesity has arguably become the primary childhood health problem in developed nations and, to some degree, in other parts of the world (Blanck & Collins, 2015; Ebbeling, Pawlak, & Ludwig, 2002). As reported in years past (Centers for Disease Control and Prevention (CDC, 2007), and more recently (Ogden & Freedman, 2012; Ogden, Carroll, Kit, & Flegal, 2012), the prevalence of obesity continues to be a health concern for adults, children, and adolescents in the United States. Overweight and obesity have been considered independent risk factors for increased morbidity and mortality throughout the life cycle, and obesity-associated chronic disease risk factors are present in adults and also in overweight and obese children (Deckelbaum & Williams, 2001). The Bogalusa Heart Study was the first source demonstrating a link between childhood obesity and disease. The study showed that 60% of overweight 5- to 10-year-old children had at least one cardiovascular risk factor, such as high blood pressure, hyperlipidemia, or elevated insulin levels (Freedman, Dietz, Srinivasan, & Berenson, 1999; Sabin, Kao, Juonala, Baur, & Wake, 2015).

Defining Obesity

According to the CDC (2010), adult obesity is defined by a body mass index (BMI) greater than 30 (BMI ≥ 30), and in children, by a BMI at or above the age- and gender-specific 95th percentile cutoff points. For children and teens, BMI age- and sex-specific percentiles are used for two reasons: (a) the amount of body fat changes with
age, and (b) the amount of body fat differs between girls and boys. The CDC BMI-for-age growth charts account for these differences and allow for translation of a BMI number into a percentile for a child’s sex and age (Centers for Disease Control and Prevention, 2007).

**Increasing Prevalence of Childhood Obesity**

Trends in childhood obesity, using the sex- and age-specific BMI ≥ 95th percentile based on the CDC growth charts, show that from between 1976–1980 to 2007–2008, the prevalence of obesity increased from 6.5% to 19.6% among those aged 6 to 11; and for those aged 12 to 19, the prevalence increased from 5.0% to 18.1% during the same period (Ogden, Carroll, & Curtin, 2010c). More recently, the CDC (2011) has reported that in the United States, childhood obesity affects approximately 12.5 million children and teens.

**Obesity and Hispanic Children**

Different reports have shown that in the United States, the prevalence of obesity in children has increased more than twice as fast among minority groups compared to white groups (Ebbeling et al., 2002; Ogden, Carroll, & Curtin, 2010c). There is evidence that certain ethnic minority populations, children in families of low socioeconomic status (SES), and children in the country’s southern region tend to have higher rates of obesity than the rest of the population (Hanson & Chen, 2007; Tandon et al., 2014). Data from the CDC report on the trends in obesity from the 2005–2008 National Health and
Nutrition Examination Survey (NHANES) (Ogden, Lamb, Carroll, & Flegal, 2010a) showed that there are significant racial and ethnic disparities in obesity prevalence among U.S. children and adolescents. The prevalence of obesity increased between 1988–1994 and 2007–2008 among boys aged 12 to 19 by race and ethnicity. Specifically, among adolescent boys aged 12 to 19, Mexican American boys experienced the largest increase in the prevalence of obesity (from 14.1% to 26.8%) compared to the increases among non-Hispanic white boys (from 11.6% to 16.7%) and non-Hispanic black boys (from 10.7% to 19.8%). Prevalence of obesity also increased between 1988–1994 and 2007–2008 among girls aged 12 to 19 by race and ethnicity. Among adolescents aged 12 to 19, non-Hispanic black girls experienced the largest increase in the prevalence of obesity, from 16.3% to 29.2%. Mexican American girls, experienced the second-largest increase, from 13.4% to 17.4%. Lastly, non-Hispanic white girls experienced an increase in obesity from 8.9% to 14.5%. It is clear that there are differences in the trend and prevalence of obesity for this age group for both genders, and that minority groups have experienced greater increases in the prevalence of obesity. Another report by the same group of investigators (Ogden, Lamb, Carroll, & Flegal, 2010b) identified prevalence increases for younger populations. For children aged 6 to 11, the years 1963–2008 saw prevalence increase from 4.2% to 19.6%; these data are for both genders, with race and ethnicity together.

The data confirm findings from another report that used a different survey to acquire the data. Lutfiyaa and colleagues (2008) used data from the National Survey of Children’s Health (NSCH) to report that among minority groups, the number of children
in the overweight to obese categories according to BMI as higher than in from the non-Hispanic white population. The authors reported that for school-aged children of both genders and aged 5 to 18, 49.2% of the African American children and 44% of Hispanic children were overweight (BMI = 85th to < 95th) or obese (BMI ≥ 95th), while only 32.2% of non-Hispanic white children appeared in those categories. Both of these studies (Lutfiyya, Garcia, Dankwa, Young, & Lipsky, 2008; Ogden, Lamb, Carroll, & Flegal, 2010b) use data from surveys to calculate BMI levels of children. Interestingly, a study involving children living in a rural area of Puerto Rico (Rivera-Soto & Rodríguez-Figueroa, 2012), in which BMI was calculated by a trained evaluator using standardized equipment to measure height and weight, reported that children aged 6 to 11 had a high prevalence of obesity, at 26.8%. This is higher than the 19% obesity prevalence among all Hispanic children of the same age group in the United States, as reported by Ogden (2010). Overall, these reports have shown a consistent difference in the prevalence of obesity between Hispanic and non-Hispanic children.

**Contributing Factors to Obesity**

Ethnicity is the end result of biology, history, cultural orientation and practice, language, religion, and lifestyle, all of which can affect health (Pearce, Foliaki, Sporle, & Cunningham, 2004). Variations in these factors across groups make it likely that ethnicity could be associated with certain types of PA depending of the group of interest. For example, depending on the cultural orientation of the family a child may relate to
physical activity only as a form of earning a living and not necessarily as a recreational activity (Malina, 2008).

Researchers have reported that moderate to vigorous PA is lower in Latino girls than non-Latino black and white children (Gordon-Larsen, Adair, & Popkin, 2002). However a review of the correlates of PA and SB published in 2007 found that ethnicity was not correlated with PA levels and SB in children (Van Der Horst, Paw, Twisk, & van Mechelen, 2007). When looking at gender, Latino ethnicity, and overweight status together, these three factors had a significant association with PA levels. Specifically, Latino ethnicity was found to be associated with total PA as Latino children tended to report less PA than non-Latino children (Byrd-Williams, Kelly, Davis, Spruijt-Metz, & Goran, 2007). Differences in PA by gender have been explained from a cultural perspective, as in most Latin countries PA is not encourage in women (Pichon et al., 2007).

Related to ethnicity are cultural factors, beliefs and perceptions adopted from family values. Parental perceptions of their children’s weight status, participation in PA and time spent in SB have been identified as potential factors affecting PA participation and contributing to increases in childhood obesity (Adamo et al., 2010; Kaushal & Rhodes, 2014; Trost et al., 2003). Thus, increasing parental support for PA could be a means to increase children’s participation in PA, for example by parents increasing their active engagement in watching their child participate and by positively reinforcing their child’s participation in PA (Trost et al., 2003). Parental beliefs and knowledge of the benefits of increased PA levels could also be factors for clinicians and practitioners to
consider when designing intervention programs to promote PA and decrease SB (Pocock, Trivedi, Wills, & Bunn, 2010; Rivera-Soto & Rodríguez-Figueroa, 2012). Family factors have been reported to be associated with family members’ fitness levels (Kimiecik, & Thorn, 2012).

Health-related fitness refers to those fitness components that are related to health and measurement of these components can provide an understanding of the health risks of the child. They include: cardiorespiratory fitness, muscular strength, muscular endurance, body composition and flexibility. Skills-related fitness is the combination of components related to task performance, which include: agility, balance, coordination, speed, power, and reaction time (Cooper et al., 2010). Studies of health-related fitness and its association with PA and SB in Latino children generally have examined only one component of fitness, specifically cardiorespiratory fitness, using only Mexican American children (Cooper, 2010). It has been found that Latino children from Mexican American background do not reach average levels of cardiorespiratory fitness when tested on this component of health related fitness.

Along with ethnic variation and fitness, participation in physical activities by children is positively associated with other factors that have not been as thoroughly investigated including the level of motor skills affecting performance during certain tasks. Researchers using different methodologies have investigated the relationship between motor skills and PA in children, with studies reporting an association between low motor skills performance and low levels of participation in PA (Castelli, 2007; Erwin, Woods, Woodard, & Castelli, 2007; Faught et al., 2008; Okely, Booth, &
Patterson, 2001; Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006)

Research investigations into these correlates or possible determinants of PA and SB in Latino children have only included children from Mexican American backgrounds, and have attempted to generalize their results to all Latino populations without considering the cultural differences that may be associated with different countries of origin (Gordon-Larsen, Harris, Ward, & Popkin, 2003).

Better understanding the causes of childhood obesity can provide the opportunity to focus resources, interventions, and research in directions that would be most beneficial in addressing the problem. The purpose of this dissertation is to provide more information on factors that may be related to obesity in Latino children. Specifically, this research examined correlates of PA participation and/or the amount of time spent in SB. Identification of variables related to PA and SB in this population will enable the development of targeted interventions to enhance PA and decrease SB time.

To achieve this purpose, two studies were completed. The first study explored the associations among several components of fitness, parental perceptions of health and weight status, motor proficiency, and time spent on moderate-to-vigorous PA (MVPA) and on SB in children living in the island of Puerto Rico (PR). The second study was designed to identify predictors of MVPA and SB, including the search for possible moderators of the relationship between predictor(s), MVPA and SB. The aim of both studies was to contribute to the expanding body of knowledge on factors related to PA and SB participation in Latino children and specific underrepresented population, in order to guide future intervention programs.
References


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Exercise, 33(11), 1899–1904.


I. FITNESS AND FAMILY BEHAVIORS ASSOCIATED WITH PHYSICAL ACTIVITY AND SEDENTARY TIME IN LATINO CHILDREN LIVING IN PUERTO RICO.

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Abstract

**PURPOSE:** The purpose of this study was to examine associations among several factors that could affect physical activity (PA) and sedentary behaviors (SB) in children, including parental perceptions of weight status of their children and intentions of changing health behaviors. Associations with accelerometry measured time spent in SB and moderate-to-vigorous PA (MVPA) in Puerto Rican children living on the Island were calculated.

**METHODS:** Seventy-three children (age, 8.92 ± 1.28 yrs; BMI 33.05 ± 10.37 kg m\(^2\)) wore an ActiGraph GT3X accelerometer on their right hip for seven days. Time spent in SB and MVPA were estimated using the Crouter child vector magnitude two-regression model (VM\(^2\)RM). Parents of each child completed two assessments: 1) using age-related sketches of body type, a body image was selected that most accurately resembles the body type of their child (higher sketch number equals higher body weight; range, 1 to 7) ; 2) Survey questions about their intentions to modify family health behaviors related to diet, PA, and TV viewing in their household (possible responses: *I already do this, I will try, and I will not try*; scored 1-3, with 1 being the most likely to change). Children completed a motor proficiency test and a muscle strength and endurance test. Partial correlations, controlling for age, gender, body weight, body height and accelerometer wear were used to examine associations between parent perceptions’ of child’s body weight, parents’ intentions of reducing TV times, motor proficiency scores and muscle fitness scores, and time spent in SB and MVPA.
**RESULTS:** Mean scores for the parental visual report of child’s body weight and response to reducing TV time were 3.4 ± 1.5 and 2.1 ± 1.0, respectively for boys and 2.4 ± 1.0 and 2.7 ± 0.8, respectively for girls. Mean daily values for time spent in SB and MVPA were 239.3 ± 74.6 and 126.4 ± 40.7, minutes respectively for boys and 296.2±128.4 and 85.7±42.3, minutes respectively for girls. Parental perception of child’s body weight was significantly associated with time spent in SB (r = 0.36, p = 0.03) and MVPA (r = -0.35, p = 0.04). Parental reports that they are already limiting their child’s daily TV time to 2 hours per day were significantly associated with child’s time spent in MVPA (r = 0.27, p = 0.03). No other variable was associated with either PA or SB.

**CONCLUSIONS:** Time spent in SB and MVPA for Puerto Rican children was associated with their parents’ intentions of reducing TV time and their perception of their child’s body weight. These are modifiable factors related to parental perceptions and intentions, suggesting that working with the family is an important area to explore in future interventions.
Introduction

The rise in childhood obesity is due to complex interactions across a number of relevant biological, social, environmental, and policy determinants that influence eating behaviors, sedentary behaviors (SB) and physical activity participation (PA). These determinants and their interactions include age, gender, nutrition practices, child activity levels, genetic and metabolic factors, socioeconomic factors, behavioral factors, and family factors (Byrd-Williams, Kelly, Davis, Spruijt-Metz, & Goran, 2007; Kaushal & Rhodes, 2014; L. R. Larsen, Kristensen, Junge, Rexen, & Wedderkopp, 2014; Lutfiyya, Garcia, Dankwa, Young, & Lipsky, 2008). Improved understanding of how these factors relate to participation in PA and/or amount of time spent in SB would help to focus resources, interventions, and research in directions that would be most beneficial in addressing the problem of childhood obesity.

One focus of current investigations of the possible mechanisms of obesity in children has been the association between PA, defined as engagement in bodily movements that result in energy expenditure, and fitness levels. Results suggest that a lower level of daily energy expenditure without a parallel decrease in total energy consumption may be one of the underlying factors contributing to the increase in childhood obesity (Lifshitz, 2008). Some of this research has also examined these factors (e.g. PA, SB, Nutrition) in children of different ethnic groups (Butte, Puyau, & Adolph, 2007; Simons-Morton et al., 1997) and has found differences in the degree of decrease in daily energy expenditure among groups. For example differences have been found in obesity rates, PA participation, and involvement in SB among groups from different
ethnic backgrounds, such as Latinos, Black/African American and non Hispanic Whites (Butte et al., 2007). As reported by Gordon-Larsen and her group (2002), Latino children demonstrated less variation in PA intensity (moderate to vigorous) in exercise sessions per week than their non-Latino counterparts across a one year period of PA monitoring. These findings suggest that Latino children consistently maintain lower intensity levels of PA than their non-Hispanic white, non-Hispanic black, and Asian peers. It has been suggested that less variation in the intensity levels of PA and/or exercise could limit the potential benefits to health from regular PA, such as reducing body fatness (Abbott & Davies, 2004). It has been argued that manipulation of intensities of exercise/PA provide more reduction of visceral fat than interventions with a steady PA routine (Gutin et al., 2002).

Studies with diverse populations, including non Hispanic Whites, Black/African-American, Asians, and Latinos, including Latino sub-groups such as Mexican, Puerto Rican and Dominican, have contributed important information about some factors that may contribute to childhood obesity (Goran, 2008; Vangeepuram, Mervish, Galvez, Brenner, & Wolff, 2012). Study of additional factors such as parental perceptions of weight status and health knowledge, children’s fitness levels, and levels of motor skills, and their association with PA and SB, could provide additional valuable information on how to manage the childhood obesity problem. For example, PA and sport competence perceptions are also related to the child’s level of mastery of motor skills such as throwing and catching a ball (Cairney et al., 2005; Lifshitz, 2008), which in turn may
contribute to their willingness to engage in PA. However research investigating the mediators of participation in PA and correlates of PA often has not included motor proficiency as one of the constructs investigated (Baranowski, Anderson, & Carmack, 1998; Sallis, Prochaska, & Taylor, 2000; Sollerhed, Apitzsch, Råstam, & Ejlertsson, 2008). Motor proficiency can influence PA by influencing the child’s perceptions of competence (Crane, Naylor, Cook, & Temple, 2014). Studies that have examined motor proficiency have reported an association between poor motor competence and lack of participation in PA (Silman, Cairney, Hay, Klentrou, & Faught, 2011). Parental perceptions of their children’s weight status, participation in PA and time spent in SB have also been identified as potential factors affecting PA participation, resulting in increases in childhood obesity (Adamo et al., 2010; Kaushal & Rhodes, 2014; Trost et al., 2003). It seems that increasing parental support for PA could be a means to increase in participation of children in PA, for example by parents increasing their active participation in watching their child participate and by positively reinforcing their child’s participation in PA (Trost et al., 2003). Furthermore, parental beliefs and knowledge of the benefits of increased PA levels could also be factors for clinicians and practitioners to consider when designing intervention programs to promote PA and decrease SB. (Rivera-Soto & Rodriguez-Figueroa, 2012) (Pocock, Trivedi, Wills, & Bunn, 2010)

In the majority of the studies just reviewed, the methods used to measure PA were subjective, such as questionnaires either completed by parents or children, child recall and parental interviews (Erwin, Woods, Woodard, & Castelli, 2007; Faught et al., 2008; Hands & Larkin, 2002; Hands & Parker, 2003; Okely, Booth, & Patterson, 2001). Only
two studies (Fisher et al., 2005; Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006) used objective measures of PA. Measurements of PA by questionnaires, recalls, or surveys should be used with caution with children under 12 years old because their memories may not be accurate (Hands, Larkin, Parker, Straker, & Perry, 2008).

Although there is a substantial literature describing trends, prevalence and possible factors associated with obesity in Latino children, most of these reports share a significant limitation; that is, most have treated Latinos as a homogeneous population with little distinction among Latino sub-groups (Umaña-Taylor & Fine, 2001). This limitation applies to studies of fitness, nutrition, PA and SB levels in Latino children. Applying results from studies that group Latino children into a single ethnic group without taking into account the cultural background of their ethnic origins raises concerns about the validity of the findings for groups that were not represented (Umaña-Taylor & Fine, 2001). For example diversity among the Latino population has been shown to affect the reliability and validity of instruments used to assess psychological constructs (Umana-Taylor, Gonzales-Backen, & Guimond, 2009). An examination of specific subgroups of Latino children, such as children from the Caribbean and/or of Caribbean background, would help practitioners and clinicians better understand the specific needs of individual populations when designing intervention programs.

Grouping Latinos into a single group not only affects methodology and reliability values when conducting research on this population. It also has been suggested that children’s sedentary behaviors vary depending on maternal country of origin, and with each country culturally oriented beliefs toward PA and SB. For example TV viewing time
varied between children of mothers from Mexico and Puerto Rico, with children of low-income Puerto Rican mothers watching more TV daily on average than children of Mexican descent (Thompson, Matson, & Ellen, 2013).

To date, no study has examined the relation among factors that may be associated with objective measures of PA and SB in Latino children who are United States citizens and are living outside the continental United States. As a first step toward studying Latino groups separately, in this study, we tested children living in Puerto Rico to examine the association of family, fitness and motor proficiency factors with objectively measured PA and SB levels.

Data from the Puerto Rican population living on the island is used to develop health programs and to assign funding by the federal government, but most of these data come from surveys such as population census. Minimal data, especially on PA and SB behaviors in children, is acquired by objective measures. Accordingly, the purpose of this study was to examine associations among parental perceptions of weight and health status of their children, fitness components and motor coordination levels with time spent in moderate-to-vigorous PA and in sedentary behavior measured by accelerometry in Puerto Rican children living on the Island.
Methods

Participants

Participants were recruited from the city of San Juan youth basketball clinic program, from a private elementary/middle school in the city of San Juan, and members of a volleyball program. The first author is affiliated with Puerto Rico’s Physical Education Association and with several state and private universities that provide services to children within their communities. Participants were recruited from two of those programs and from a private school where the first author was allowed to distribute advertisement and recruitment information to parents. A flyer explaining the purpose of the study and what it involved was distributed to the parents of children during the first week of the basketball and volleyball programs, and a meeting was arranged at the private school for the PI to inform interested parents about the study.

Participants were between the ages of 7 through 11 years old. This age range was selected in part because data on the prevalence of obesity in children indicates that children in this age group are at high risk of obesity (Ogden, Carroll, & Curtin, 2010). Although the assessment battery for motor skills testing the Movement Assessment Battery for Children – second edition (MABC-2) includes an age range form 6 to 12 years of age, the evaluator for this study was trained for the age ranges from 7 to 11. A total of 75 children participated. The mean age for the sample was 8.92 ± 1.28 years.

Children with any neurological diseases, physical or behavioral problems, special educational needs, intellectual impairments, or any history of learning difficulties (as reported by parents) were excluded from the study. Children receiving any medication
that affects growth or appetite such as steroids or stimulants also were excluded, as were those with severe asthma using inhalers. Children with attention deficit hyperactive disorder (ADHD) who were not taking stimulant medication, as reported by the parents during the screening process, were included in the study. This information was obtained using a pre screening questionnaire completed by the parents.

At least one parent from each household also participated in the study. Parents’ marital status and education characteristics are shown in Table 3. Parents unable to read and/or write were excluded and their children also were not included. In the sample, all parents were able to read and write Spanish and all were Spanish speakers.

The procedures were reviewed and approved by the Boston University Institutional Review Board before the start of the study. The parent of each participant signed a written informed consent and completed a health-screening questionnaire, and each child participant signed a written assent form before participation in the study.

Instruments

All questionnaires, but one, were translated into Spanish by the first author. The Parental Perception of Health and Weight Status Questionnaire (PPHWSQ) was reported in Spanish in the original study from which it was obtained (Eckstein et al., 2006).

*Screening Questionnaire*

The child’s eligibility to participate was assessed by a questionnaire that addressed the inclusion and exclusion criteria described in the Participants section.

*Motor Abilities Questionnaire (MAQ)*

A questionnaire, developed for a previous study (Cermak, Katz, & Weintraub,
2015), was used to obtain parental demographic information along with parental report on their child’s motor coordination and the parent’s perception of its effect on the child’s daily living skills and school function. Respondents answered 12 questions about their child’s fine and gross motor competence and also identified differences with functional skills, such as buttoning shirts, riding a bike or eating with a fork, either in the past or present time during their child’s development. Individual items were used for analysis. An example of the items is a question that asked parents to subjectively rate their child’s gross and fine motor skills in comparison to their age and gender peers on a scale of 1 (much better than others) to 5 (much worse than others).

**Parental Perception of Health and Weight Status Questionnaire (PPHWSQ)**

The PPHWSQ assesses parental perceptions and levels of concern about their child’s weight status, and parental intentions to modify PA, eating and sedentary behaviors at home (Eckstein et al., 2006). It includes six sections and uses two approaches to obtain respondent perceptions regarding the child’s weight status (Table 2). The first approach involves 10 multiple-choice questions, such as “I feel my child is...” with scaled response options: *underweight, a little underweight, about the right weight, a little overweight, or overweight*. The second approach asks the respondent to select, using age-related sketches of body type, the type (Figure 1 and Figure 2) that most accurately resembles the body type of their child. An additional section asks about parental levels of concern regarding the health effects of overweight, their child’s weight status, and their degree of influence on their child’s food choices and physical activity habits. This section of the questionnaire uses eight questions with five Likert-scale response choices: strongly
agree, agree, neutral, disagree, or strongly disagree. Finally, another section used in this study inquires about the intentions of the respondent to modify family health behaviors related to diet, physical activity, and television viewing in their household, with responses including I already do this, I will try, and I will not try. The PPHWSQ is reported to have test re-test agreement of 96.1% on the multiple-choice answers and 91.7% for the pictorial sketches (Eckstein et al., 2006).

**Anthropometric Measures**

We used body mass index (BMI) (kg/m$^2$) to measure body weight status. BMI was calculated from measures of height and weight using age and gender-specific growth charts (Centers for Disease Control and Prevention, 2010). Z-scores were used because the sample included male and female participants who ranged in age from 7 through 11 years and research with children has shown that BMI varies as a function of the child’s age and gender (Centers for Disease Control and Prevention, 2010). Height and weight were measured on a Detecto 437 Eye Level Physician Mechanical Beam Scale accurate to 0.1 cm and to 0.1 kg respectively. Body weight was measured in light clothing without shoes. BMI was calculated from the ratio of the body weight in kilograms and the square of the height measure in meters (kg/m$^2$).

**The Movement Assessment Battery for Children – second edition (MABC-2)**

The MABC-2 is a norm-referenced test designed to identify motor impairments in children 3 to 16 years (Henderson, Sugden, Barnett, & Petermann, 2008). The test includes 8 performance-based items that are administered to each child within three categories: manual dexterity, catching skills, and static and dynamic balance. The
categories within each age group remain the same but items vary with the child’s age (Schoemaker, Niemeijer, Flapper, & Smits-Engelsman, 2012). Scores are reported as total motor impairment scores with scores below the 15th percentile indicating risk for motor impairment. Scores are interpreted in percentiles, with the child's motor functioning rated as ‘having a significant movement difficulty’ (<5%); 'at risk' for having movement difficulty (5-15%); ‘no movement difficulty detected’ (>15%), or as standardized scores depending of the total raw score for each category ranging from 1 to 19. The validity of the first edition of the MABC has been evaluated extensively by comparing the total impairment score to scores from individual skills tests (Van Waelvelde, De Weerdt, De Cock, & Smits-Engelsman, 2004). The validity of the MABC-2 has been reported to meet the standards for validity and reliability for a motor proficiency test (Ellinoudis et al., 2011). The MABC-2 was administered using the original manual and forms in English and the first author of the study, who is bilingual, translated at the moment of administering the test.

Fitness Components

In order to assess abdominal strength and endurance the curl-up test from the FITNESSGRAM® was used, which measures the number of curl-ups completed in a one minute period. Previously, this test was shown to have high levels of reliability (87% of agreement between tests) when administered by an expert (Morrow, Martin, & Jackson, 2010).

Body composition was measured using a skinfold measurement to the closest millimeter (mm) at 2 sites (triceps and sub scapular) with a calibrated Lange caliper. The
methods for skinfold measurement have been reported in detail elsewhere (Norgan, 1988). A variable named average skinfold (AVg skin) was created from the sums of the triceps and subscapular skinfold measurement.

*Physical Activity and Sedentary Behavior Times*

Time spent in physical activity and in sedentary behavior was measured using an ActiGraph GT3X accelerometer. The accelerometer is a small (3.8 x 3.7 x 1.8 cm), lightweight (27 grams), water resistant tri-axial accelerometer. The GT3X measures accelerations in the range of 0.05 to 2 G’s, which are digitized by a 12-bit analog-to-digital converter at a rate of 30 Hz. Once digitized, the data are filtered using a band-limited frequency of 0.25 to 2.5 Hz. These values correspond to the range in which most human activities are performed.

The ActiGraph GT3X was worn for seven consecutive days, of which at least two should be weekend days. The accelerometer was worn at waist level at the right anterior axillary line attached to a nylon belt. The GT3X was initialized using 1-second epochs and the low frequency extension was turned on. The primary output variable from the accelerometer device was average time in minutes per day in sedentary activity across all days (SB) and average time in minutes per day in moderate-to-vigorous PA across all days (MVPA).
Procedures

After meeting with parents at the evaluation site, a screening form was collected and reviewed. Parents of participants who met the criteria were given a package that included a consent form, assent form, the parental perception of health and weight questionnaire (PPHWSQ) and the motor abilities questionnaire (MAQ). After signing the consent and assent forms the families proceeded to answer the PPHWSQ and the MAQ.

Measurements were conducted over a two day period. The first day of testing consisted of anthropometric measurements, abdominal strength and endurance (one minute curl-up fitness test) and digitalization of the activity monitor with the participant’s anthropometric, gender and race/ethnicity information.

Child participants were asked, with help from parents, to keep a diary of when they wore or took off the accelerometer. The possibility of malfunction and/or lost devices is common in this type of study (Matthews, Hagstromer, Pober, & Bowles, 2012). In case of data or device loss a date for possible re-administration of the 7 day period of accelerometer wear was discussed with the parents. During testing only two accelerometers malfunctioned and on both occasions families agreed to have their children go through the process for a second time.

Eight days after the initial testing day, children were asked to return the accelerometer and then they completed the MABC-2 for their age group.
Data Analysis

Frequency distributions and descriptive statistics were performed for ordinal and continuous variables respectively. Due to the non-normality of the data, a Mann–Whitney U-test was used to explore the differences between genders on all the variables.

Movement-ABC 2 performance was scored using the developer’s manual and instructions (Henderson et al., 2008), using the standardized scores developed for each of the sections as well for the complete assessment.

Actigraph data were processed using the method proposed by Crouter (2012) where data for each axis are collected in 1-s epochs. Mean vector magnitude was calculated as the square root of the sum of the squared activity counts in each vector. The 1-s epochs for each axis and vector magnitude were converted to counts per 10 s and counts per minute; the coefficient of variation (CV) was also calculated using the method developed by Crouter and colleagues (2006). The CV was calculated for each 10-s epoch by examining each 10-s epoch and the surrounding five 10-s epochs in the following manner: the 10-s epoch of interest and 1) the five 10-s epochs before, 2) the four 10-s epochs before and one 10-s epoch after, 3) the three 10-s epochs before and two 10-s epochs after, 4) the two 10-s epochs before and three 10-s epochs after, 5) the 10-s epoch before and four 10-s epochs after, and 6) the five 10-s epochs that followed. The lowest CV was used as the CV for that 10-s epoch.

In order to calculate minutes spent in PA and SB an Actigraph vector two-regression model (VM²RM) that has been validated for use in children was used (Crouter et al., 2012). From the equations developed by Crouter (2012) two dependent variables...
were obtained;

Average time in minutes per day in sedentary behaviors for all days (SB)

Average time in minutes per day in moderate-to-vigorous PA for all days (MVPA)

Bivariate correlations were performed between the independent variables (age, gender, body weight, body height, Avgskin, parental marital status, parental education levels from the MAQ questionnaire, parental perceptions, parental intentions and parental opinions on child physical activity and weight status) and the dependent variables (SB and MVPA from accelerometry). A second round of partial correlations was run controlling for age, gender, body weight, body height and accelerometer average wear time for all days between the rest of the independent variables and the dependent variables.

Linear regression models with and without controlling for covariates of age, gender, and accelerometer total wear times were developed in order to study the strength of associations between the independent variables and the dependent variables from the accelerometer. The models used to control for covariates were developed in a progressive way with each of the subsequent models preserving the covariates from previous models. Statistical analyses were conducted using SPSS version 20.0 for Mac (SPSS, Inc., Chicago, IL). For all analyses, alpha level of $< 0.05$ was used to indicate statistical significance. Bonferroni’s method was used to examine the multiple associations between the variables to prevent experiment-wise errors.
Results

No significant differences in age, body weight, and body height were found between genders (Table 2). Significant differences were found on BMI percentiles between males and females, $t(71) = -3.33$, $p = 0.004$, (Table 2). Parents of the female participants reported higher levels of education with 44% of the female’s fathers and 83% of the mothers having completed post-graduate education versus 21% of the male’s fathers and 27% of the mothers. (Table 3.)

Table 7 shows the average time spent in SB and MVPA from the GT3X for both genders. On average, boys spent significantly less time in SB per day than girls and significantly more time in MVPA per day.

Analyses with both genders grouped together showed younger children engaged in more MVPA ($r = -0.38$, $p < 0.01$). When data were analyzed separately by gender, the association was still apparent with younger children engaging in more time on MVPA (females $r = -0.36$, $p = 0.03$; males $r = -0.33$, $p = 0.04$).

Height was associated with the two accelerometer-derived main variables. Height was moderately associated with SB ($r = 0.29$, $p = 0.01$) and with MVPA ($r = -0.30$, $p < 0.010$). When divided by gender, taller females tended to spend more time in SB ($r = 0.35$, $p = 0.04$). BMI percentiles were not associated with any accelerometer variable. Body weight was not associated with any variable from the activity monitor when both genders were analyzed together or when analyzed separately.

Averages of skinfold measure from triceps and sub-scapular did not show any associations with accelerometry variables when both genders were grouped together.
Separate analyses showed that males with lower average skinfolds measures tended to have higher MVPA \((r = -0.36, p = 0.03)\). After controlling for age, gender, body weight, body height and average accelerometer wear time, low measures of skinfold from triceps and sub-scapular and higher muscle endurance measured by the number of sit-ups completed in one minute were associated with MVPA \((r = -0.26, p = 0.02, \text{ and } r = 0.33 \ p = 0.01 \text{ respectively})\).

**Association between M-ABC and MVPA, SB**

Movement-ABC components were not associated with accelerometer variables when both genders were analyzed together. When analyzed separately, only the M-ABC sub-scale of “throwing and catching” was associated positively with SB \((r = .35, p = .04)\) in females.

Controlling for age, gender, body weight, body height and average accelerometer wear time, “throwing and catching” was associated with MVPA, \(r = 0.25, p = 0.04\). No other M-ABC factor was associated with an outcome variable when controlling for possible covariates.

**Associations between parental characteristics, perceptions, intentions and opinions of child’s health and weight status and variables from accelerometer**

In analyses with both genders together, the higher the number of days the parent perceived their child participated in PA per week, the lower the time spent in SB, \(r = -0.24, p = 0.04\).
Analyzed by gender, girls with more MVPA time had parents who believed that overweight children grow up to be overweight adults \((r = 0.40, p = 0.02)\). Parental perceptions of child’s body weight expressed by marking a sketch demonstrated that the higher the sketch number chosen by the parent (representing a higher body weight), the greater the time spent on SB \(r = 0.36, p = 0.03\), and the lower the MVPA \(r = -0.35, p = 0.04\).

Controlling for age, gender, body weight, body height and average accelerometer wear time, parental reports that they already are limiting their child’s daily TV time to two hours per day was associated with higher MVPA times, \(r = 0.27, p = 0.03\).

Children from non-divorced parents had more MVPA time \((r = 0.32, p = 0.01)\). When analyzed by gender, only females from non-divorced parents tended to have more MVPA time \((r = 0.41, p = 0.01)\). The higher the father’s school grade the lower the MVPA, \(r = -0.36, p < 0.01\). Mother’s school grade was also negatively associated with MVPA, \(r = -0.38, p < .01\). In males the higher the school grade of the mother the lower the MVPA times, \(r = -0.38, p = 0.02\).

Controlling for age, gender, body weight, body height and average accelerometer wear time, no associations were found between these set of variables.

**Linear regression models**

After a process of forward selection, parental intentions of reducing TV time to 2 hours per day (TV time), and parental marital status were significant predictors of MVPA (Table 8). The overall model predicted a moderate amount of variance \((R^2 = 0.51)\). No
other independent variable was found to be a significant predictor of variance in MVPA. Regression models did not identify any of the independent variables as significant predictors of variance in SB.
Discussion

Examination of the correlates of PA and SB behaviors in Latino children is important to guide the design of effective, culturally suitable prevention and intervention programs for this population. Our study identified several child and parent factors that were related to PA and SB times measured by accelerometers in a group of children living on the Island of Puerto Rico.

The main findings of the present study suggest that parental intentions should be taken into account or at least considered when designing a PA program for Latino children. In this study, children of parents who expressed intentions of reducing TV time in the future were already engaging in higher levels of PA than their peers. This finding is important as children’s TV time within the context of the family environment has been reported as an important factor contributing to either lower or higher PA times (Salmon, Timperio, Telford, & Carver, 2012). It could be the case that those parents with future positive intentions were already engaging in behaviors that moved their children to participate more in PA than their peers, but we were unable to examine that possibility with the present study.

Parental perceptions of children’s body weight were also associated with measures of PA and SB. It has been suggested that knowing or having an accurate perception of children’s weight status could interact with PA levels (Pocock et al., 2010); however, how this type of knowledge leads to more and better participation in PA is not clear yet (Adamo et al., 2010), particularly in Latino children. It is possible that those parents who are aware of the changes in body weight and body composition of their
children tend to favor behaviors in their households that lead to more participation in PA by their children.

It also has been suggested that motor coordination could not only predict PA in children but also changes in levels of PA during childhood (Lopes, Rodrigues, L.P., Maia, & Malina, 2010). We found that at least one component of a motor coordination test, throwing and catching, was associated with MVPA. In our sample of Puerto Rican children, independent of age and gender, the more skill they demonstrated in this gross motor component the higher the MVPA levels of PA recorded by the accelerometer. However when genders were studied separately, this motor competence showed a positive association with SB in females, indicating that those female participants with higher levels of this skill were not necessarily more active. This could be to an independence between motor skills and general participation in PA. Other studies with Latino children have not found such an association, but the measures of motor coordination and/or PA used in those studies differed from the present study (Sallis, Taylor, & Dowda, 2002). The skill of throwing and catching is related to participation in team sports and our sample was mostly from children who participated in sports such as basketball, volleyball and baseball. Culturally Puerto Ricans are more accustomed to participating in sports similar to those popular in the continental United States than in sports common in Latin America such as soccer.

Interestingly, only height of the participants was associated with the two outcomes of PA and SB. This relates to a concern regarding which factors related to PA and SB are actually modifiable (King et al., 2011). In the present study, we found that of
the child factors correlated with PA and SB, only three are modifiable (average skinfolds, sit-ups, and throwing and catching skills). In contrast, we identified several modifiable factors related to parental perceptions and/or intentions, suggesting that working with the family as a group may be a potential avenue of intervention to explore. Related studies in Puerto Rico are scarce, however similar studies outside the Island also support that most of the correlates of PA and SB are factors that are not necessarily modifiable in an intervention program (King et al., 2011)

This study differs from previous studies in the use of objective methods for measuring PA and SB. This difference is important because we can make objective assessment of PA using accelerometers based on the measurement of energy expenditure (EE). The use of accelerometry with children has been reported in the literature outside Puerto Rico for almost two decades, but no major studies using this device with children from the island of Puerto Rico were found in the literature. More work needs to be done with these type of devices in order to understand better the patterns of activity and sedentary behaviors of children who are living outside the continental United States but affected by the economy and policies established by the US government.

The present study was limited in the analysis of correlates between PA and SB by BMI subgroups. Similar to King et al. (2011), our study was underpowered for such purposes as our sample was homogenous within BMI categories. Another limitation to be considered for future studies with this population is the analysis of social economic status (SES) data from the families. In our study parental education was associated with PA and SB and parents’ education can be used as a surrogate measure of SES (Santelli, Lowry,
Brener, & Robin, 2000), specific measures of SES, particularly income, should be considered in future studies. Most of the children in our sample were living with both of their parents at the moment of data collection but only information from the mother was available as in the vast majority, the mother was the person answering our questionnaires. Unexplained variance could be accounted for by the missing information regarding the fathers’ perceptions and intentions. Another source of unexplained variance could be the child’s self-efficacy toward PA, which other studies have reported to be associated with PA (Dishman, Dunn, Sallis, Vandenberg, & Pratt, 2009; J. J. Martin, Oliver, & McCaughtry, 2007).

Conclusions

In this study, we used objective measures to assess PA and SB in Puerto Rican children living on the Island, and investigated factors associated with time spent at a specific level of PA, moderate-to-vigorous PA, and in SB. Parental intentions of reducing TV time to 2 hours per day and parental perceptions of their child’s body weight status were found to be associated with the PA and SB levels of their children.
TABLES FOR STUDY ONE
<table>
<thead>
<tr>
<th>Sections</th>
<th>Method of Parental Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demographic characteristics and medical conditions perceived to limit the child’s growth or physical activity</td>
<td>Eight multiple choice questions</td>
</tr>
<tr>
<td>2. Perceptions of their child’s weight for height and physical activity habits/ability.</td>
<td>Five multiple choice questions</td>
</tr>
<tr>
<td>3. Parental levels of concern about the health effects of overweight, their child’s weight status, their degree of influence on their child’s food choices and physical activity habits, and the importance of parents as role models for exercise and dietary habits</td>
<td>Eight questions with five Likert-scale response choices (response options: strongly agree, agree, neutral, disagree, or strongly disagree).</td>
</tr>
<tr>
<td>4. Intentions of the respondent to modify family health behaviors related to diet, physical activity, and television viewing.</td>
<td>Four multiple choice questions</td>
</tr>
<tr>
<td>5. History of medical illnesses (heart attack, stroke, diabetes, and high blood pressure) for the parents and grandparents</td>
<td>For each item, the respondent indicated whether the illness had occurred and whether they believed it was related to smoking, alcohol use, diet, low physical activity, or obesity</td>
</tr>
<tr>
<td>6. Sketches of children</td>
<td>Respondents were requested to circle the drawing that most resembled their child body figure. The middle image in each series of sketches was developed to represent a child at the 50th BMI percentile; other sketches were not tied to particular BMI percentile categories</td>
</tr>
</tbody>
</table>
Table 2. *Child participants’ anthropometric and demographic characteristics*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Males (N = 37)</th>
<th>Females (N = 36)</th>
<th>Total (N = 73)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>8.68 ± 1.27</td>
<td>9.17 ± 1.25</td>
<td>8.92 ± 1.28</td>
</tr>
<tr>
<td>Total children in the family</td>
<td>2.00 ± .86</td>
<td>1.89 ± .62</td>
<td>1.94 ± .75</td>
</tr>
<tr>
<td>Months to first walk (months)</td>
<td>11.08 ± 3.30</td>
<td>11.53 ± 2.51</td>
<td>11.30 ± 2.93</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>35.08 ± 12.20</td>
<td>30.98 ± 7.71</td>
<td>33.05 ± 10.37</td>
</tr>
<tr>
<td>Body height (cm)</td>
<td>133.47 ± 9.88</td>
<td>135.66 ± 10.24</td>
<td>134.5 ± 10.05</td>
</tr>
<tr>
<td>*BMI (kg/m²)</td>
<td>19.28 ± 4.93</td>
<td>16.58 ± 2.27</td>
<td>17.95 ± 4.06</td>
</tr>
<tr>
<td>BMI %ile</td>
<td>68.45 ± 29.86</td>
<td>44.97 ± 30.42</td>
<td>56.87 ± 32.17</td>
</tr>
<tr>
<td>*Avg Skinfold (mm)</td>
<td>13.62 ± 7.29</td>
<td>11.69 ± 3.27</td>
<td>12.67 ± 5.72</td>
</tr>
<tr>
<td>Curl-ups (1 minute)</td>
<td>20.22 ± 8.98</td>
<td>23.28 ± 8.82</td>
<td>21.73 ± 8.97</td>
</tr>
</tbody>
</table>

*Note.* *Independent sample t-test results significant differences at p<0.05*
Table 3. Parent demographic characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Male Children (%) (N=37)</th>
<th>Female Children (%) (N=36)</th>
<th>Total Sample (%) (N=73)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married / living with partner</td>
<td>75.7</td>
<td>72.2</td>
<td>74</td>
</tr>
<tr>
<td>Divorce / separated</td>
<td>16.2</td>
<td>16.7</td>
<td>16.4</td>
</tr>
<tr>
<td>Single parent</td>
<td>8.1</td>
<td>8.3</td>
<td>8.2</td>
</tr>
<tr>
<td>Widowed</td>
<td>0.0</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Highest grade of father</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior High school</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>High School</td>
<td>29.7</td>
<td>5.6</td>
<td>17.8</td>
</tr>
<tr>
<td>Some college / 2 yr min</td>
<td>27.0</td>
<td>13.9</td>
<td>20.5</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>21.6</td>
<td>36.1</td>
<td>28.8</td>
</tr>
<tr>
<td>Postgraduate degree</td>
<td>21.6</td>
<td>44.4</td>
<td>32.9</td>
</tr>
<tr>
<td>Highest grade of mother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior high school</td>
<td>0.0</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td>High School</td>
<td>21.6</td>
<td>0.0</td>
<td>11.0</td>
</tr>
<tr>
<td>Some college / 2 yr min</td>
<td>21.6</td>
<td>2.8</td>
<td>12.3</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>29.7</td>
<td>11.1</td>
<td>20.5</td>
</tr>
<tr>
<td>Postgraduate degree</td>
<td>27.0</td>
<td>83.3</td>
<td>54.8</td>
</tr>
</tbody>
</table>
Table 4. *Parental perceptions of child's weight and physical activity status*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Male Children (%) (N=37)</th>
<th>Female Children (%) (N=36)</th>
<th>Within Total Sample (%) (N=73)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel my child is</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>0.0</td>
<td>8.3</td>
<td>4.1</td>
</tr>
<tr>
<td>A little underweight</td>
<td>8.1</td>
<td>2.8</td>
<td>5.5</td>
</tr>
<tr>
<td>About the right weight</td>
<td>73.0</td>
<td>77.8</td>
<td>75.</td>
</tr>
<tr>
<td>A little overweight</td>
<td>10.8</td>
<td>8.3</td>
<td>5.5</td>
</tr>
<tr>
<td>Overweight</td>
<td>8.1</td>
<td>2.8</td>
<td>5.5</td>
</tr>
<tr>
<td>Days my child participates in PA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-7 days per week</td>
<td>27.0</td>
<td>55.6</td>
<td>41.1</td>
</tr>
<tr>
<td>3-5 days per week</td>
<td>73.0</td>
<td>36.1</td>
<td>54.8</td>
</tr>
<tr>
<td>1-2 days per week</td>
<td>0.0</td>
<td>8.3</td>
<td>4.1</td>
</tr>
<tr>
<td>When my child runs, usually</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is faster than others</td>
<td>32.4</td>
<td>44.4</td>
<td>38.4</td>
</tr>
<tr>
<td>About as fast as others</td>
<td>56.8</td>
<td>44.4</td>
<td>50.7</td>
</tr>
<tr>
<td>Slower than others</td>
<td>10.8</td>
<td>11.1</td>
<td>11.0</td>
</tr>
</tbody>
</table>
Table 5. Parental perceptions of their influence on child's PA and food consumption

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Male Children (%) (N=37)</th>
<th>Female Children (%) (N=36)</th>
<th>Within Total Sample (%) (N=73)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can influence my child’s amount of PA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly agree</td>
<td>37.8</td>
<td>41.7</td>
<td>39.7</td>
</tr>
<tr>
<td>Agree</td>
<td>48.6</td>
<td>47.2</td>
<td>47.9</td>
</tr>
<tr>
<td>Neutral</td>
<td>10.8</td>
<td>8.3</td>
<td>9.6</td>
</tr>
<tr>
<td>Disagree</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>2.7</td>
<td>2.8</td>
<td>2.7</td>
</tr>
<tr>
<td>I can influence my child’s amount of food consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly agree</td>
<td>51.4</td>
<td>61.1</td>
<td>56.2</td>
</tr>
<tr>
<td>Agree</td>
<td>35.1</td>
<td>25.0</td>
<td>30.1</td>
</tr>
<tr>
<td>Neutral</td>
<td>10.8</td>
<td>8.3</td>
<td>9.6</td>
</tr>
<tr>
<td>Disagree</td>
<td>0.0</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>2.7</td>
<td>2.8</td>
<td>2.7</td>
</tr>
<tr>
<td>I’m worried about my child’s weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly agree</td>
<td>16.2</td>
<td>2.8</td>
<td>9.6</td>
</tr>
<tr>
<td>Agree</td>
<td>16.2</td>
<td>16.7</td>
<td>16.4</td>
</tr>
<tr>
<td>Neutral</td>
<td>21.6</td>
<td>25.0</td>
<td>23.3</td>
</tr>
<tr>
<td>Disagree</td>
<td>10.8</td>
<td>13.9</td>
<td>12.3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>35.1</td>
<td>41.7</td>
<td>38.4</td>
</tr>
</tbody>
</table>
Table 6. Motor coordination characteristics and differences between males and females

<table>
<thead>
<tr>
<th>Motor Component</th>
<th>Males</th>
<th>Females</th>
<th>t-test, df, p</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMDS</td>
<td>12.35 ± 3.85</td>
<td>13.83 ± 3.44</td>
<td>t=1.72, df=70, p=0.091</td>
</tr>
<tr>
<td>SCS</td>
<td>9.97 ± 3.89</td>
<td>9.00 ± 4.14</td>
<td>t=-1.027, df=70, p=0.308</td>
</tr>
<tr>
<td>SBS</td>
<td>14.76 ± 4.53</td>
<td>16.94 ± 3.43</td>
<td>t=2.32, df=67, p=0.024</td>
</tr>
<tr>
<td>STTS</td>
<td>13.86 ± 4.32</td>
<td>15.34 ± 3.74</td>
<td>t=1.55, df=70, p=0.127</td>
</tr>
</tbody>
</table>

Note. SMDS = Standardized manual dexterity score; SCS = Standardized catching score; SBS = Standardized balance score; STTS = Standardized total test score; Independent sample t-test results significant differences at p<0.05
Table 7. *Accelerometry results*

<table>
<thead>
<tr>
<th>Accelerometry variables</th>
<th>Males (N=37)</th>
<th>Females (N=35)</th>
<th>t-test, df, p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average daily sedentary time in minutes</td>
<td>239.33 ± 74.63</td>
<td>296.24 ± 128.42</td>
<td>t=2.31, df=70, p=0.024</td>
</tr>
<tr>
<td>Average daily MVPA in minutes</td>
<td>126.41 ± 40.73</td>
<td>85.70 ± 42.33</td>
<td>t=-6.02, df=57, p=0.000</td>
</tr>
</tbody>
</table>

*Note. MVPA = Moderate-to-vigorous physical activity; Independent sample t-test results significant differences at p<0.05*
Table 8. *Summary of Linear Regression Model for Parent Intentions and Marital Status with MVPA (N = 73)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE(B)</th>
<th>β</th>
<th>t</th>
<th>Sig. (p)</th>
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</thead>
<tbody>
<tr>
<td>TV Time</td>
<td>11.29</td>
<td>4.60</td>
<td>.230</td>
<td>2.46</td>
<td>.02</td>
</tr>
<tr>
<td>Marital Status</td>
<td>16.94</td>
<td>7.75</td>
<td>.200</td>
<td>2.19</td>
<td>.03</td>
</tr>
</tbody>
</table>

*Note: $R^2 = 0.51$*
FIGURES FOR STUDY ONE
Figure 1. Weight Pictorial Sketches for Girls

<table>
<thead>
<tr>
<th>Ages 2-5</th>
<th></th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Ages 6-9</td>
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<td>Ages 10-13</td>
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</tbody>
</table>

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Figure 2. Weight Pictorial Sketches for Boys

<table>
<thead>
<tr>
<th>Ages</th>
<th>Sketches</th>
</tr>
</thead>
<tbody>
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<td>6-9</td>
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<tr>
<td>10-13</td>
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</tr>
<tr>
<td>14-17</td>
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</table>

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References


II. PERSONAL AND CONTEXTUAL FACTORS ASSOCIATED WITH
PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOR IN PUERTO RICAN CHILDREN: A MODERATION MODEL.

Mario A. Muñoz
Gael Orsmond
Simone Gill
Sharon Cermak
Wendy Coster
Abstract

The way parents think they could influence their child’s participation in physical activity (PA) and sedentary behaviors (SB), or parental perceptions of their own influences on those two behaviors, could be an important factor contributing to the associations between known predictors of PA and SB. These associations have not been studied in detail in Latino children.

PURPOSE: The purpose of this study was to examine the possible moderating effect of specific factors, including parent demographics and parental beliefs toward PA/SB and intentions of modifying behaviors, on known predictors of PA and SB in Puerto Rican children living on the Island.

METHODS: Seventy-three children (age, 8.92 ± 1.28 yrs; BMI 33.05 ± 10.37 kg m²) wore an ActiGraph GT3X accelerometer on their right hip for seven days. Time spent in SB and PA were estimated. One parent, in majority the mother, of each child completed a questionnaire including questions about their perceptions of how much they influence their child PA. The PROCESS method proposed by Hayes (2013) was used to analyze relationships among variables that were associated with each other to evaluate a moderation model between child and parental factors, PA and SB.

RESULTS: PROCESS analysis identified a three-way interaction between child’s age, maternal beliefs of influence on child’s PA and SB, and maternal education level.

CONCLUSIONS: The results suggest that the strength of age as a predictor of PA and SB levels of Latino children may be moderated by parent’s perceptions of influence in their child’s PA, which itself may be moderated by the parent’s level of education.
The rise in childhood obesity is believed to be due to complex interactions across a number of relevant factors influencing eating behaviors, sedentary behavior (SB) and physical activity (PA) participation. According to a recent report (Dentro et al., 2014), PA levels among United States (U.S.) children are low and levels of SB are high. Improved understanding of the factors related to participation in PA and/or amount of time spent in SB would help to focus resources, interventions, and research in directions that would be most beneficial in addressing the problem of childhood obesity.

Parental perceptions of their child’s weight status, child’s participation in PA and child’s time spent in SB have been identified as potential factors affecting PA participation and contributing to increases in childhood obesity (Adamo et al., 2010; Kaushal & Rhodes, 2014; Trost, Sallis, Pate, Freedson, Taylor, & Dowda, 2003b). Thus, increasing parental support for PA could be a means to increase children’s participation in PA, for example by parents increasing their active engagement in watching their child participate and by positively reinforcing their child’s participation in PA (Trost, Sallis, Pate, Freedson, Taylor, & Dowda, 2003b). Parental beliefs and knowledge of the benefits of increased PA levels could also be factors for clinicians and practitioners to consider when designing intervention programs to promote PA and decrease SB (Pocock, Trivedi, Wills, & Bunn, 2010; Rivera-Soto & Rodríguez-Figueroa, 2012).

The common approach of previous studies has been to investigate how parental perceptions, beliefs and characteristics are directly associated with PA and SB. Other studies, separately, have reported associations between age, gender, body mass index
(BMI), PA and SB in children (Van Der Horst, Paw, Twisk, & van Mechelen, 2007) without accounting for possible interactions among these factors and the desired outcome variables of interest.

To further understand the complexity of the interactions among factors associated with PA and SB, it is important to use models that are better suited to account for different interactions among factors. A possible solution to study the effect of external factors on already known predictors of PA and SB is to examine how these external factors moderate such associations.

Described as a third variable that affects the zero-order correlation between two other variables (Baron & Kenny, 1986), moderation analysis has been used, for example, to identify how self-efficacy moderates the association between declines in PA and perceived social support in adolescent girls (Dishman, Saunders, Motl, Dowda, & Pate, 2009; Gamble, Parra, & Beech, 2009). Using moderators in models may also produce different estimates of associations at different levels for each of the factor studied (Bauman, Sallis, Dzewaltowski, & Owen, 2002), for example factors related to the parents that could influence their children’s PA participation or time spent on SB.

DeDecker and colleagues, using a mediation-moderator model, found that parental rules for TV time viewing mediated the association between parent’s own TV time and children’s TV viewing time (De Decker et al., 2014). Other researchers have reported that encouragement to engage in PA from the parent may moderate the association between parent PA and child PA (Tate et al., 2014). Parental beliefs toward PA, knowledge of PA levels of their children, and encouragement have been studied
recently as possible moderators of the interactions between parents’ own levels of PA, perceived neighborhood crime, pedestrian and traffic safety, and child PA levels. Others factors included in these types of studies have been gender, race/ethnicity, education levels, and monetary income (Adamo et al., 2010; Carlson et al., 2014; Tate et al., 2014; Trost, Sallis, Pate, Freedson, Taylor, & Dowda, 2003a). These types of studies are scarce and samples were not representative of diverse populations in relation to race and ethnicity.

Using more conventional correlational models investigators have observed that parent’s own TV viewing time is associated TV viewing time of their children at preschool age (De Decker et al., 2014), and parental participation in PA and encouragement to participate are factors associated with the PA levels of their school age children (Tate et al., 2014). The interaction between parent influences on PA and SB (LeBlanc et al., 2015), age of the child and outcomes also could be influenced by parental level of education (Fuemmeler & Anderson, 2011).

In their study of correlates of SB measured by accelerometers, LeBlanc et al (2015) reported that father’s education level was positively correlated with child’s self-reported screen time, a common SB of children. Fuemmeler (2011) reported a correlation between the physical activity level of the child and parental education. The association between education level of the parent and other factors known to be correlated with PA and or SB has not been investigated. Based on Welk’s (1999) model, Youth Physical Activity Promotion (YPAP), one might hypothesize that the higher the parent’s level of education, the more awareness of the benefits of PA to the child. However it could also
be argued that higher education levels lead to more awareness of social barriers to participation in PA such as neighborhood safety (Gomez, 2004). The YPAP model suggests that the child’s participation in PA is reinforced by a self-evaluative construct and cognitive assessment of perceived outcome. Parental influences in this model are regarded as a factor that is able to facilitate children’s PA behavior directly and promote children’s PA participation by enhancing the self-evaluative and cognitive assessment constructs (Cheung & Chow, 2010). Other theoretical models that lay the foundation for our work include the biocultural model of maturity-associated variance in adolescent PA proposed by Cumming (2012). The proposed model includes biological factors, psycho-behavioral outcomes, and mediating and moderating factors, recognizing the various dimensions of biological maturation and moderating factors such as social support for PA and cultural ideals regarding PA and SB (Cumming et al., 2012). As discussed previously, studies of these relationships have assumed direct associations, without considering potential moderating effects of other variables or factors.

Interactions between parental beliefs and PA and SB may also be influenced by the culture of each specific group being studied. Parental readiness to make behavioral changes or to influence changes in their children could be affected by their ethnic background or by what has been called “cultural attitudes” (Rhee, De Lago, Arscott-Mills, Mehta, & Davis, 2005). Previously it has been speculated that ethnic minorities, in relation to health habits and PA, are more likely to turn to familial role models and are more susceptible to family influences than their Anglo counterpart (Sallis, Patterson, Buono, Atkins, & Nader, 1988). This suggestion was made with regard to minorities
living in the United States mainland, and their migratory status (years in the US) was not reported. There is even more limited information on how the influences of culture and familial models could affect children’s PA participation and/or time spent on SB in children from minority groups living outside mainland USA, in places such as Puerto Rico and United State Virgin Islands. No study, to our knowledge, has examined the potential moderating effect of parental beliefs toward PA and SB, parental intentions of behavioral change toward PA and SB, and parental education levels on predictors of PA and SB such as age, gender, and BMI, especially in a specific group of Latino children.

Several factors have being identified as contributors to better health behaviors in Latino families. Different parenting styles, for example, were associated with healthy eating and physical activity in a group of families living in San Diego (Arredondo et al., 2006). Results from that study indicated that parental monitoring for healthy eating was associated positively with children’s healthy eating and negatively correlated with children’s unhealthy eating. Also, parental monitoring for PA and parental reinforcement for PA were two styles positively associated with children’s PA.

Some cultural correlates of PA participation have also been identified in Latino families (O’Connor et al., 2014). Cultural factors, measured as acculturation variables such as language used, language proficiency and electronic media, and “familism” (explained as the cultural value of strong attachment and identification with one’s family), were identified as factors explaining the variance in safety concerns toward children’s participation in PA in Latino families (O’Connor et al., 2014).

The purpose of the current study was to examine personal and contextual factors
associated with PA and SB, including the analysis of possible moderators of the relationships among predictor(s) and the outcomes of PA and SB. It was hypothesized that variables related to parental beliefs and perceptions would moderate the association of already known factors that are associated to PA and SB such as age, gender, body mass index (BMI) (kg/m²).
Methods

Participants

Participants were recruited from the city of San Juan youth basketball clinic program, from a private elementary/middle school in the city of San Juan, and members of a volleyball program. The first author is affiliated with Puerto Rico’s Physical Education Association and with several state and private universities that provide services to children within their communities. Participants were recruited from two of those programs and from a private school where the first author was allowed to distribute advertisement and recruitment information to parents. A flyer explaining the purpose of the study and what it involved was distributed to the parents of children during the first week of the basketball and volleyball programs, and a meeting was arranged at the private school to inform interested parents about the study.

Participants were children between the ages of 7 through 11 years old, and at least one parent from each household also participated in the study (See Table 10 and Table 11). This age range was selected in part because data on the prevalence of obesity in children indicates that children in this age group are at particular risk of obesity in reports with data from the U.S. and from Puerto Rico (Ogden, Lamb, Carroll, & Flegal, 2010; Rivera, Rodríguez-Figueroa, & Calderón, 2010). The participants were part of a different study where motor proficiency was assessed using a battery of tests specific to this age group (Munoz, Coster, Orsmond, Gill, & Cermak 2015).

Children with neurological conditions, physical or behavioral problems, receiving
special educational services, cognitive impairments, or history of learning difficulties (as reported by parents) were excluded from the study. Children receiving any medication that affects growth or appetite such as steroids or stimulants also were excluded, as were those with severe asthma who used inhalers. Children with attention deficit hyperactivity disorder (ADHD) who were not taking stimulant medication, as reported by the parents during the screening process, were included in the study.

Parents unable to read and/or write were excluded and their children also were not included. In the sample all parents were able to read and write and all were Spanish speakers.

The procedures were reviewed and approved by the Boston University Institutional Review Board before the start of the study. The parent of each participant signed a written informed consent and completed a health-screening questionnaire about the health of their child and child participants signed a written assent form before participation in the study.

Instruments

All questionnaires, but one, were translated into Spanish by the principal investigator of the study as part of a previous study (Cermak et al., 2015) using a back translation technique. A Spanish version of the Parental Perception of Health and Weight Status Questionnaire (PPHWSQ) was obtained from the original study that reported on it (Eckstein et al., 2006).
**Screening Questionnaire.**

The child’s eligibility to participate was assessed by a questionnaire that addressed the inclusion and exclusion criteria described in the Participants section.

**Parental Perception of Health and Weight Status Questionnaire (PPHWSQ).**

The PPHWSQ assesses parental perceptions and levels of concern about their child’s weight status, as well as parental intentions to modify PA, eating and sedentary behaviors at home (Eckstein et al., 2006). It includes six sections and uses two approaches to obtain respondent perceptions regarding the child’s weight status (Table 9). One of the sections asks about parental levels of concern regarding the health effects of overweight, their child’s weight status, and their degree of influence on their child’s physical activity habits. For example, the parents were asked “I am worried about my child’s weight right now” and “I can influence my child’s amount of physical activity.” This section of the questionnaire uses eight questions with five Likert-scale response choices: strongly agree, agree, neutral, disagree, or strongly disagree. A second section inquires about the intentions of the respondent to modify family health behaviors related to diet, physical activity, and television viewing in their household, with responses including *I already do this, I will try, and I will not try*. The PPHWSQ is reported to have test re-test agreement of 96.1% on the multiple-choice answers (Eckstein et al., 2006).
*Anthropometric Measures.*

We used BMI to measure body weight status. BMI was calculated from measures of height and weight using age and gender-specific growth charts (Centers for Disease Control and Prevention, 2010). Research with children has shown that BMI varies as a function of the child’s age and gender (Centers for Disease Control and Prevention, 2010). Therefore, z-scores were used because the sample included male and female participants who ranged in age from 7 through 11 years and research with children has shown that BMI varies as a function of the child’s age and gender (Centers for Disease Control and Prevention, 2010). Height and weight were measured on a Detecto 437 Eye Level Physician Mechanical Beam Scale accurate to 0.1 cm and to 0.1 kg respectively. Body weight was measured in light clothing without shoes. BMI was calculated from the ratio of the body weight in kilograms and the square root of its height measure in meters ($\text{kg/m}^2$).

*Physical Activity and Sedentary Behavior Times.*

Time spent in physical activity and in sedentary behavior was measured using an ActiGraph GT3X accelerometer. The accelerometer is a small (3.8 x 3.7 x 1.8 cm), lightweight (27 grams), water resistant tri-axial accelerometer. The GT3X measures accelerations in the range of 0.05 to 2 G’s, which are digitized by a 12-bit analog-to-digital converter at a rate of 30 Hz. Once digitized, the data is filtered using a band-limited frequency of 0.25 to 2.5 Hz. These values correspond to the range in which most human activities are performed.
The ActiGraph GT3X was worn for seven consecutive days, of which at least two were weekend days. The accelerometer was worn at waist level at the right anterior axillary line attached to a nylon belt. The GT3X was initialized using 1-second epochs and the low frequency extension turned on. The primary output variable from the accelerometer device was average time in minutes per day in sedentary activity across all days (SB) and average time in minutes per day in moderate-to-vigorous PA across all days (MVPA).

**Procedures**

After meeting with parents at the evaluation site, a screening form was collected and reviewed. Parents of participants who met the criteria were given a package that included a consent form, assent form and the parental perception of health and weight questionnaire (PPHWSQ). After signing the consent and assent forms the families proceeded to complete the PPHWSQ.

Measurements were conducted over a two-day period. The first day of testing consisted of anthropometric measurements (height and weight) and digitalization of the activity monitor with the participant’s anthropometric, gender and race/ethnicity information. Children’s height and weight were measured in light clothing.

Child participants were asked, with help from parents, to keep a diary of when they wore or took off the accelerometer. The possibility of malfunction and/or lost devices is common in this type of study (Matthews, Hagstromer, Pober, & Bowles, 2012). In case of data or device loss a date for possible re-administration of the 7 day period of accelerometer wear was discussed with the parents. During testing only two
accelerometers malfunctioned and on both occasions families agreed to have their children go through the process for a second time. No children refused to wear the accelerometer.

Data Analysis

Frequency distributions and descriptive statistics were performed for ordinal and continuous variables respectively. BMI and BMI percentiles were calculated using the template provided by the CDC.

Actigraph data were processed using the method proposed by Crouter et al., (2012) where data for each axis are collected in 1-s epochs. Mean vector magnitude was calculated as the square root of the sum of the squared activity counts in each vector. The 1-s epochs for each axis and vector magnitude were converted to counts per 10 s and counts per minute; the coefficient of variation (CV) was also calculated using the method developed by Crouter (2006). The CV was calculated for each 10-s epoch by examining each 10-s epoch and the surrounding five 10-s epochs in the following manner: the 10-s epoch of interest and 1) the five 10-s epochs before, 2) the four 10-s epochs before and one 10-s epoch after, 3) the three 10-s epochs before and two 10-s epochs after, 4) the two 10-s epochs before and three 10-s epochs after, 5) the 10-s epoch before and four 10-s epochs after, and 6) the five 10-s epochs that followed. The lowest CV was used as the CV for that 10-s epoch.

In order to calculate energy expenditure (EE) an Actigraph vector two-regression model (VM²RM) that has been validated for use in children was used (Crouter et al., 2012). From the equations developed by Crouter (2012) two dependent variables were
obtained.

Average time in minutes per day in sedentary behaviors for all days (SB)
Average time in minutes per day in moderate-to-vigorous PA for all days (MVPA)

Bivariate correlations between the independent variables (age, gender, body weight, body height, parental marital status, parental education levels from the questionnaire, parental perceptions, parental intentions and parental opinions on child physical activity and weight status) and the dependent variables (SB and MVPA from accelerometry), were examined to identify the best factors to be included in the moderation model. Those factors with significant correlation coefficients were identified as “best” factors to be included in the model.

The PROCESS method proposed by Hayes (2013) was used to analyze relationships among variables that were associated with each other to develop a moderation model between child and parental factors, PA and SB, controlling for average wear time of the accelerometer device and gender of the child.

PROCESS is a computational macro added to SPSS version 20.0 for Mac (SPSS, Inc., Chicago, IL) for path analysis-based moderation analysis that can estimate unstandardized model coefficients, standard errors, \( t \) and \( p \)-values, and confidence intervals using ordinary least squares (OLS) regression. An analytical method termed “conditional process modeling” (Hayes, 2013) is the root for the development of PROCESS.

Conditional process modeling is used with the goal of understanding and describing the conditional nature of the mechanism or mechanisms by which one variable
has an effect on another variable integrating moderation and mediation analysis together (Hayes, 2013).

Moderation and mediation analysis could provide a better understanding of the effects of X over Y, that is, total effect, indirect effect, direct effect, conditional effect, conditional indirect effect, and conditional direct effect. PROCESS is capable of not only performing the regression analysis necessary to acquire the coefficients of associations between X and Y, but is able to generate direct and indirect effects in mediation models and conditional effects in moderation models (Hayes, 2012). PROCESS adapts its calculation depending on the model more suitable for analysis of the specific interactions that are being studied. For all analyses the variables were considered together in the model, and alpha level of < 0.05 was used to indicate statistical significance.
Results

A total of 75 children participated. Mean age for the sample was 8.92 ± 1.28 years. No significant differences in age, body weight, and body height were found between genders. Significant differences were found on BMI percentiles between males and females, t(71) = -3.33, p = 0.004. (See Table 10).

Parents’ marital status and education characteristics are shown in Table 11. Parents of the female participants reported higher levels of education (Table 11). Analysis of parental perceptions of influence on child’s PA revealed no significant differences between male and females children (Table 12).

Table 13 shows the average time spent in SB and MVPA from the GT3X for both genders. On average, boys spent significantly less time in SB per day than girls (239.3 ± 74.6 and 296.2±128.4, respectively) and significantly more time in MVPA per day (126.4 ± 40.7 and 85.7±42.3, respectively) (P<0.05).

Moderation model

PROCESS analysis identified a three-way interaction between child’s age, maternal beliefs of influence on child’s PA and SB, and maternal education level (Figure 3). A statistical representation of the model is depicted in figure 4 where X represents child’s age, Y represents either PA or SB, M represents maternal perception of influence on child’s PA or SB, and W represents maternal education level. This “moderated moderation” model (as named by Hayes, 2013) can be represented by the following equation:

\[ Y = \beta_0 + (\beta_1 + \beta_4M + \beta_5W + \beta_7MW) X + \beta_2M + \beta_3W + \beta_6MW + e_y \]
For the outcome PA, the main interaction XWM resulted in a statistically significant coefficient, \( b_7 = 11.82, t(62) = 2.74, p = 0.008 \). For the outcome SB, the main interaction XWM also resulted in a statistically significant coefficient, \( b_7 = -22.93, t(62) = -2.09, p = 0.040 \).

As proposed by Hayes and Matthes (2009) the Johnson-Neyman technique was applied using the SPSS script provided by Hayes (2012) to identify where the interaction between our predictor X (age) and the principal moderator M (parental influence on PA) transitions between statistically significant and not significant along the distribution of the secondary moderator W (parental education).

Results from the Johnson-Neyman procedure indicated a variation in the significant levels of the interactions between parental perception of influence in PA and child’s age on child’s PA (Y), when parental education level (W) is higher than two years of college. That is, if parental education level (W) was equal to middle school up to at least two years of college, the moderator effect on parental perception of influence on child’s PA (M) of education level (W) was significant. At higher education levels (W) such as completed college and/or graduate education the effect of parental perceptions of influence on child’s PA (M) and child’s age (X) on child’s PA (Y) were not significant. Statistical results for the Johnson-Neyman procedure are represented as follow:

Conditional effect of XM on Y at values of W transitioned in significance at a parental education level (W) of 5.11, \( b = -16.57, \text{SE} = 8.29, t = -1.99, p = 0.0500 \)

When the effects of XM on the outcome of child’s SB (\( Y_i \)) were evaluated at values of W, utilizing the Johnson-Neyman approach, no statistical transition points were
These results reveal a three-way interaction between child’s age, maternal perception of influencing PA, and maternal level of education. That is, the extent to which maternal perception of influence on their child’s PA moderates the age effect on child’s PA and SB depends on maternal level of education.

**Discussion**

Results from this study suggested that the association between child age and PA and SB is moderated by the extent to which parents believe they could influence their child’s PA and SB. Parental beliefs about influence on PA and SB is further moderated by the level of education of the parent.

The three-way interaction identified by the moderated-moderation model could be used to understand how parental level of education interacts with the parental beliefs of how much they could influence their child PA levels. Specifically when parental level of education is between high school and college the interaction is significant. The effects of child’s age on PA and/or SB level do not change along the different levels of education of the parents. We also found the common trend of less PA time and more SB time with an increase in age.

We used a moderation-moderated model approach to understand the complexity of the interactions between factors that are or could be associated with PA and SB in children. Analyses in previous studies have examined either direct associations between predictor and outcome variables and/or a simple moderation model demonstrating that the predictor is moderated by another variable without accounting for other variables that
could influence the moderator variable itself.

In a study examining the associations between parent and child PA levels and the moderating effects of parents’ encouragement, modeling, and perceived influence toward child’s PA, Tate et al. (2014) reported that parent and child MVPA were positively related with each other and that parents’ encouragement to their child to participate in PA moderated this association. That is, as parents’ levels of encouragement increased child’s MVPA increased even if the parent’s MVPA was low. The authors did not report whether parents’ behaviors were moderated by other factors.

Researchers have previously examined the moderating effects of socio-demographic characteristics on the association between neighborhood safety and PA in adults (Carlson et al., 2014). Socio-demographic characteristics as moderators explained some of the variations in the participants’ PA but no other variable was reported to be a moderator of the socio-demographic factor itself. The authors did not report if they explored the possibility of a “moderated-moderation” model to explain the mechanism involved in the interactions between the variables they studied.

In our proposed model the level of education of the parent contributes to their perception of how much they can influence the PA/SB levels of their child, especially if the level of education is high school or at least college level, but the mechanisms of this associations are not well understood. Reports linking parental education with factors like low socio-economic status, and stressful environment at home have reported that the higher the education level of the parents the less the negative impact of such factors on PA participation (Hanson & Chen, 2007; Madsen, McCulloch, & Crawford, 2009). An
argument could be made that higher education levels often provide better social opportunities such as financial sustainability, more time, better transportation, among others factors, and such opportunities could provide better opportunities for their children to be more active and less sedentary (Brown, Hume, Pearson, & Salmon, 2013; O'Connor et al., 2014; Tandon, Zhou, Sallis, & Cain, 2012).

We did not measure how knowledgeable the parents were about the health implications of being physically active and/or being sedentary. Thus the identified influence of parental level of education on their perceptions of how much they can influence their child PA and SB may not necessarily reflect their knowledge of PA and SB as health outcomes. In order to better understand the mechanisms behind the complex interactions between factors that could affect PA and SB in children, future investigations should directly study associations between parental level of education and their knowledge about and attitudes toward PA and SB.

In our study the main predictor of both outcomes, PA and SB, was child age. The moderation effect from parental intentions of influencing those behaviors is not only affected by their level of education and the type of knowledge they have about PA and SB but also by the actual age of their child. This suggests that age should be investigated in future models as a moderator itself of interactions between other known predictors of PA and SB.

This study had strengths and limitations. In addition to the cross-sectional nature of the data, one limitation of the study is that the greatest proportion of questionnaire responses was from mothers. More than 87% of the respondents were mothers leaving the
father’s perspective almost unaccounted for by comparison. Finally, parental perceptions of influencing children PA and SB was assessed by self-reports, opening the possibility for either overestimation and/or underestimation of their own perception of influence on their child’s PA and SB.

**Conclusions**

Our results indicate that the extent to which age predicts Latino children’s PA and SB levels could be moderated by the parent’s perceptions of influence, which in turn may be influenced by the parent’s level of education. The three-way interaction model proposed in our study is an example of how a well-established predictor of a behavior, in this case age of the child predicting PA and SB, may be conditional on other external factors. Those factors not only could affect the predictor/outcome relationship, but may also interact with each other, as in the case of parental level of education interacting with parental perceptions of their influence on their child’s PA and SB levels. The findings suggest that future research of this kind should consider using analytic tools that allow for the analysis and interpretation of more complex models that have more than one factor as a moderator.

Information regarding associations among possible contributors to PA and SB levels in children could be used to design better intervention programs for this population. If the practitioner knows what to expect from the family perspective, he or she can tailor a better program with the family’s needs in mind. Our data support a recommendation that the practitioner consider the parent’s education level and also how the parent perceives their own influence over their child’s PA participation, especially in
older children when a tendency toward a decrease in their activity levels was also reported.
TABLES FOR STUDY TWO
<table>
<thead>
<tr>
<th>Sections</th>
<th>Method of Parental Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demographic characteristics and medical conditions perceived to limit the child’s growth or physical activity</td>
<td>Eight multiple choice questions</td>
</tr>
<tr>
<td>2. Perceptions of their child’s weight for height and physical activity habits/ability.</td>
<td>Five multiple choice questions</td>
</tr>
<tr>
<td>3. Parental levels of concern about the health effects of overweight, their child’s weight status, their degree of influence on their child’s food choices and physical activity habits, and the importance of parents as role models for exercise and dietary habits</td>
<td>Eight questions with five Likert-scale response choices (response options: strongly agree, agree, neutral, disagree, or strongly disagree).</td>
</tr>
<tr>
<td>4. Intentions of the respondent to modify family health behaviors related to diet, physical activity, and television viewing.</td>
<td>Four multiple choice questions</td>
</tr>
<tr>
<td>5. History of medical illnesses (heart attack, stroke, diabetes, and high blood pressure) for the parents and grandparents</td>
<td>For each item, the respondent indicated whether the illness had occurred and whether they believed it was related to smoking, alcohol use, diet, low physical activity, or obesity</td>
</tr>
<tr>
<td>6. Sketches of children</td>
<td>Respondents were requested to circle the drawing that most resembled their child body figure. The middle image in each series of sketches was developed to represent a child at the 50th BMI percentile; other sketches were not tied to particular BMI percentile categories</td>
</tr>
</tbody>
</table>
Table 10. *Child participants’ anthropometric and demographic characteristics*

| Characteristics                          | Males  
|                                         | (N = 37) | Females  
|                                         | (N = 36) | Total  
|                                         | (N = 73) |
|-----------------------------------------|---------|---------|
| Age (yrs)                               | 8.68 ± 1.27 | 9.17 ± 1.25 | 8.92 ± 1.28 |
| Total children in the family             | 2.00 ± .86 | 1.89 ± .62 | 1.94 ± .75 |
| Body mass (kg)                           | 35.08 ± 12.20 | 30.98 ± 7.71 | 33.05 ± 10.37 |
| Body height (cm)                         | 133.47 ± 9.88 | 135.66 ± 10.24 | 134.5 ± 10.05 |
| *BMI (kg/m²)                             | 19.28 ± 4.93 | 16.58 ± 2.27 | 17.95 ± 4.06 |
| BMI %ile                                 | 68.45 ± 29.86 | 44.97 ± 30.42 | 56.87 ± 32.17 |
| †Avg Skinfold (mm)                       | 13.62 ± 7.29 | 11.69 ± 3.27 | 12.67 ± 5.72 |
Table 11. *Parent demographic characteristics*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Male Children (%) (N=37)</th>
<th>Female Children (%) (N=36)</th>
<th>Total Sample (%) (N=73)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married / living with partner</td>
<td>75.7</td>
<td>72.2</td>
<td>74</td>
</tr>
<tr>
<td>Divorce / separated</td>
<td>16.2</td>
<td>16.7</td>
<td>16.4</td>
</tr>
<tr>
<td>Single parent</td>
<td>8.1</td>
<td>8.3</td>
<td>8.2</td>
</tr>
<tr>
<td>Widowed</td>
<td>0.0</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Highest grade of father</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior High school</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>High School</td>
<td>29.7</td>
<td>5.6</td>
<td>17.8</td>
</tr>
<tr>
<td>Some college / 2 yr min</td>
<td>27.0</td>
<td>13.9</td>
<td>20.5</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>21.6</td>
<td>36.1</td>
<td>28.8</td>
</tr>
<tr>
<td>Postgraduate degree</td>
<td>21.6</td>
<td>44.4</td>
<td>32.9</td>
</tr>
<tr>
<td>Highest grade of mother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior high school</td>
<td>0.0</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td>High School</td>
<td>21.6</td>
<td>0.0</td>
<td>11.0</td>
</tr>
<tr>
<td>Some college / 2 yr min</td>
<td>21.6</td>
<td>2.8</td>
<td>12.3</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>29.7</td>
<td>11.1</td>
<td>20.5</td>
</tr>
<tr>
<td>Postgraduate degree</td>
<td>27.0</td>
<td>83.3</td>
<td>54.8</td>
</tr>
</tbody>
</table>
Table 12. *Parental perceptions of their influences on child’s PA.*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Male Children (N=37) (%)</th>
<th>Female Children (N=36) (%)</th>
<th>Within Total Sample (N=73) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can influence my child’s amount of PA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strongly agree</td>
<td>37.8</td>
<td>41.7</td>
<td>39.7</td>
</tr>
<tr>
<td>Agree</td>
<td>48.6</td>
<td>47.2</td>
<td>47.9</td>
</tr>
<tr>
<td>Neutral</td>
<td>10.8</td>
<td>8.3</td>
<td>9.6</td>
</tr>
<tr>
<td>Disagree</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>2.7</td>
<td>2.8</td>
<td>2.7</td>
</tr>
</tbody>
</table>
Table 13. *Accelerometry results*

<table>
<thead>
<tr>
<th>Accelerometry variables</th>
<th>Males (N=37)</th>
<th>Females (N=35)</th>
<th>t-test, df, p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average daily sedentary time in minutes</td>
<td>239.33 ± 74.63</td>
<td>296.24 ± 128.42</td>
<td>t=2.31, df=70, p=0.024</td>
</tr>
<tr>
<td>Average daily MVPA in minutes</td>
<td>126.41 ± 40.73</td>
<td>85.70 ± 42.33</td>
<td>t=-6.02, df=57, p=0.000</td>
</tr>
</tbody>
</table>

*Note.* MVPA = Moderate-to-vigorous physical activity; Independent sample t-test results significant differences at p<0.05
FIGURES FOR STUDY TWO
Figure 3. Three-way interaction conceptual model for child’s age, maternal perception of influence on child's PA and SB, and maternal education level.
Figure 4. Three-way interaction statistical diagram
References


Hayes, A. F., & Matthes, J. (2009). Computational procedures for probing interactions in


Nutrition and Physical Activity, 9, 88–88.


III. DISCUSSION

The two studies discussed in this dissertation provided information on factors associated with PA and SB of Puerto Rican children, with some of those factors coming from the family perceptions, meanings, influences and values. More importantly the information about PA and SB gathered on the two studies was collected by the use of an objective method of assessing PA and SB times.

Physical activity and SB were assessed using accelerometers. The use of accelerometry with children has been reported in the literature outside Puerto Rico for almost two decades, but no major studies using this device with children from the island of Puerto Rico were found in the literature. More work needs to be done with these type of devices in order to understand better the patterns of activity and sedentary behaviors of children who are living outside the continental United States but affected by the economy and policies establish by the US government.

In study one the aim was to examine associations among parental perceptions of weight and health status of their children and their children PA and SB times. It was found that children of parents who had intentions of reducing TV time in their household, had higher times of PA. Such findings are important, as TV time in the family environment is known to be an important factor contributing to both lower and/or higher PA times. Parental perceptions of children’s body weight were also associated with measures of PA and SB. It has been suggested that knowing or having an accurate perception of children’s weight status could interact with PA levels.

Measures of motor skills were also studied in our first study with interesting
results. The skill of throwing and catching was associated with MVPA. In our sample of Puerto Rican children, independent of age and gender, the more skill they demonstrated in this gross motor component the higher the MVPA levels of PA recorded by the accelerometer. However when genders were studied separately, this motor competence showed a positive association only with SB in females, indicating that those female participants with higher levels of this skill were not necessarily more active.

Study two’s aim was to examine personal and contextual factors associated with PA and SB, including the analysis of possible moderators of the relationships among predictor(s) and the outcomes of PA and SB. Results suggested that the association between child age and PA and SB is moderated by the extent to which parents believed they could influence their child’s PA. The level of education of the parent further moderates parental beliefs about influence on PA. These findings suggest a three-way interaction among these factors.

Using a moderated-moderation model it was possible to identify a three-way interaction, and this interaction could be used to understand how parental level of education interacts with the parental beliefs of how much they could influence their child PA levels. Specifically when parental level of education is between high school and college the interaction is significant. The effects of child’s age on PA and/or SB level do not change along the different levels of education of the parents.

In our study the main predictor of both outcomes, PA and SB, was child age. The moderation effect from parental intentions of influencing those behaviors is not only affected by their level of education and the type of knowledge they have about PA and
SB but also by the actual age of their child. This suggest that age should be investigated in future models as a moderator itself of interactions between other known predictors of PA and SB.

This dissertation had strengths and limitations. First, it was limited in the analysis of correlates between PA and SB by BMI subgroups. Similar to King et al. (2011), our study was underpowered for such purposes as our sample was homogeneous within BMI categories. This could be explained by a potential selection bias, as 70% of the sample was children participating in an organized team sport program. Another limitation to be considered for future studies with this population is the analysis of socio economic status (SES) data from the families. Although in our two studies parental education was in part associated with PA and SB and parents’ education can be used as a surrogate measure of SES (Santelli, Lowry, Brener, & Robin, 2000), more specific measures of SES, particularly income, should be considered in future studies. In addition to the cross-sectional nature of the data, another limitation of the dissertation is that the greatest proportion of questionnaire responses was from mothers. More than 87% of the respondents were mothers leaving the father’s perspective almost unaccounted for by comparison. Finally, parental perceptions of influencing children PA and SB was assessed by self-reports, opening the possibility for either overestimation and/or underestimation of their own perception of influence on their child’s PA and SB. Future studies should consider these limitations as well further individual analyses of the regression models to better comprehend the interactions among the variables.

The findings suggest that future research of this kind should consider using
analytic tools that allow for the analysis and interpretation of more complex models that include multiple interactions. Future analyses should consider specific regression modeling for better understanding of the interactions among variables.

Information regarding associations among possible contributors to PA and SB levels in children could be used to design better intervention programs for this population. More specifically, this is one of few studies that has provided information about the Puerto Rican subgroup of the larger Hispanic population. Our data suggest that practitioners should consider the parents’ education level as well as how parents perceive their own influence over their child’s PA participation, especially in older children when a tendency toward a decrease in their activity levels was also reported.
APPENDIX A

DEMOGRAPHIC, MEDICAL & MOTOR QUESTIONNAIRE

Directions: Please answer the following questions. Each item has one answer unless otherwise indicated.

CHILD INFORMATION

1. What is your child’s date of birth? _________ / __________ / __________
   Month    Day    Year

2. What is your child’s sex?
   □ Male
   □ Female

3. What is your child’s race/ethnic background?
   □ White
   □ African American
   □ Hispanic
   □ Asian
   □ Pacific Islander
   □ Native American
   □ Other: _______________________________

4. What is your country of birth? ____________________________

5. If not born in USA, how many years your child has been living here? ________________

6. What is your child preferred spoken language
   □ Spanish
   □ English
   □ Both

FAMILY INFORMATION

7. What is yours’ relationship with the child?
   □ Father
   □ Mother
   □ Grandparent
   □ Other

8. What is yours’ race/ethnic background?
   □ White
   □ African American
   □ Hispanic
   □ Asian
   □ Pacific Islander
   □ Native American
   □ Other: _______________________________
9. What is the child’s mother/father race/ethnic background?

☐ White
☐ African American
☐ Hispanic
☐ Asian
☐ Pacific Islander
☐ Native American
☐ Other: _______________________________

10. What is the child’s grandparent from the mother’s side country of birth?

______________________________

11. What is the child’s grandparent from father’s side country of birth?

______________________________

12. Which best describes your marital status?

☐ Married/ Living with Partner
☐ Divorced/Separated
☐ Single Parent
☐ Widowed

13. What is the highest grade in school that your child’s father completed?

☐ No formal schooling
☐ Elementary school
☐ Junior high school
☐ High school/trade school
☐ Some college/2 year college
☐ Bachelor’s degree
☐ Postgraduate degree
☐ Does not apply/ Don’t know

14. What is the highest grade in school that your child’s mother completed?

☐ No formal schooling
☐ Elementary school
☐ Junior high school
☐ High school/trade school
☐ Some college/2 year college
☐ Bachelor’s degree
☐ Postgraduate degree
☐ Does not apply/ Don’t know

15. How many children are in your family? _________________________

16. Was your child adopted?

☐ No
☐ Yes
If adopted, at what age was your child adopted? _____ years ___ months.
If an international adoption, what was the country of birth? _______________________

MEDICAL/DEVELOPMENTAL INFORMATION

1. Have you been told that your has (or is currently being evaluated for) any of the following? (check all that apply):

☐ Developmental Coordination Disorder/ Dyspraxia/Motor Planning
☐ Anxiety
☐ Attention Deficit Hyperactivity Disorder (ADHD or ADD)
☐ Bipolar Disorder
☐ Depression
☐ Dyslexia
☐ Learning disability
☐ Mental retardation
☐ Obsessive Compulsive Disorder (OCD)
☐ Oppositional Defiant Disorder (ODD)/ Conduct Disorder
☐ Sensory integration disorder
☐ Small for gestational age/Premature <28 weeks gestation/low birth weight
☐ Birth-related disorders
☐ Other: __________________________________________

2. If your child currently takes any prescription medications, please complete the section below:

Please report frequency (daily/weekly/occasionally as needed). Please also indicate if you have been told by a health care professional that these medications have an effect on your child’s appetite (increases or decreases appetite) or energy level (e.g. makes child tired).

<table>
<thead>
<tr>
<th>Name of Medication</th>
<th>Frequency (Please check one below)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MOTOR COORDINATION AND DEVELOPMENT

Please answer the following questions about your child’s development and motor coordination.

3. How old was your child when he/she first walked alone without holding on?
   _____ months
   ☐ I don’t remember
4. Indicate if your child ever received services for poor motor coordination or delayed motor development (Please check all that apply)

<table>
<thead>
<tr>
<th>Service</th>
<th>Past</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early intervention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adapted physical education</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B

Physical Activity Questionnaire

Directions: Please answer the following questions. Each item has one answer unless otherwise indicated.

1. Compared to other children of the same age and sex, my child is:
   - Very Inactive
   - Inactive
   - Typical of other children his/her age in terms of physical activity
   - Active
   - Very Active

2. Compared to other children of the same age and sex, how much does your child like physical activity?
   - Much less than others
   - Somewhat less than others
   - About the same as others
   - Somewhat more than others
   - Much more than others

3. When my child has a choice about how to spend recreational time, my child:
   - Almost always chooses quiet recreation (like TV, reading, playing video games or cards)
   - Usually chooses quiet recreation
   - Is just as likely to choose quiet as active recreation
   - Usually chooses active recreation (like bicycling, dancing, swimming, sports)
   - Almost always chooses active recreation
4. Your child’s participation in physical activity may be limited by many factors. The next series of questions relate to community, family, and social factors.

a. Is your child’s participation in physical activity limited by any of these community factors? (Please check all that apply).

☐ Opportunities in my neighborhood/community are not available or are inadequate.
☐ Opportunities in my neighborhood are too costly.
☐ There is no transportation available for my child to attend opportunities for physical activity.
☐ My neighborhood is not safe.

b. Is your child’s participation in physical activity limited by any of these individual or family factors? (Please check all that apply).

☐ My child has poor motor skills (e.g., coordination, balance, strength, etc.) that make it difficult for him/her to participate in physical activity.
☐ My child has social and/or behavioral problems that make it difficult for him/her to participate.
☐ My child has learning problems that make it difficult for him/her to participate.
☐ My child requires too much supervision to participate.
☐ Sports and physical activities are over-stimulating for my child.
☐ Making sure my child gets exercise is too time-consuming for me.
☐ It is difficult to make the necessary arrangements for my child to participate.

c. Is your child’s participation in physical activity limited by any of these social factors? (Please check all that apply).

☐ My child has difficulty with social skills that make participation in physical activity difficult.
☐ My child has no friends to play with.
☐ Adults who run activities do not make my child feel welcome.
☐ Adults who run activities lack the skills they need to be able to include my child successfully.
☐ Children participating in activities reject my child and do not allow him/her to participate.
If there are other factors that limit your child’s participation in physical activity, please indicate below.

☐ Other – please specify:

________________________________________________________________

5. **Physical activities and team sports**: Think about your child’s different types of physical activity of the last year (team sports, play, and activities with friends). On average, please estimate the amount of HOURS PER WEEK spent on the following activities. (Note: many of these activities do not apply to younger children)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Fall Hours/wk</th>
<th>Winter Hours/wk</th>
<th>Spring Hours/wk</th>
<th>Summer Hours/wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseball/Softball</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basketball</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheerleading</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross-Country or Downhill Skiing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dancing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Football</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golf</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gymnastics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hiking/Backpacking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hockey: Ice, Floor, Field</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horseback Riding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Karate or other martial arts program</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playing outside/playground play</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skating: Ice, Roller, Roller blading or skateboarding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soccer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swimming</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tag, pick-up street games</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tennis/Racquet Sports</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Track and Field</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volleyball</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6. For other activities your child is involved in, outside of the regular school day, please indicate the season, frequency and time spent (HOURS PER WEEK).

<table>
<thead>
<tr>
<th>Activity</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours/wk</td>
<td>Hours/wk</td>
<td>Hours/wk</td>
<td>Hours/wk</td>
</tr>
<tr>
<td>Arts classes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choir and/or choral group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Band or Orchestra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Music Lessons</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scouts (Girl Scouts, Boy Scouts, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drama groups</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Over the past month, on average, how many HOURS PER DAY did your child spend sitting (or lying down) engaged in the following activities:

<table>
<thead>
<tr>
<th>Activity</th>
<th>HOURS PER DAY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weekdays</td>
</tr>
<tr>
<td></td>
<td>Weekend Days</td>
</tr>
<tr>
<td>Reading</td>
<td></td>
</tr>
<tr>
<td>Watching Television/Video/DVD</td>
<td></td>
</tr>
<tr>
<td>Video Games</td>
<td></td>
</tr>
<tr>
<td>Computer Use (e.g., games, Internet)</td>
<td></td>
</tr>
<tr>
<td>Riding in a Car (include time riding to school)</td>
<td></td>
</tr>
</tbody>
</table>
8. On how many of the *past 7 days* did YOUR CHILD exercise or participate in physical activity for at least 20 minutes that made your child sweat and breathe hard, such as basketball, running, swimming laps, tennis, fast bicycling or similar aerobic activities?

___ days

9. On how many of the *past 7 days* did YOU exercise or participate in physical activity for at least 20 minutes that made you sweat and breathe hard, such as basketball, running, swimming laps, tennis, fast bicycling or similar aerobic activities?

___ days

10. On how many of the *past 7 days* did YOUR SPOUSE/PARTNER exercise or participate in physical activity for at least 20 minutes that made him/her sweat and breathe hard, such as basketball, running, swimming laps, tennis, fast bicycling or similar aerobic activities?

___ days

☐ Does not apply

11. How important is physical activity or exercise to you?

☐ Very important
☐ Somewhat important
☐ Not very important
☐ Not important at all

12. How important is physical activity or exercise to your spouse/partner?

☐ Very important
☐ Somewhat important
☐ Not very important
☐ Not important at all
☐ Does not apply

Thank you for completing this survey.
5. Compared to other children of the same age and sex, how would you rate your child’s motor skills?

a. Gross motor skills (e.g. sports, swimming, playground, running)

☐ Much better than others
☐ Somewhat better than others
☐ About the same as others
☐ Somewhat worse than others
☐ Much worse than others

b. Fine motor skills (e.g. handwriting, cutting, coloring)

☐ Much better than others
☐ Somewhat better than others
☐ About the same as others
☐ Somewhat worse than others
☐ Much worse than others

6. Please indicate with a check if your child’s motor coordination problems have resulted in difficulty in any of the following (more than would be expected for your child’s age):

<table>
<thead>
<tr>
<th>Has your child ever had difficulty with any of the following?</th>
<th>Past</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Please check all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dressing independently (including fasteners)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting dressed in a timely fashion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buttoning buttons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tying shoes or learning to tie shoes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using a fork and knife at meals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening containers such as juice box or milk carton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pouring from containers without spilling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riding a tricycle using pedals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riding a bicycle without training wheels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handwriting is slow or illegible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using scissors and other art materials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Throwing, catching and kicking balls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playing sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playing age appropriate sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pumping swing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gym class in school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playing on the playground or at recess with peers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning new motor skills or sports</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Playing structured in-school or after school activities (karate class, gymnastics, swimming, dance, yoga, basketball, soccer)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dealing cards</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Learning to type on the keyboard
Opening door knobs and door handles
Using a key in a door
Household chores such as setting the table, washing the dishes, assisting with cooking (chopping food)

5. Additional comments regarding your child’s motor abilities:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Thank you for completing this questionnaire!
APPENDIX C

PERCEPTIONS OF CHILD APPEARANCE AND HEALTH

This survey is for parents and guardians of children from 2-17 years old.

1. Today’s date: _____/_____/_____

2. Child’s birth date: _____/_____/_____

3. Child’s sex:
   □ Male
   □ Female

4. What is your relationship with child?
   □ Mother
   □ Father
   □ Other, (describe ________________)

5. What is your highest grade completed?
   (Check one)
   □ Did not finish high school
   □ High school graduate or GED
   □ Some college or trade school
   □ College graduate
   □ Post-graduate degree

6. Does your child have any medical condition that has limited his or her growth?
   □ No
   □ Yes (describe ________________)

7. Does your child have any medical condition that limits his/her physical activity?
   □ No
   □ Yes (what ________________)

8. Child’s race/ethnicity:
   □ Asian/ Pacific Islander
   □ Black/African-American
   □ Hispanic
   □ White/Caucasian
   □ Other (describe ________________)

9. I feel my child is...
   □ underweight
   □ a little underweight
   □ about the right weight
   □ a little overweight
   □ overweight

10. Did you child’s doctor ever tell you that your child is gaining weight too fast or is overweight?
    □ No
    □ Yes
    □ I don’t know

11. About how many days per week does your child participate in active physical exercise for at least 20-30 minutes (such as running, biking, sports or active playing)?
    □ 6-7 days each week
    □ 3-5 days each week
    □ 1-2 days each week or less
    □ I don’t know

   For the next two questions, compare your child with other children of the same age.

12. In summer weather, my child participates in active physical exercise...
    □ more hours/week than other children
    □ about the same number of hours/week as other children
    □ fewer hours/week than other children

13. When my child runs, he/she is usually...
    □ faster than other children
    □ about as fast as other children
    □ slower than other children

Practice # _____ Survey _________
| 14. How strongly do you agree or disagree with each of the following statements?  
(Check one box for each statement.) | Strongly agree | Agree | Neutral | Disagree | Strongly disagree |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I can influence my child's food choices.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I can influence my child's amount of physical activity.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I am worried about my child's weight right now.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Overweight children are likely to be overweight as adults.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Overweight children are more likely to develop diabetes (high blood sugar) than children who are not overweight.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Overweight children are more likely to have problems in their social relationships with other children than children who are not overweight.</td>
<td>☐(581,710),(623,738)</td>
<td>☐(630,710),(672,738)</td>
<td>☐(679,710),(721,738)</td>
<td>☐(729,710),(771,738)</td>
<td>☐(778,710),(820,738)</td>
</tr>
<tr>
<td>Children will exercise more if their parents exercise regularly.</td>
<td>☐(581,757),(623,785)</td>
<td>☐(630,757),(672,785)</td>
<td>☐(679,757),(721,785)</td>
<td>☐(729,757),(771,785)</td>
<td>☐(778,757),(820,785)</td>
</tr>
<tr>
<td>Eating habits of parents influence the eating habits of their children.</td>
<td>☐(581,803),(623,831)</td>
<td>☐(630,803),(672,831)</td>
<td>☐(679,803),(721,831)</td>
<td>☐(729,803),(771,831)</td>
<td>☐(778,803),(820,831)</td>
</tr>
</tbody>
</table>
15. (Check one box for each statement.)

<table>
<thead>
<tr>
<th>I probably will try.</th>
<th>I probably will not try.</th>
<th>I already do this</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>During the next month, I intend to get 30 minutes of physical exercise at least 5 days per week.</strong></td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td><strong>During the next month, I intend to buy less junk food when I shop.</strong></td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td><strong>During the next month, I intend to limit the amount of juice and sweetened beverages (regular soda, Kool Aid, sports drinks, etc.) that my child drinks to 2 cups a day (or less).</strong></td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td><strong>During the next month, I intend to limit my child’s daily television viewing to 2 hours per day (or less).</strong></td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
16. Has the child's parent or grandparent had a heart attack?

- [ ] No  
- [ ] I don’t know  
- [ ] Yes  

If yes, do you believe the heart attack was related to: (Check all that apply, or NONE)

- Smoking
- Alcohol use
- Diet
- Low physical activity
- Obesity
- NONE

17. Has the child's parent or grandparent had a stroke?

- [ ] No  
- [ ] I don’t know  
- [ ] Yes  

If yes, do you believe the stroke was related to: (Check all that apply, or NONE)

- Smoking
- Alcohol use
- Diet
- Low physical activity
- Obesity
- NONE

18. Does the child's parent, grandparent, bother or sister have diabetes (high sugar)?

- [ ] No  
- [ ] I don’t know  
- [ ] Yes  

If yes, do you believe the diabetes was related to: (Check all that apply, or NONE)

- Smoking
- Alcohol use
- Diet
- Low physical activity
- Obesity
- NONE

19. Does the child's parent, grandparent, bother or sister have high blood pressure?

- [ ] No  
- [ ] I don’t know  
- [ ] Yes  

If yes, do you believe the high blood pressure was related to: (Check all that apply, or NONE)

- Smoking
- Alcohol use
- Diet
- Low physical activity
- Obesity
- NONE

Next
Cumulative References


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Movement Assessment Battery for Children-2.


CURRICULUM VITAE

EDUCATION:

2015  PhD, Rehabilitation Sciences, concentration: Activity, Participation and Environment - Boston University | Boston, Massachusetts

Dissertation: The association between parent and child variables and physical activity and sedentary behaviors in Puerto Rican children. – Dr. Wendy Coster, Chair/Mentor

1996  Master of Science, Exercise Science - Northern Michigan University | Marquette, Michigan

Thesis: Validity of the Caltrac accelerometer in measuring caloric expenditure during a 20-minute walk - Dr. Randall Jenssen, Advisor

1994  B. A., Physical Education - University of Puerto Rico | Rio Piedras, Puerto Rico

RESEARCH EXPERIENCE:

2006 – 2008  Research Assistant – Rehabilitation Sciences Department
Boston University | Boston, Massachusetts
University of Massachusetts Medical School Shriver Center, Waltham, Massachusetts

Study Title: Physical Activity, Fitness and Obesity in Children with Developmental Coordination Disorders – NIH/NICHD – Grant number 1R21HD051861-01, Dr. Sharon Cermak – PI, Dr. Linda Bandini – Co-PI, Dr. Aviva Must – Co-PI

- Coordinate recruitment of participants
- Participants’ evaluations using the following tools: Actical accelerometers, Movement ABC Motor Proficiency Test, Polar Heart Rate Monitors, OMNI Scale of Perceived Exertion, and the fitness components of The Bruininks-Oseretsky Test of Motor Proficiency-2
- Conducted statistical analysis of accelerometry and fitness data
1994 – 1996  Research Assistant – Exercise and Health Sciences Department
Northern Michigan University | Marquette, Michigan

- Measurement technician for different studies related to sport performance – Supervised by Dr. Phil Watts, and Dr. Randall Jenssen

PROFESSIONAL CAREER HISTORY:

2008 – Present  Full Time Lecturer – Exercise and Health Sciences Department
University of Massachusetts | Boston -Lecturer for Undergraduate Courses

- Research Methods – EHS 460 and EHS 470
- Exercise Physiology and Laboratory – EHS 380
- Fitness and Wellness – EHS 160
- Exercise and Aging – EHS 320

2004 – 2006  Instructor – Physical Education and Exercise Sciences Department
Turabo University, Caguas, PR | Puerto Rico - Lecturer for Master Degree Program

- Advanced Exercise Physiology I and II
- Advanced Research Methods

2002 – 2006  Instructor – Exercise Science
Sacred Heart University | San Juan, Puerto Rico

- Exercise Physiology

2002 – 2005  Instructor – Exercise Science
University of Puerto Rico | Ponce, Puerto Rico

- Exercise Physiology
- Research Methods
2002 – 2005  
**Teacher – Health and Physical Education**

*Colegio San Jose Private School | San Juan, Puerto Rico*

- Teaching health and physical education courses to high school students
- Develop strength and conditioning programs for the student athletes of different sports

2000 – 2005  
**Consultant – Youth Sports Performance**

*Performance Developers and Consultants, Inc. | San Juan, Puerto Rico*

- Physiological evaluations of young athletes
- Evaluations of sports skills of young athletes
- Develop strength and conditioning programs for young athletes participating in different sports
- Evaluation of conditioning programs of young athletes

1999 – 2005  
**Consultant**

*Department of Sports and Recreation for the Government | Puerto Rico*

- Develop and evaluate physical conditioning program for the community elite sport programs

**AWARDS, DISTINCTIONS, AND FELLOWSHIPS:**

- Federation of American Societies for Experimental Biology (FASEB)
Boston University

- Doctoral Fellowship from the College of Health and Rehabilitation Sciences at Boston University 2013 – 2014
- Sargent College of Health and Rehabilitation Sciences’ Dudley Allen Research Grant – 2008
- Science Day Sargent College Dean’s Award – Award for poster presented at Annual Research Symposium at Boston University – 2008

American College of Sports Medicine

- Leadership & Diversity Training Program Fellowship - 2010-2011 and 2011-2012

PROFESSIONAL ORGANIZATIONS:

2013 – present  The Obesity Society
1996 – present  American College of Sports Medicine
2008 – present  New England Chapter of the American College of Sports Medicine
1993 – present  Physical Education and Recreation Association of Puerto Rico

SERVICE:

2015 to 2018  Appointed to the Membership Committee
American College of Sports Medicine | National – appointed by Dr. Larry Armstrong, president.

2008 – 2013  Massachusetts’ Representative
New England Chapter of the American College of Sports Medicine

1993 – 1994  Secretary
Physical Education and Recreation Association of Puerto Rico
LANGUAGES:

- Fully bilingual – English and Spanish

PUBLICATIONS:


In Progress

- Muñoz, M., Crouter, S. E., Coster, W., Orsmond, G., & Gill, S. Fitness and family behaviors associated with physical activity and sedentary time in Latino children living in Puerto Rico.

- Muñoz, M., Coster, W., Orsmond, G., & Gill., S. Personal and contextual factors associated with physical activity and sedentary behavior in Puerto Rican Children: A moderated-moderation model.


REVIEWER:

- Preventive Medicine – Manuscript for publication Spring 2015


LECTURES AND PRESENTATIONS:

Refereed Presentations


• Marquez, D. X., **Muñoz, M.,** & Martinez, V. (2014, May) *Yes, we are Latinos. No, we are not the same: Considering cultural differences when designing interventions programs for the Latino population.* Tutorial lecture presented at the Annual Conference of the American College of Sports Medicine, Orlando, FL.


**Instructional Presentations**

• **Muñoz, M.,** Beyond Physical Activity and Nutrition: Other Factors Associated with Childhood Obesity in Hispanic Children – Keynote Lecturer at the Annual Conference of the Puerto Rico’s Association for Physical Education and Recreation, San German, PR, October 2013

• Armstrong, L., **Muñoz, M.,** Looking Toward 2025: The Future of Technology in Sports Medicine and Exercise Sciences – Colloquium presented at the Fall Conference of the New England Chapter of the American College of Sports Medicine, Providence, RI, November, 2011

• **Muñoz, M.,** Physical Activity Participation in Children with Developmental Coordination Disorder – Lecture to the fellow residents in pediatrics at Boston Medical Center, Boston, MA, October, 2011
• Muñoz, M., Developmental Coordination Disorder and Self-efficacy Towards Physical Activity in Children – Slide presentation at the PRAAPHERD First Annual Conference, Dorado, PR, August, 2010

• Muñoz, M., Physical and Academic Fatigue of the Student Athlete – Lecture to participants of the Catholic Schools Annual Convention, San Juan, PR, January, 2003

• Muñoz, M., How to Attract Young Participants to Wellness Programs to Increase Their Health Status – Presentation at the Annual Conference of the Physical Education and Recreation Association of Puerto Rico, December 2001

• Muñoz, M., Exercise Physiology and Children in Sports – X International Congress of Children and Sport, Dominican Republic, March 2001