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# Family Characteristics Associated with Parents' Knowledge and Beliefs Regarding Preschoolers' Physical Activity

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FAMILY CHARACTERISTICS ASSOCIATED WITH PARENTS' KNOWLEDGE AND  
BELIEFS REGARDING PRESCHOOLERS' PHYSICAL ACTIVITY

By:

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Undergraduate Research Project

Laramie, Wyoming

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**Abstract**

The obesity epidemic has been rising in magnitude for several decades and has spread its influence to include children of all ages. Much research has been done to examine the effect that physical activity (PA) has on an individual's weight. The amount of PA that children participate in is mediated by various factors: high socioeconomic status, access to green space, having a sibling, and parental support for PA are all associated with greater child PA. While all of these factors influence PA participation, their concurrent effect is unknown. A holistic perspective is imperative to the understanding of childhood PA, as children are not experiencing just one of these influences at a given time.

The purpose of this project was to determine how family characteristics, including number of siblings and socioeconomic status, are associated with parental behaviors, knowledge, and beliefs regarding child's PA. A secondary goal was to determine how child PA varies according to family characteristics. Of special interest is the role of siblings and birth order in determining preschooler PA (min/day) and whether or not children participate in rough and tumble play. Parent and family characteristics, child PA, and parental knowledge and beliefs regarding child PA were assessed via a web-based survey (modified Preschool Physical Activity Questionnaire, Pre-PAQ). Linear regression and logistic regression analyses were used to determine variation in child PA and parenting behaviors according to family characteristics.

## **Review of Literature**

### ***Introduction***

The rate of obesity has been on the rise for many years and is now considered to be at epidemic proportions. While many still associate this epidemic with the adult population, it has become a significant health concern for youth, as the prevalence of obesity is approximately 17% (Ogden, Carroll, Lawman, Fryar, Kruszon-Moran, Kit, & Flegal 2016). Obesity, among adults and children, is correlated with many other health conditions, such as hypertension, atherosclerosis, insulin resistance, sleep apnea, and depression (Daniels 2006).

Physical activity is an oft-cited means to prevent or treat overweight and obesity. The benefits of PA are numerous and well documented. These benefits include lowered blood pressure; improved cardiovascular health; improved bone structure and density; improved hormonal function; reduced mental stress, anxiety, and depression; and improved body image and self-esteem (Sothorn, Loftin, Suskind, Udall, Blecker 1999). As such, various organizations have published PA recommendations for different populations. American preschoolers are recommended to participate in a total of at least sixty (60) minutes of both structured and unstructured PA each day, while not being sedentary for longer than sixty (60) minutes at time (SHAPE America). Only forty-two percent (42%) of children aged six through eleven are meeting similar recommendations (Troiano, Berrigan, Dodd, Masse, Tilert, & McDowell 2008). While at a preschool facility, only approximately half of enrolled children are participating in at least fifteen minutes of PA each hour (Pate, O'Neill, Brown, Pfeiffer, Dowda, & Addy 2015). These discrepancies may be partially explained by factors such as socioeconomic status, number of siblings, parenting behaviors experienced, and the home environment.

Participation in PA is mediated by family characteristics and the environment that the family experiences. Characteristics such as parent marital status, education level, and income have an effect on the PA level of the child(ren) within the family. Generally, those families that are considered more affluent have higher PA levels for both the parent and the child. The environment that the family experiences can be considered from two perspectives – the built environment and the interpretation of that environment, which leads to perceptions of safety. If an area has more green space or park land, there is an increase in the amount of PA that those in the area engage in.

### *Markers of Socioeconomic Status*

Socioeconomic status (SES) generally refers to the total measure of a person or family's position in society as determined by their income, education, and occupation. This is often an indicator of the relative advantage that the family experience. SES of the neighborhood in general influences an adult's activity level, and the influence of SES on childhood or adolescent PA is garnering more interest (Yen & Kaplan 1998).

Obese adults and children often have a lower income (Pachucki, Lovenheim, & Harding 2014). While causality is not determined, this association may help explain the greater clustering of health issues in those who are of a lower SES seen in both adults and children (Fernandez-Alvira, te Velde, Singh, Jimenez-Pavon, Bourdeauduij, Manios, Kovacs, Jan, Moreno, & Brug 2014). Education level is also associated with amounts of PA. In families where the parent is more highly educated, the children and the parent were more physically active than those who obtained a lower level of education (Fernandez-Alvira, et al. 2014). These findings support the belief that higher SES is associated with greater health, but they do not account for the

confounding advantages that those of a higher SES experience, such as neighborhood characteristics.

Simply stated, markers of more advantaged areas are associated with increased levels of PA (Lovasi, Jacobson, Quinn, Neckerman, Ashby-Thompson, & Rundle 2011). These markers may include more green open space near the home, street trees, the presence of clean sidewalks, and transportation stop density (Evans, Jones-Rounds, Belojevic, & Vermeulen 2012; Lovasi, et al. 2011). For instance, there is generally more green space around neighborhoods that have higher average incomes. The children living in these areas were more physically active than their counterparts living in less affluent areas (Evans, et al. 2012).

Families with a greater SES, whether via income level or education level, tend to be more physically active. This may be due to a more affluent neighborhood and the benefits therefore experienced. While some studies have found an association between SES and PA, most simply adjust for SES rather than determining whether differences occur at varying statuses.

### *Siblings*

Approximately half of all families in the United States have multiple children (US Census Bureau). Siblings spend a large amount of their time together, often separately from their parents, which might be in a greater amount than that spent with their parents (McHale, Updegraff, & Whiteman 2014; Pachucki, et al. 2014). This time can have a significant influence on the behavior of each child. The PA of one child may play a role in determining the PA of the other children in the family. This role varies depending upon the birth order of the children; if the older sibling is more active, it may lead the younger sibling to be more active in turn. This is a traditionally understudied aspect of the family environment.

The strength of the relationship between sibling activity levels may be mediated by how well the children get along. If the children have a closer, more intimate relationship, they experience an increased amount of activity (Umadevi, Whiteman, & Jensen 2014). When siblings encourage each other, as they often do in agreeable relationships, there is an increase in child PA both during after-school and lunch-time activities (Hohepa, Scragg, Schofield, Kolt, & Schaaf 2007). Interestingly, if the siblings do not get along and experience conflict in their relationship, there is no effect on the amount of activity that either child participates in (Umadevi, et al. 2014). Additionally, if siblings are discordant in their weight status, their PA habits are not similar (Roemmich, White, Paluch, & Epstein 2010).

Siblings demonstrate many trait and behavior similarities. Sibling obesity status is more closely associated with each other than with their parent's obesity status, which could be partially genetic and partially because PA habits are stronger between siblings than between children under eighteen years old and their parents (Duncan, Duncan, Strycker, & Chaumeton 2004; Liu, Wiehe, & Aalsma 2014; Pachucki, et al. 2014). These influences have been rightly noticed by parents, as they perceive that their children are influencing each other's activity choices (Edwards, Jago, Sebire, Kesten, Pool, & Thompson 2015). If children have siblings in general, they are found to be less sedentary, and therefore more active, than those without siblings (Pachucki, et al. 2014). If children have active siblings, there is a greater likelihood that the target child will be more physically active as well (Crawford, Cleland, Timperio, & Salmon 2010).

Birth order may play a role in the activity level of each individual child. Children who are born later (are the younger sibling) are often both more obese and more active (Pachucki, et al. 2014). These younger siblings also experience more freedom to go where they please than their

older sibling likely had at a given age. This is due to parent perception that a park is safer for the children to be at if a sibling is with them (Berge, Meyer, MacLehose, Loth, & Neumark-Sztainer 2016). Older children would not have had a sibling to go with them and would have been more dependent upon their parents for access to the park, whereas the younger sibling may have more opportunity to engage in PA.

The presence of siblings is an interesting factor to consider when evaluating child PA. Siblings have more closely related PA levels with each other than they do with their parents and they are generally more active simply by having a sibling. Previous literature has not focused on the birth order of the children and how that may affect the activity of either the younger or the older sibling. There has also been a lack of information on how the number of siblings may affect PA, as the maximum number of siblings included in studies is consistently two. Investigating only two children in a family does not necessarily capture the characteristics and behaviors of a “large” family.

### *Parenting Behaviors*

The behaviors of parents have a direct influence on children’s activity levels. This influence may be through support/encouragement or modeling. Encouragement occurs when a parent demonstrates supportive behavior to their child regarding PA, such as suggesting that a child play sport related games. Modeling can be either direct or indirect. This means that parents can participate in activities with their children, in front of their children, or out of sight of their children. This might manifest as a parent going for a hike with their child (direct) or doing a home workout before picking their child up from daycare while still in their workout clothes (indirect).

In families that have less active parents, encouragement becomes a more important factor (Tate, Shah, Jones, Pentz, Liao, & Dunton 2015). The amount of encouragement that a child receives from their parents can influence their activity levels both away from and at home. When children are at child-care, they are likely less active if their parents do not encourage them (Tucker, van Zandvoort, Burke, & Irwin 2011). When children are at lunch during their school day, they are more active if their parents exhibit more supportive behavior (Hohepa, et al. 2007). When children leave school and when they are at home, they have higher amounts of PA with supportive parents (Hohepa, et al. 2007; Loprinzi & Trost 2010). These effects of encouraging behaviors are seen regardless of whether the children are discordant for weight status – if one child is overweight while their sibling is of normal weight. Parents display the same behaviors for both siblings regardless of their weight status (Berge, et al. 2016).

Modeling behaviors is a known major influencer of children's behaviors. When parent and child PA habits are evaluated, there is a significant similarity between the two sets of information. These associations can be gender-specific or generalized for the whole family. When comparing the habits of daughters with their mothers, it has been shown that sedentary time is correlated, while there was no association for their PA habits (Jago, Fox, Page, Brockman, & Thompson 2010). Contrary to Jago, *et al.* (2010), it has been suggested that there is a gender-specific association for PA habits (Schoeppe, Liersch, Robl, Krauth, & Walter 2016). There are many counts of nonspecific associations between parent modeling and child PA (Crawford, et al. 2010; Schoeppe, et al. 2016; Tate, et al. 2015; and Tucker, et al. 2011). In addition, when a family engages in exercise together, regardless of overall activity level, there is an increase in amounts of child PA (Mulhall, Reis, & Begum 2011).

In general, when parents encourage their children to be active or model this activity, their children have higher amounts of PA. This makes intuitive sense, as many children do as their parents tell them and try to mimic the behaviors of their parents. What is unknown regarding modeling and encouragement is how siblings may affect child PA habits. Children may shape the behavior of their siblings in a similar fashion to that of their parents. This link has the potential to alter the ways in which we create intervention programs for families.

### *Environmental Factors*

The environment a family lives in can influence their activity levels in a variety of ways – through the built environment and parents’ perceived safety of the area. The built environment includes aspects associated with the rurality or urbanity of the area or the amount of park space available. Income levels of families in the area are often associated with the built environment, as families with higher SES are more frequently able to afford living in nicer neighborhoods. Parenting behaviors may be influenced by the perceptions of the neighborhood. If the parent feels their area is safe, they may feel more comfortable allowing their children to play outside.

The built environment is often assessed using geographical information software that analyzes the intended use of land in an area. These measurements are objective and are used quantitatively. It has been shown that areas with mixed land use, which incorporate parks, and that have more open green space are associated with an increase in child PA (Evans, et al. 2012; Lovasi, et al. 2011). In contrast, children are less active in rural areas that arguably have ample “open” space (Hessler, 2009). It has also been found that areas with greater amounts of traffic are associated with decreased child PA (Crawford, et al. 2010). These results, together, imply that areas that may be considered suburban are ideal for child PA.

Parental perceptions of the environment may be more important than the actual environment as it influences whether the family will actually interact with their environment. For instance, when an environment is perceived by the parent as “good”, there is an increase in non-organized PA, implying that this is leisure-time activity engaged in for play or pleasure (Mota, Almeida, Santos, Tibeiro, & Santos 2009). It has also been seen that those who participate in organized activities live in areas that are termed “good,” which may be a function of SES (Mota, et al. 2009). Another finding that may be a function of SES is that of increased PA when the park is perceived as being within an appropriate walking distance from the home (Babey, Tan, Wolstein, & Diamant 2015). This study also found that, when children visited the park nearby, most of them were active on their last trip (Babey, et al. 2015). Interestingly, it has been demonstrated that some parents did not think it was safe for their children between the ages of eight and fifteen to be at the park by themselves, yet parent perceptions of safety were not associated with child PA in the same age range (Christian, Villanueva, Klinker, Knulman, Divittini, & Giles-Corti 2014; Liu, et al. 2014). This may suggest that parental perceptions of the environment are greater influencers when the child’s access to activity is dependent upon their parent.

The built environment influences child activity levels, but this influence may be partially explained by the SES of the family and neighborhood. Additionally, rurality and high amounts of traffic have a negative effect on child PA. Perceptions of the neighborhood are more difficult to quantify and are less often examined. A select number of studies have focused on the perceptions of the neighborhood, but few have focused on the safety of the environment in particular.

### *Conclusion of Literature Review*

The literature review shows that SES, the presence of siblings, parenting behaviors, and environmental factors all influence the activity level of those younger than eighteen years old. If a family is of a higher SES, the children are more physically active. When a family has more than one child, both children are more active than those in single child families. Children whose parents model PA and are more encouraging have more active habits. Families who live in “good” areas and perceive that their neighborhood is safe have higher activity as well.

Previous research has investigated the PA habits, and the factors that influence these habits, in youth. However, within this evaluation of youth, there has been a primary focus on adolescents. Youth is a time when there are dramatic changes and is best subdivided. While literature has evaluated the PA habits of school-aged children and adolescents, there is a lack of information relevant to preschoolers (aged 2-5y/o).

Research on the effects of the number of siblings and the birth order of siblings has been increasing. However, there is still inconclusive information for realistic families. The literature revealed that there are various associations found between siblings, but these results are all taken from studies that only evaluate up to two children. This does not take into account whether those particular families had additional children. While it does reflect the average number of children in American households (1.92), it does not explain the experiences of children in “large” families (2010 US Census).

The majority of the existing research examines one variable or category of variables in relation to the target child’s activity level. This does not control for the confounding effects of a real-world experience. Children in the families that participated in these studies were experiencing all of the factors described above, not just one or one category. To gain a true

understanding of the effects that these factors have on preschoolers' PA habits, a holistic approach is needed. These are all related and can influence each other in addition to the child's habits.

### **Purpose of Study**

This study has two aims. The first was to determine how family characteristics, including number of siblings and socioeconomic status, are associated with parental behaviors, knowledge, and beliefs regarding child's physical activity. The second was to determine how child physical activity varies according to family characteristics.

### *Hypotheses*

As supported by previous research, I predicted that:

1. Children with more siblings receive less modeling and encouragement from their parents.
2. Parents of more children perceive them as safer.
3. Children with more siblings are more physically active.

### **Methods**

Parents who identify as the primary caregiver of a child between the ages of 2 and 5 years were invited to complete a modified, online version of the Preschool Physical Activity Questionnaire (Pre-PAQ) to assess parenting practices and physical activity (PA) behaviors. Participants were recruited via advertisements on social media, email, and word of mouth. Parents providing an email address were invited to participate again each season for one year (4

times). If parents had more than one child within the age-range, they were asked to complete the survey for the youngest child within the specified range. Data reported here were collected in February 2016.

### *Demographics*

Parent demographics included age in 10-year intervals (<20 y, 20-29 y, 30-39 y, 40-49 y, and  $\geq 50$  y), gender, marital status, level of education (less than high school, high school graduate, some college, associate's degree or equivalent, bachelor's degree or equivalent, post-graduate degree), partner's level of education, and relationship to focal child. Zip code was also requested and used to identify climate regions. Family demographics included age and gender of any other children living in the household. Parents were also asked to report their child's age and date of birth (used to calculate chronologic age), as well as the child's gender.

### *Parent Physical Activity*

The Pre-PAQ includes an assessment of parental physical activity. Questions ask parents to recall their own activity over the past week, including walking continuously without stopping for at least 10 minutes, other moderate activities including gentle swimming, social tennis, etc., and vigorous activities such as running, cycling, and heavy aerobics. For each activity the parent reported engaging in, they were prompted to enter the total time in minutes they spent engaged in that activity in the previous week. Responses to these questions were then used to calculate weekly minutes of walking, moderate physical activity (MPA), vigorous physical activity (VPA), and moderate-to-vigorous physical activity (MVPA). Parents were then classified according to whether or not they engaged in sufficient PA to meet national recommendations (150 min/week

of MVPA). Additional prompts regarding sedentary time included time spent watching TV, videos, or DVDs, playing electronic games, or using a computer for leisure activities in the past week.

### *Child Physical Activity*

Child PA was assessed as participation in PA “last week,” “yesterday,” and “last weekend.” Survey questions probed about a variety of activities, which include engagement in active outdoor play, walking for transportation, and participation in outdoor activities. The survey then prompted parents to report how much time, in minutes, their child spent engaged in 15 physical activities, ranging from sedentary through vigorous intensity, “yesterday” (referring to the most recent weekday the parent was home with the focal child) and “last weekend.” Additional prompts include suitability of the weather for playing outside, type of and time spent in childcare settings, and time spent traveling in a car. Weekday and weekend PA responses were combined to create an average of time spent being physically active per week.

### *Parenting Practices*

Parenting practices were assessed using various questions in the Pre-PAQ. Specific questions regarding parenting behaviors, such as modeling, can be seen in Table 1. These questions were scored on a five-point Likert scale, where 1 equals never and 5 equals always. Questions about the perceived safety of the home environment can be seen in Table 2. These questions were scored on a four-point Likert scale, where 1 equals strongly agree and 4 equals strongly disagree. Any items related to perceived risks that would have designated a desirable, safe neighborhood if selected as “strongly agree” were reverse coded. The scores of all items

related to danger were added together to reflect a composite danger score, where lower scores represent a less desirable, more dangerous neighborhood.

**Table 1.** Items that assess parenting practices and beliefs about a child in the Pre-PAQ, scored on a five-point Likert scale, from never to all the time.

I encourage my child to play outside when the weather is suitable.
I am physically active with or in front of my child
I limit what my child does as I worry that he/she may injure themselves
My child needs me to motivate him/her to play
My child needs company (e.g. friends, siblings, parents, adults) to be motivated to play

**Table 2.** Perceptions of neighborhood safety items in the Pre-PAQ that were scored on a four-point Likert scale from strongly agree to strongly disagree. Question 4 was multiplied by -1 to indicate reverse scoring.

There are major barriers or dangers to walking with my child in my neighborhood that make it hard to get from place to place (for example, major roads, railroad tracks, creeks and streams, storm water drains or rivers)
There is so much traffic along the streets that it makes it difficult or dangerous to walk with my child around the neighborhood
There are sufficient traffic lights or pedestrian crossings to make it safe to walk with my child around my neighborhood
The level of crime in my neighborhood makes it unsafe to go on walks with my child during the day
There are dangers (e.g. dogs, undesirable people in the local park(s) so I avoid taking my child there

*Statistical Analyses*

All statistical analyses were performed using SPSS Software, version 24 for Mac, with a 5% type 1 error rate. The National Institutes of Health define a child as a person under twelve years of age, while a preschooler is between the ages of two and five years old. This study used the same definition for all statistics.

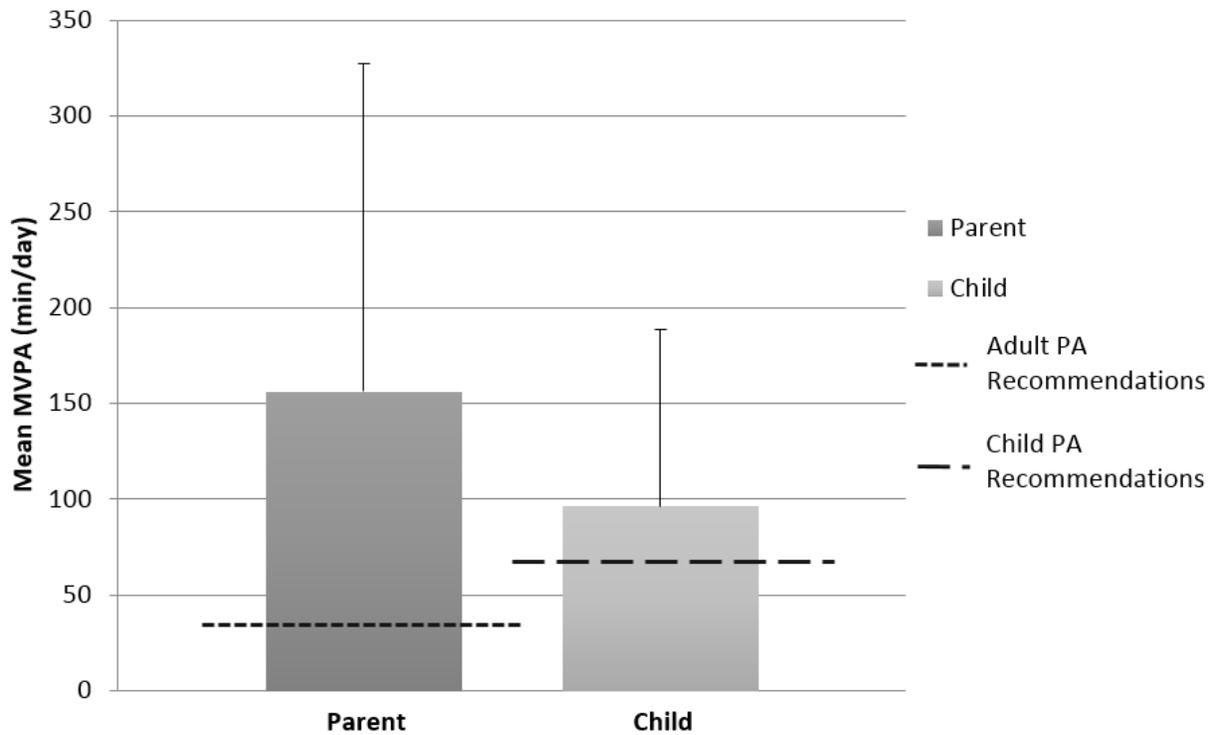
## Results

The characteristics of the responding parents and their focal child, are presented in Table 3. There were five focal children who were twins. Seventy (roughly 60%) parents and fifty-four (46%) children met the national PA recommendations for their age groups. Children were 3.5  $\pm$ 1.0 years old, on average, and most had one sibling (range 0-5).

**Table 3.** Child and family characteristics. Values are mean (SD) unless otherwise indicated.

	<i>0</i>	<i>1</i>	<i>2</i>	<i>3+</i>
Number of Siblings (n(%))	26 (22.2)	64 (54.7)	19 (16.2)	8 (6.9)
	<i>Only child</i>	<i>Oldest</i>	<i>Middle</i>	<i>Youngest</i>
Birth order (n(%))	26 (22.2)	38 (32.4)	14 (12.0)	34 (29.1)
	<i>20-29 years</i>	<i>30-39 years</i>	<i>40-49 years</i>	<i>50+ years</i>
Parent Age (n(%))	13 (11.1)	88 (75.2)	14 (12.0)	2 (.18)
	<i>Female</i>	<i>Male</i>	<i>Other</i>	
Parent gender (n(%))	106 (90.6)	11 (9.4)	0 (0.0)	
	<i>Married</i>	<i>Divorced</i>	<i>Living with Partner</i>	<i>Never Married</i>
Parent marital status (n(%))	111 (94.9)	2 (1.7)	2 (1.7)	2 (1.7)
	<i>High school</i>	<i>Associates or some college</i>	<i>Baccalaureate</i>	<i>Post-baccalaureate</i>
Parent education (n(%))	1 (.9)	17 (14.5)	33 (28.2)	66 (56.4)

Figure 1 shows the amount of PA that the focal child and the parent were participating in, as determined from the Pre-PAQ.



**Figure 1.** Parent and child PA presented against the age-specific recommendations.

Parent responses to the physical activity-related questions, such as “I am physically active with or in front of my child,” are shown in Table 4.

**Table 4.** Frequency of parent response to child physical activity-related questions. Responses range from never (1) to all the time (5).

<i>Survey Item</i>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
I am physically active with or in front of my child	(n)	1	4	41	45	26
	%	.9	3.4	35.0	38.5	22.2
My child needs me to motivate him/her to play	(n)	29	61	22	5	0
	%	24.8	52.1	18.8	4.3	0
I limit what my child does as I worry that he/she may be injured	(n)	13	67	34	2	1
	%	11.1	57.3	29.1	1.7	.9
		<b>Yes (n(%))</b>			<b>No (n(%))</b>	
Participates in any organized sport		59 (50.4)			58 (49.6)	
Participates in any rough & tumble play		102 (87.2)			15 (12.8)	

The five questions in the Pre-PAQ that addressed perceptions of neighborhood danger or safety were compiled into one composite score. A higher composite score indicates that the parent perceives more safety and less danger in their area. These scores were widely distributed, with the majority (81.3%) of parents falling between scores of 10 and 15, inclusive.

Spearman’s correlations were run to evaluate the relationship between number of siblings and parent responses to PA-related items on the Pre-PAQ seen in Table 5. There was only one statistically significant correlation – this was between birth order (when twins were included as the highest value) and the composite danger score (where low scores indicate less safety).

**Table 5.** Correlations between family characteristics and parental responses to modeling, motivation, and risk-related survey items.

	Number of siblings	Birth Order	
	r	r <sup>a</sup>	r <sup>b</sup>
I am physically active with or in front of my child	.104	.065	.072
My child needs me to motivate him/her to play	-.099	-.014	-.018
My child needs company to be motivated to play	-.052	.006	-.039
Composite danger score	-.056	-.183*	-.156

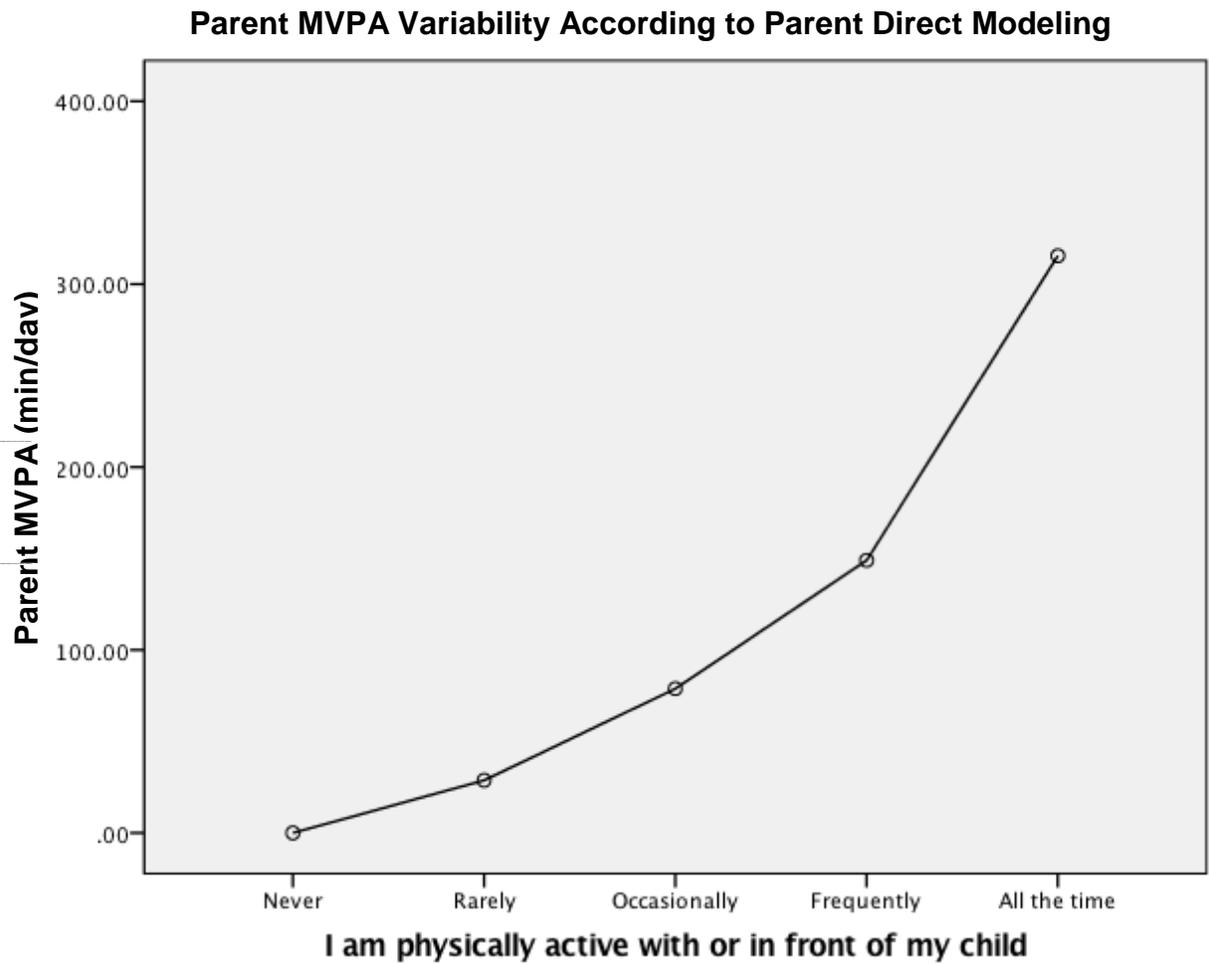
<sup>a</sup> twins included in analysis as separate category; <sup>b</sup> twins excluded from analysis

\* correlation is significant at the 0.05 level

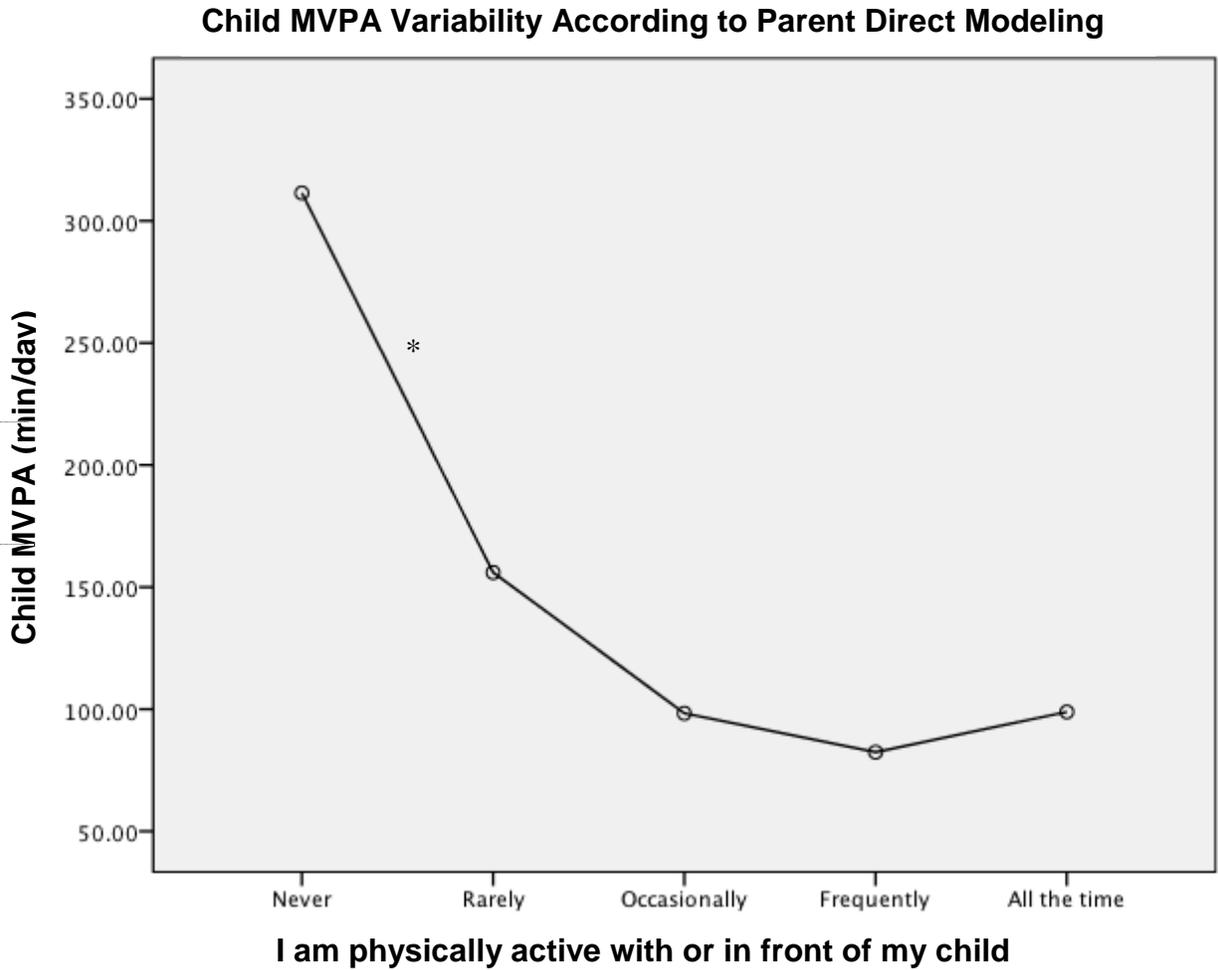
A logistic regression was run to determine whether birth order was associated with odds of a low composite danger score (indicating more perceived danger). This revealed no significance, as the values had wide confidence intervals. Logistic regressions were also performed to determine whether birth order was associated with the odds of children meeting PA recommendations as well as whether parents were more likely to allow rough & tumble play if they had more children. Both of these regressions were not significant.

A one-way ANOVA revealed that child MVPA does not differ according to birth order. These results are shown in Figure 2. Surprisingly, child PA appears to be higher when the

parents do not meet the recommendation (mean of both groups, p value). When comparing parent MVPA according to responses to the survey item “I am physically active with or in front of my child,” parents who reported being active in front of their children “all the time” were significantly more active than those who did so less often (Figure 3). Interestingly, child MVPA appears to be higher when parents report that they are “never” or “rarely” active in front of their children, although this difference did not reach statistical significance (Figure 4).



**Figure 3.** Parent activity (min/day) as it relates to parental response to “I am physically active with or in front of my child.”



**Figure 4.** Child activity (min/day) as it relates to parental responses to “I am physically active with or in front of my child.”

### Discussion

The purposes of this study were to determine how family characteristics, including number of siblings and socioeconomic status, are associated with parental behaviors, knowledge, and beliefs regarding child’s physical activity; and to determine how child physical activity varies according to family characteristics.

We hypothesized that children with more siblings would receive less modeling and encouragement from their parents. This was not supported by our data. There was no statistically significant difference between the varying numbers of siblings that the focal child had.

We also hypothesized that the parents of children with more siblings would report a lower, “better” perceived safety rating. When examining just the number of siblings that a child had, we did not find any statistically significant correlations. However, when we examined birth order, there were interesting findings. In the initial correlation model, which included twins who were coded as the highest value, there was a statistically significant correlation between high birth order value (being older or a twin) with a higher, “worse” perceived safety score. However, when the twins were removed from the analysis, the correlation was no longer significant. This suggests that there is something about twins that is influencing this relationship.

Our final hypothesis was that children with more siblings would be more physically active than their counterparts. This was not supported by our data. The number of siblings a child had did not influence how physically active the child was, as such, there were no differences between the groups.

This study is not in agreement with the literature. Previous studies have found statistically significant correlations between the family characteristics, behaviors, and physical activity levels of children. Our study did not produce any of these same correlations. Some of this is due to differing foci between the current study and previous ones. Other aspects of this discrepancy may be due to our sample characteristics, which is further explained within the limitations section.

Specifically, we did not find the same correlation between parent education level and parent or child activity that Fernandez-Alvira, *et al.* (2014) did. This may be due to the sample’s

overall high education level. There were not enough respondents who represented lower education levels to reveal any differences.

The primary focus of our study was on siblings. However, we did not examine how well the siblings get along with each other, so no comparisons could be made in that way. Additionally, because there was only one focal child for each family, regardless of the age of the siblings, we could not evaluate whether siblings' PA habits were more similar to each other than to their parents such as Crawford, *et al.* (2010), Duncan, *et al.* (2004), Liu, *et al.* (2014), and Pachucki, *et al.* (2014) did. We were able to evaluate whether having a sibling made the child more active than those without siblings, like Pachucki, *et al.* (2014) did, but did not find a correlation. We were able to evaluate birth order and its effect on child PA. However, we did not evaluate it in the same way as previous literature since we only had one child's data.

Parenting behaviors were evaluated specifically through evaluating encouragement and modeling. Overall, previous research found that parental encouragement was important for a child's PA habits, regardless of the setting that the child's PA took place in (Hohepa, *et al.* 2007; Loprinzi & Trost 2010; Tate, *et al.* 2015; Tucker, *et al.* 2011). We did not find this effect. Parent response to the question regarding motivating their child was not correlated with the child's PA. Modeling has been correlated with child PA by previous researchers (Crawford, *et al.* 2010; Schoeppe, *et al.* 2016; Tate, *et al.* 2015; Tucker, *et al.* 2011). Similar to Jago, *et al.* (2010), our study did not show a correlation between parental modeling and child PA.

We did not evaluate the built environment in this study. Instead, we focused on parent perceptions of the neighborhood that contribute to the safety of an area. Contrary to Babey, *et al.* 2015 and Mota, *et al.* 2009 whether parents perceived their environment as "good" or safer did

not have an effect on child PA. However, whether or not a parent deemed it safe for their child in the area did not affect their PA habits, which is in agreeance with Liu, *et al.* (2014).

Interestingly, there was a trend for parent and child PA to be in opposition. When a parent responded “5 – All the time” on a Likert scale in regard to modeling PA, their child tended to be less active. Conversely, when a parent reported that they are never or rarely active in front of their child, their child tended to be more active. This may be due to parenting behaviors specific to this age group. Parents who are active with or in front of their child may be out for a run while their child is in a stroller. Parents who are not active with or in front of their child may be taking their child to the park and sitting on a bench while they play. This finding is the first to be reported to our knowledge.

### *Limitations*

This study was limited in two primary ways. The most impactful limitation was the sample size. After correcting for incomplete data, there were simply not enough participants to produce statistical power for our analyses. The other limitation was sample bias, as the sample demographics appear fairly homogenous. Respondents were more active than the average population, had received a higher education, were primarily clustered in one age range, were almost exclusively married, and almost exclusively females.

### *Future Research Direction*

Future studies should consider investigating additional items in the Pre-PAQ. Additional items may include a question regarding birth order. This had to be deduced from the age of the focal child and the age of their siblings. It may help develop a deeper understanding if the survey

directly asks when the child was born in relation to others, especially if they are a twin. Future versions of the Pre-PAQ should also evaluate time that the family is spending doing activities together. Currently, the study asks for parent and child activity separately, for various activities such as running or playing sports. It would be beneficial to include a question that asks the parent whether any of this activity time overlaps – if the parent and child are being active at the same time – and how much time this totals. There is no way to determine whether parent and child activity is done separately or together in the current version of the Pre-PAQ. The addition of this question may help to illuminate the meaning of Figures 3 and 4 as they relate to each other.

This study would be improved if the Pre-PAQ was more widely dispersed among different subpopulations. Future marketing should aim to include less active families, those who are unmarried, and who have attained a lower education. This would allow for a greater possibility of achieving population representativeness.

### **Conclusion**

Childhood obesity is a major public health concern in the United States. Physical activity has the potential to mitigate some of the causal factors that lead to obesity. Unfortunately, few children meet PA recommendations and the prevalence of those who do drops significantly as they age. This is a multifactorial occurrence that may be influenced by things such as socioeconomic status; the presence of siblings; the birth order of siblings; parenting behaviors such as modeling and encouragement; and environmental factors that include the built environment and parents' perceptions of their neighborhood.

The literature has consistently shown that adults and children who are of a higher socioeconomic status are more physically active and less likely to be obese. Children who have

siblings, and are the youngest of them, tend to be more physically active than their counterparts. Additionally, when children receive encouragement from their parent or see their parent engaging in PA, they are more likely to be active themselves. When a family lives in a neighborhood that displays markers of a higher SES, such as more park space or sidewalks, the children are more active. This may be due to increased parental perceptions of the safety of the neighborhood, which is also correlated with child PA.

The current study did not result in any statistically significant findings that mirror those of previous literature. Our population did not tend to have more active children in relation to any of the aforementioned factors. This may be due to a small, homogenous sample. To gain a more holistic view of these factors as they relate to each other and to the child, a larger, more diverse sample is needed. Additional research is needed to evaluate the influence of SES, siblings, parenting behaviors, and environmental factors on child PA.

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