

# Family Members Impact on Physical Activity Levels and Enjoyment in Preschool-Age Children

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## ABSTRACT

**Purpose:** The primary purpose of this study was to investigate the impact mothers and older siblings have on the physical activity levels of preschoolers. Secondly, the preschooler's co-participation enjoyment was explored as well. **Methods:** A sample of 27 families (mother, sibling, and preschooler) participated in a one-time research visit. During the visit, there were two 20-minute play sessions: preschooler playing with mother and preschooler playing with older sibling independently. During the play sessions the participants were given a variety of sedentary and physical activities to choose from. Total physical activity counts during each play session were measured with an accelerometer. Enjoyment of physical activity co-participation was measured using a smiley face Likert scale. Data were analyzed using a paired t-test to compare total physical activity counts of the preschooler when playing with mother and when playing with older sibling. A paired t-test was also used to compare preschooler's rating of enjoyment of physical activity co-participation between the mother and older sibling. **Results:** This study found that preschooler's physical activity levels are similar when playing with their mothers ( $47,071.22 \pm 19,653.04$  counts per second) and older siblings ( $54,530.81 \pm 20,791.38$

counts per second) ( $p=.21$ ). For enjoyment, there was no significant difference between the preschooler's rating of enjoyment when playing with their mother or older sibling ( $4.76 \pm .52$  and  $4.88 \pm .86$ , respectively;  $p=.31$ ). However, a higher percentage of preschoolers said they enjoyed playing with their mother (62%) more than their older sibling (38%) when asked.

**Discussion:** The findings of this study show that both mothers and older siblings have a positive impact on preschoolers' physical activity. This study further expands on the existing literature suggesting that families need to continue to be investigated as a determinate of physical activity for preschoolers. The novel findings on enjoyment of co-participation of physical activity contribute to the small amount of existing literature suggesting that enjoyment of co-participation needs to be further explored as a determinate of preschooler physical activity.



**Family Members Impact on Physical Activity Levels and Enjoyment in Preschool-Age  
Children**

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## INTRODUCTION

Physical activity is essential for normal growth and development in preschool-aged children and can also play a role in decreasing the risk of a variety of chronic diseases (Piercy et al., 2018). Due to the many benefits of physical activity, it is recommended that children ages 3 – 5 years be active throughout the day and that parents encourage active play through a variety of activities (Piercy et al., 2018). Unfortunately, less than half of preschool-aged children are meeting physical activity guidelines (Pate et al., 2015).

To address the low activity levels in preschoolers, it is important to determine the factors that influence a preschool-aged child's physical activity behaviors. One main factor is the role of the family. Past studies have defined "family" in the traditional sense, meaning a mother, father, and children all living in the same household (Sukach et al., 2019). Previous research has noted that both parents and siblings can impact young children's physical activity behaviors (Hesketh et al., 2017; Kracht and Sisson, 2018; Dlugonski et al., 2020).

Many studies have examined the role parents (mothers and/or fathers) have on preschool-aged children's physical activity levels; additionally, it has been found that parents can influence a young child's physical activity levels either positively or negatively in a variety of ways (Rebold et al., 2016; Dlugonski et al., 2017). For example, a parent can positively influence their child's physical activity levels by taking them to the park. In contrast, a parent who is concerned about injuries or safety may keep their child from running. Therefore, negatively impacting the child's time spent being physically active. To summarize, mothers have been found to be both a facilitator and inhibitor to their child's physical activity levels (Hesketh et al., 2017; Lindsay et al., 2019).

Recently the importance of parental and child co-participation in physical activity has been reported. Dlugonski et al. (2020) found that a preschool-aged child's total physical activity (e.g., light, moderate, and vigorous physical activity) and moderate-to-vigorous physical activity was positively associated with parent-child in-proximity active minutes ( $r=.53$  and  $r=.48$ , respectively;  $p<.01$ ). Further, moms who engaged in physical activity had children that participated in more activity which would be considered modeling (Hesketh et al., 2014; Dlugonski et al., 2020). Another important aspect is how a mother can help a child be more active. While verbally encouraging a child to be active is one way (Hesketh et al., 2017), participating in physical activity with the child might be more effective (Rebold et al., 2016; Dlugonski et al., 2017).

Siblings are an important part of many families and may impact physical activity behaviors of the other children living in the house (Hesketh et al., 2017). The presence of a sibling is beneficial to a young child's physical activity levels. To illustrate this point, children who have siblings engage in more moderate to vigorous activity when compared to children without siblings (Estimate=5.18, 95% CI 1.05 to 9.32,  $p=.01$ ; Kracht & Sisson, 2018). The research strongly supports the positive effects a sibling has on a child's physical activity level compared to an only child; however, less is understood about the impact the age of the sibling has children's physical activity levels. The limited research is mixed on the impact an older or younger sibling has on another child's physical activity levels (Kracht & Sission, 2018; Kracht et al., 2019). Of the limited research, it appears that an older sibling is more likely to impact a younger sibling's physical activity levels than a younger sibling is likely to positively impact an older sibling's physical activity levels (Kratch et al., 2019). Given the paucity of research which indicates contradictory results it is important to gain a better understanding on the role of the sibling.

Another factor to consider is the preschooler's enjoyment of co-participation during physical activity. While there is little research on the enjoyment of co-participation of physical activity in this age group, higher physical activity enjoyment may promote more physical activity (Hesketh et al., 2017). Further, Rebold et al. (2016) measured enjoyment after co-participation and found that children enjoyed playing with their parent the most compared to either playing alone or with the parent watching (2016).

While research has shown that both parents, especially mothers, and siblings, can positively or negatively impact physical activity levels of children in the family, the past literature has explored the roles of parents and siblings individually. Further, it is suggested that the presence of an older sibling has more of a positive effect on physical activity to other children in the household than younger siblings (Kracht et al., 2019). Moreover, the level of perceived enjoyment of co-participation needs to be further understood in the age group. Given the importance of co-participation to increase a child's physical activity levels, it is necessary to understand which family members physical activity co-participation would have the most impact on other children in the household.

Therefore, the primary purpose of this study is to examine the role mothers and older siblings have on a preschooler's physical activity levels. A secondary purpose is to compare the preschooler's enjoyment when playing with mom versus older sibling. Due to limited past research the evidence necessary to generate hypotheses for both purposes were not present, thus no hypotheses were not made.

**Delimitations:**

- Preschooler participants are ages 3-5 years
- Older sibling is no more than 4 years older than preschool-aged child
- The 3–5-year-old child
- Mothers over the age of 19 years
- All participants must live in the same household
- Mother cannot be pregnant or < 6 weeks post pregnancy

**Limitations:**

- Participants from Greenville, NC and surrounding areas

**Definitions:*****Preschool Children***

Preschool-aged children are defined as children that ages 3 through 5 years of age (CDC, 2021).

***Physical Activity***

Physical activity is movement of the body that uses skeletal muscle and causes an increase in energy expenditure (how much energy is being used by the body). Physical activity includes activities such as walking, sports, games, and even some household chores (CDC, 2022).

***Light Intensity***

In preschool-aged children, light intensity physical activity creates a slight increase in heart rate and breathing when compared to resting. Light intensity activities for preschool-aged children include slow paced walking or standing activities (U.S. Dept. of Health and Human Services, 2018).

***Moderate Intensity***

In preschool-aged children, moderate physical activity will cause an increase in heart rate and breathing when compared to resting and light intensity. Moderate intensity includes activities such as dancing, jumping, running, playing on the playground, or riding a bike (U.S. Dept. of Health and Human Services, 2018).

***Vigorous Intensity***

In preschool-aged children, vigorous physical activity will cause the greatest increase in heart rate and breathing when compared to resting state, light intensity, and moderate intensity. Vigorous intensity includes activities such as swimming, running games such as tag, or other activities such as gymnastics or tumbling (U.S. Dept. of Health and Human Services, 2018).

***Total Physical Activity***

Total physical activity is the total time spent in physical activity regardless of the intensity level.

***Total Physical Activity Counts***

Total physical activity counts are measured by accelerometer. Total physical activity is counted across all intensities of physical activity (light, moderate, and vigorous) and is measured by acceleration.

***Enjoyment***

Enjoyment is the amount of liking or pleasure in something. For this study, enjoyment of spending time with either the mother or older sibling was measured.

***Co-Participation***

Co-participation is defined as two or more individuals participating in the same activity together. More specifically for this study, co-participation occurs when the mother and preschooler participate in activities together or the older sibling and preschooler participate in activities together.

## **LITERATURE REVIEW**

The following section will explore the existing literature on preschool-aged children's physical activity levels. More specifically, the literature will explain the impact that mothers and older siblings have on young children's physical activity levels.

### **Physical Activity and Preschoolers**

Physical activity is defined as movement of the body that requires energy. In preschool-aged children, physical activity promotes good health and normal growth and development. The 2018 Physical Activity Guidelines for Americans reported that children aged 3 to 5 who engage in regular activity have improved bone health and weight status (Piercy et al., 2018). Low levels of physical activity can lead to a higher risk of becoming either overweight or obese. While keeping this in mind, it is important to note that children who were obese at the age of 3 had a 90% higher probability of being overweight or obese as an adolescent (Geserick et al., 2018). Due to the importance of physical activity in this age group as well as advances in research, the 2018 Physical Activity Guidelines for Americans have updated information that includes preschool-aged children. It is recommended that preschool-aged children engage in activities that vary in intensity and are active throughout the day. A suggested target for physical activity is 180 minutes per day (Piercy et al., 2018).

While it is known that physical activity is important for growth and development of preschool-aged children, Pate et al. (2015) found approximately half of these children are meeting the physical activity guidelines ( $\geq 15$  min/hour of total physical activity per day). Two different studies, CHAMPS (Children's Activity and Movement in Preschool Study) and SHAPES (Study of Health and Activity in Preschool Environments), were utilized to assess the physical activity levels of preschool-aged children. Accelerometer data in the CHAMPS study found that

41.6% of the preschool-aged children that participated were meeting the guidelines. In SHAPES, 49.8% of preschool-aged children did not meet the physical activity guidelines. The findings of the study highlight the importance of promotion of physical activity for preschool-aged children due to half of the sample not engaging in adequate amounts of physical activity.

In addition to the parents' role in actively participating in physical activity with their preschool-aged child, the parent's perception, or awareness of how active their child is may be a factor in the child's physical activity levels. The results of a study in 478 children, who were 4 years old, and their mothers found that 40.08% of the children were categorized as inactive which means they engaged in less than 60 minutes of moderate to vigorous physical activity (MVPA) per day (Hesketh et al., 2013). Further, of those children who were inactive, 89.7% of mothers considered their child to be active, meaning the parent overestimated how active the child was. If there is a disconnect between how much activity the child is participating in and how much activity the parent thinks the child is doing, the parent may not encourage the child to increase their physical activity.

In summary, physical activity in preschool-aged children is beneficial for normal growth and development. Even with this information, less than half of the preschool-aged population are meeting the recommended physical activity levels. From here, it is important to investigate what factors can impact preschoolers' physical activity participation.

### **Determinates of Childhood Physical Activity**

There are many different factors that can influence a child's physical activity level. A few examples of these factors include weather, safety, and community (Tovar et al., 2015). A determinate can be either a barrier or facilitator of physical activity. For example, living in a rainy environment will hinder a child's ability to play outside which would be a barrier. Another child may live in an environment with mild temperatures year-round in which they would be more



likely to play outside therefore facilitating more physical activity. A systematic review identified seven themes of physical activity determinates perceived by parents and childcare providers. The themes included: the home, out-of-home childcare, parent-childcare provider interactions, environmental factors, safety, and weather (Hesketh et al., 2017). These identified themes highlight the perceived importance of the role that adults play in the shaping of a young child's physical activity levels due to many of the determinates involving parents.

Families can influence all aspects of child development, including physical activity (Carneiro et al., 2003; Hesketh et al., 2017). Families can be made up in many ways, but past research has been conducted using the traditional family make-up, a mother and father with one or more children (i.e., siblings) living in one household (Sukach et al., 2019). Both parents and siblings independently can influence a young child's physical activity levels either indirectly by modeling physical activity behaviors (Hesketh et al., 2017; Lindsay et al., 2019; Kracht & Sisson, 2018) or directly by encouraging a child to participate in physical activity either through verbal encouragement, co-participation, or providing the resources to be active (i.e. enrolling them in gymnastics program) (Hesketh et al., 2017; Dlugonski et al., 2020; Kracht et al., 2019). To the best of our knowledge the impact families (parents and siblings) have on preschool-aged children's physical activity levels has been examined independently. Therefore, the next sections in this literature review will highlight the research as it stands for parents and siblings separately.

### ***Parent's Role***

Parents play an important role in helping preschool-aged children develop healthy behaviors, such as physical activity (Tucker, 2008). Parents can teach children the importance of physical activity through a variety of ways, such as, watching their parents be active (modeling), participating in physical activity with their child (co-participation), encouraging the child to be active, and providing an environment that supports the child being active (Welk,

1999; Hesketh et al., 2017). Given the importance of a parent on the development of physical activity behaviors, a better understanding of the barriers and facilitators of young children's physical activity and sedentary behaviors is needed. Interestingly, Hesketh et al. (2017) found that parents can have either a positive or negative impact on physical activity and sedentary behaviors. When parents are active, they function as a role model for their child to be more active, and participate in physical activity with their child, which in turn promotes their child to be more physically active. In contrast, the parent can act as a barrier to their child's physical activity levels. For example, when a parent does not have the energy or time, cannot afford certain types of physical activity, or they utilize less-active modes of transportation such as taking the bus instead of riding a bike, it can reduce a child's physical activity level.

Now that it has been determined that parents play a role on a young child's physical activity levels, some researchers have investigated a parent's role more directly. In 2016, Rebold et al. assessed the amount, intensity, and level of enjoyment of a preschool-aged child's physical activity levels under three different conditions. There were 20 child participants (mean age =  $4.05 \pm 0.94$ ) with 1 parent each (17 moms and 3 dads). The three conditions included playing alone, playing with a parent watching, and playing with a parent. Participants were brought to a gymnasium where a variety of sedentary and physical activities were set up. The child and parent wore accelerometers to collect physical activity data and direct observation was completed by research staff during the three conditions. As hypothesized, children had higher accelerometer counts in the parent participating condition (accelerometer counts:  $109,523 \pm 32,155$ ) compared to both the parent watching (accelerometer counts:  $85,624 \pm 44,985$ ) and child alone (accelerometer counts:  $67,938 \pm 37,857$ ) conditions ( $p < .05$ ). Sedentary minutes also decreased significantly for these conditions from 16.2 minutes (child playing alone) to 9.6 minutes (parent watching) to 3.8 minutes (child playing with parent). Interestingly, just the presence of the parent in the room, but not playing with the child resulted in the child being

more active and less sedentary than when the child was playing alone ( $p < .05$ ). In summary, the results of this study show that a parent actively participating in physical activity with the child is an effective way to increase the child's physical activity levels.

To get a better understanding of the amount of time parents and children spend together and what intensities of physical activities are being performed during normal daily life, Dlugonski et al. (2020) had 47 parents (51% mother) and young children (2-5 years of age) wear Bluetooth enabled accelerometers for 8 consecutive days. On average the parent-child were together for  $145 \pm 79$  minutes per day. One result of this study showed that the child's total physical activity (light, moderate, and vigorous) and child's MVPA was positively associated with parent-child in-proximity active minutes ( $r = .53$  and  $r = .48$ , respectively;  $p < .01$ ). This means that when the parent and child are together, if the parent is more active, then the child is also more active. Another finding identified time spent in MVPA was highest among children whose parents engaged in the most physical activity co-participation compared to children whose parents engaged in the least amount of physical activity co-participation (72.7 vs 50.3 min,  $p < .05$ ). This study allows us some insight into the importance of physical activity co-participation.

Additionally, there may be some common themes in ways that parents can impact their young child's physical activity. In 2019, Lindsay et al. defined parental practices that either encouraged or discouraged physical activity in preschool-aged children. The study sample was made up of 37 mothers, who had immigrated from Brazil to the United States, with at least one child aged between 2 to 5 years of age. Through focus group discussions and thematic analysis, seven parent practices were identified that encouraged physical activity in the preschoolers: modeling physical activity; engaging and being physically active with child (co-participation); providing logistic support; encouraging, praising, and offering motivational support; watching, supervising, and teaching children how to engage in physical activity; monitoring and setting limits to child's screen time; and prompting child to be physically active.

Another four practices were identified as barriers to the child's physical activity levels including: modeling of sedentary behaviors; having rules and restrictions due to safety and weather-related concerns; limiting child's outdoor time due to parental time constraints; and restricting child's outdoor and play time as punishment. These identified themes contribute to the knowledge of a parent's impact on preschool-aged children's physical activity levels and can help pinpoint some common trends amongst parents.

To review, a parent's role can impact a young child's physical activity levels in a variety of ways. The parent can either facilitate physical activity through practices such as modeling, co-participation, encouraging/motivating the child, or even being present to watch the child perform physical activity. In contrast, a parent could also be a barrier to a child's physical activity by displaying sedentary behaviors, inability to financially support certain forms of physical activity such as sports, or not being aware of the child's current level of activity. It is important to identify the impact of a parent's ability to contribute to the effort of increasing preschool-aged children's physical activity levels.

### ***Mothers Role***

While parents have been identified as important facilitators for a child's physical activity participation, most of the studies have been conducted using only mothers (Hesketh et al., 2014; Dlugonski et al., 2017; Lindsay et al., 2019). One reason most studies utilize mainly mothers is due to fathers being less likely to participate in research (Parent et al., 2017). To assess the relationship between mothers and young children's physical activity levels, Hesketh et al. (2014) conducted a study in 554 mothers and their 4-year-old children. The children and mothers wore accelerometers for 7 consecutive days. Mother-child daily activity levels were found to be positively associated at all intensity levels of activity (Light PA:  $\beta = .14$ , and MVPA:  $\beta = 1.10$ ; all  $p < .001$ ). This means the more time the mother spent in activity the more time the child spent in light and MVPA, this was especially true for MVPA. Knowing that mothers have a

direct influence on their child's physical activity behaviors will allow more insight into the parental role as well as aid with creating interventions which involve the family.

Another study focused on examining the associations of mothers' physical activity participation on their child's physical activity levels was conducted by Dlugonski et al. (2017). In this study 17 mothers and their young children (1-5 years of age) wore Bluetooth-enabled accelerometers for 7 days to measure shared time in physical activity between the mother and child. The results indicated that mothers and young children spent between 2 -4 hours a day performing shared activities. Almost half, 45%, of the shared time was spent performing sedentary activities. Shared participation in light physical activity accounted for 21.9% of the activities. Lastly, less than 1 % of the shared activity was spent performing MVPA. The results of this study highlight the importance of working with mothers given how little time they spend being active, especially at a higher intensity with their preschool-aged child.

While both studies above illustrate the importance of a mother's physical activity on their child's physical activity, they had important methodological differences which strengthen these findings. Both research groups used accelerometers to measure physical activity, but Dlugonski et al. (2017) used Bluetooth enabled accelerometers which allowed for the researchers to determine when the mother-child dyad were together. In contrast, Hesketh et al. (2014) was only able to use total time per day in the different physical activities to determine the relationships. This means that some of the physical activity time could have been done when the mother-child were not together. Even though these methodological differences are present the conclusions are similar. A mother's physical activity level is positively related to her child's physical activity level.

## ***Siblings***

With parental influence being discussed, specifically the mother's impact, there is another determinate of childhood physical activity levels to focus on and that is siblings. In 2015, Edwards et al. conducted a qualitative study on parent's perceptions of their young child's screen time and physical activity levels. Through phone calls, researchers interviewed 53 parents whose children were 5-6 years old. After analyzing the interviews, results showed that parents believed the children's screentime and physical activity levels were influenced by their peers and siblings. Only one parent stated that they believed their child's physical activity behaviors were not influenced by their sibling(s). Additionally, parents relayed that siblings have a larger influence on unstructured and impromptu bouts of physical activity rather than organized sport or play. Lastly, the parents noted that older siblings seem to act as a role model for physical activity where younger siblings will mirror the older siblings, but this may not always be true. Further, in a systematic review, siblings were found to have either a positive or negative influence on a young child's activity levels (Hesketh et al., 2017). Specifically, it was noted that younger children wanted to either play with or mimic their older sibling(s). Therefore, an older sibling not wanting to engage or interact with a younger sibling could inhibit them from participating in physical activity. This study gives us a small glimpse of the impact that siblings may have on each other.

To observe the bigger picture of a sibling's role in physical activity levels, Kracht & Sisson (2018) conducted a meta-analysis which consisted of nine different articles. These articles were analyzed for quantitative data and used accelerometry to measure physical activity levels. It was concluded that children with siblings participated in more MVPA when compared to children with no siblings (Estimate=5.18, 95% CI 1.05 to 9.32,  $p=.01$ ). Another interesting finding from this meta-analysis was the impact of having an older sibling. There were two

studies which included the comparison of children with older siblings (within 3 years of age) to children with only younger siblings on MVPA min/day. Analysis from these studies found that children with older siblings participated in more MVPA min/day than children who had a younger sibling (Estimate=6.87, 95% CI 2.38 to 11.36,  $p=.003$ ). From the results of this meta-analysis having a sibling is important for having higher physical activity levels and children engage in more activity when an older sibling is present.

When trying to understand the influence siblings have on a child's physical activity level, one way to do this is to compare the physical activity levels among children with and without siblings. Kracht et al. (2019) investigated physical activity levels in young children (5-7.9 years old) who were in families with no siblings (singleton) versus families with one or more younger siblings (nonsingleton). There were 56 mother-child dyads in the study, 23 singletons and 33 nonsingleton families. Physical activity and sedentary behavior were measured using ankle accelerometry for seven days on both the mother and child. For this study the presence of a younger sibling was important, but no measures were taken from the younger sibling; measures were only taken on the 5-7.9-year-old. Singletons displayed more sedentary behavior and less light physical activity than nonsingletons (sedentary:  $514.7 \pm 47.0$  counts/min vs  $483.9 \pm 68.6$  counts/min, respectively,  $p=.049$ ; Light:  $204.4 \pm 28.8$  counts/min vs  $227.5 \pm 38.4$  counts/min, respectively,  $p=.01$ ); however, there was no difference in time spent in MVPA (singleton: mean=  $37.6 \pm 11.5$  counts/min vs nonsingleton: mean =  $39.2 \pm 16.9$  counts/min;  $p=.41$ ). Therefore, younger siblings may influence older children to be less sedentary compared to those who do not have any siblings, but having a younger sibling does not seem to affect MVPA levels.

When researching the determinates of preschool-aged children's physical activity levels, it is important to remember that there are many factors that can influence a young child including weather, safety, and community (Tovar et al., 2015). Family members may also have

an impact on a child's PA levels. Parents and more specifically mothers have been found to have either a positive or negative impact on their young child's physical activity levels either through modeling, encouragement, or co-participation (Hesketh et al., 2013; Dlugonski et al., 2017). Siblings also have been found to positively influence each other regarding levels of physical activity (Hesketh et al., 2017; Kracht et al., 2019).

### ***Co-Participation Enjoyment***

Another possible factor impacting physical activity participation is enjoyment of co-participation during physical activity as perceived by the preschool-aged child. Limited research is available on the topic, but some studies have investigated the idea of enjoyment of physical activity in children. It has been suggested that a child's enjoyment of the activity may facilitate more engagement in physical activity; however, this finding was based on parent perception and not the child's (Hesketh et al., 2017). One study determined the enjoyment of different physical activities completed by a parent and child ( $5.9 \pm 1.7$  years) (Filanowski et al., 2021). The parent and child completed five different activities while wearing accelerometers. The activities included brisk walking, dancing, jumping games, tag, and bodyweight exercises. After completing the activities together, the parent and child independently rated their enjoyment of the different physical activities using a Visual Analog Scale which was a 1– 6 Likert scale ranging from “like it very much” to “did not like it at all”. The results of the study show that children liked tag more than brisk walking ( $2.23 \pm 1.5$ ), jumping ( $1.83 \pm 1.1$ ), and dancing ( $2.50 \pm 1.8$ ;  $p < .05$ ). Children also liked bodyweight exercises ( $1.63 \pm 1.1$ ) more than parents ( $2.35 \pm 1.2$ ;  $p < .05$ ). While these results do measure the enjoyment of different physical activities from the child and parent, they were asked independently so we do not know how much they enjoyed doing the activities together.

One study has attempted to determine the enjoyment of co-participation of physical activity in younger children. One aim of the study was to investigate child enjoyment of physical



activity when playing in three different conditions: alone, playing with a parent watching, and playing with the parent (Rebold et al., 2016). After each condition the child ( $4.05 \pm 0.94$  years of age) was asked to rate how much they enjoyed playing on a Visual Analog Scale that was 10 cm long, ranging from “like it very much” on the right and “do not like at all” on the left. The results show that overall, the children rated the parent watching ( $8.7 \pm 1.52$  cm) and parent participating condition ( $9.9 \pm 0.45$  cm) more enjoyable than playing alone ( $8.0 \pm 2.72$  cm;  $p < .05$ ). Additionally, 16 of the 20 children rated that playing with the parent was the most enjoyable. These studies suggest that enjoyment of individual physical activities and enjoyment of co-participation of physical activity might be important factors to investigate when examining physical activity participation in young children.

### **Summary of Literature Review**

To briefly summarize the literature review, it has been discovered that preschool-aged children receive benefits from being physically active, but many are not meeting the recommended levels of physical activity (Pate et al., 2015; Piercy et al., 2018). To address these levels of inactivity, the determinates of a preschool-aged child's physical activity levels need to be investigated. In these investigations, two themes were determined to be factors in the behaviors of young children which are parents and siblings (Hesketh et al., 2017). Mothers and siblings were both determined to have a positive impact on preschool-aged children's physical activity levels (Dlugonski et al., 2017; Kracht et al., 2019). What the existing literature does not explain is a mother's impact in comparison to a sibling's impact on the young child's physical activity levels. Further, based on limited research it appears that the presence of an older sibling might have more of an impact on another child's physical activity levels compared to the presence of a younger sibling (Kracht & Sisson, 2018; Kracht et al., 2019). Therefore, this study will examine the effect mothers and older siblings have on a preschool-aged child's physical activity when they each have an opportunity to participate in physical activity with the

preschool-aged child. Additionally, this study will also examine the enjoyment of physical activity during co-participation from the preschooler's perspective.

## **METHODS**

The next chapter explains the details of the methodology used. This was a quantitative study designed to objectively measure a preschool age child's physical activity level when interacting with their mother and with their older sibling as well as measure the enjoyment of co-participation from the preschooler's perspective. This study was part of a larger study in which the data were collected, but not all data was relevant to the current study. As result, the methods section discusses the data that was related to the research questions outlined in the introduction section.

### **Participants**

The participants in this study were mothers, preschool-aged children between the ages of 3 through 5 with an older sibling. This study focused on mothers because they are more likely to participate in research studies than fathers, therefore many studies have only used mothers to better understand the role parents have on preschool-aged children's physical activity levels (Parent et al., 2017). Based on past literature, the older sibling needed to be within 4 years of age from the preschool-aged child (Pereira et al., 2017; Kratch and Sisson, 2018). The qualifications for mothers included being over the age of 19 and living in the same household as both children. An exclusion criterion for mothers was that they could not be either currently pregnant or 6 weeks post-pregnancy. Participants were recruited via flyers, which were sent via email to childcare centers afterschool centers, churches, list-serves to East Carolina University, as well as to personal contacts. The flyers were also posted on social media for local mother groups and the library.

## **Design**

This study consisted of one visit that was 60 minutes long. There were two experimental conditions that were 20 minutes each: one with mothers and the other session with the older sibling. During the study visit, the mother filled out an informed consent form (Appendix A) and some questionnaires. From there, the participants were taken into the lab where they were familiarized with the space and activities. The participants were fitted with accelerometers to wear during the play sessions. Data was collected from the accelerometers to measure physical activity counts as well as direct observation recording. At the end of the study visit each child received a toy and the mother received a \$20.00 electronic gift card to Amazon.

## **Experimental Condition**

The study visit took place in the Physical Activity Promotion Lab and Developmental Motor Lab at East Carolina University. The lab spaces were set up with sedentary activities and physical activities. The activities chosen were modeled after the Rebold et al. study (2016). The sedentary activities included coloring books, reading, Legos, and puzzles (Figure 1). Physical activity options included playing catch with a ball, crawling in a tunnel (Figure 2), playing soccer, an obstacle course (Figure 3), as well as skill ladders and dots (Figure 4). There were two 20-minute play sessions: the preschool-aged child playing with their mother and the preschool-aged child playing with older sibling, with a 5-minute break in between. The order of sessions for each study visit were counterbalanced to determine whether mother or older sibling would play with the preschool-aged child first. Sessions were monitored and documented by research staff and the accelerometers.

**Figure 1**

*Sedentary Table of Activities*



**Figure 2**

*Tunnel*



**Figure 3**

*Obstacle Course*



**Figure 4**

*Skills Ladders and Dots*



## **Measures**

### ***Demographics***

Demographic information was collected using the demographic questionnaire (Appendix B) which the mother completed during the visit. The questionnaire includes questions regarding race, ethnicity, and income.

### ***Anthropometrics***

For the child and adult participants, height, and weight were taken and recorded twice (Appendix C). Height was measured in centimeters using a stadiometer and weight was measured in kilograms using a scale. Average height and weight values were used to calculate body mass index (BMI) for mother, older sibling, and preschool-aged child. BMI was calculated using this equation: weight in kg /height in m<sup>2</sup>. For the children, BMI z-scores and percentiles were also calculated using a pediatric BMI z-score calculator that was developed by the Children's Hospital of Philadelphia Research Institute ( <https://zscore.research.chop.edu>). This calculator uses national data to determine age and sex appropriate BMI z-scores and percentiles.

### ***Physical Activity***

Physical activity was measured with GT3X-BT ActiGraph accelerometers. Accelerometers use sensors to detect movement that determines when and how much physical activity is occurring. The mother, older sibling, and preschool-aged child all wore accelerometers during the play sessions. Accelerometers were used because they are a good method for directly measuring the amount of physical activity a person is engaging in. Further, past research has used accelerometers, especially ActiGraph to measure physical activity in this age group (Hesketh et al., 2014; Pate et al., 2015; Dlugonski et al., 2017). Accelerometers collect the time and physical activity counts which were used to make comparisons and know when physical activity was occurring. The sample time (epoch) was set at one second which

means the accelerometer was gathering information each second during the 20-minute play sessions.

### ***Direct Observation***

Participants' physical activity was also monitored through direct observation during the two 20-minute sessions. Research staff recorded what activity was being performed, the time each activity started, and who initiated the activity on to the direct observation form (Appendix D). Stopwatches were utilized to record timing on the direct observation forms.

### ***Co-Participation Enjoyment***

Enjoyment of the play sessions was measured using a smiley face Likert scale with values ranging from 1-5 of least to most (Figure 5; Appendix E). Likert scales have been used with children in the past (Hall et al., 2016). Enjoyment of the preschool-aged child was recorded at the end of each play session. After each session the child was asked to "Rate how much you enjoyed playing with \_\_\_\_\_ (research assistant stated either "mother" or "name of the sibling")." While the child was being asked this question they could see the smiley face Likert scale. They were instructed to point to the face that best reflected their level of enjoyment and then the corresponding number was recorded on the datasheet. Once both experimental conditions were completed the preschool-aged child were asked: "Who did you enjoy playing the with the most?" The response options were: mom or sibling. After the preschool-aged child verbally stated the response, it was recorded on the datasheet.



**Figure 5**

*Smiley Face Enjoyment Scale*



### **Data Processing/Cleaning**

Accelerometers were initialized to start collecting data 15 minutes before the participants were set to arrive and did not stop collecting data until the accelerometer data was downloaded after the conclusion of each visit. The data files were then converted into data tables as Excel files. Once the data was converted to Excel files, it was cleaned. The data cleaning process involved removing data recorded outside of the two 20-minute continuous play sessions (non-play times). Non-play times includes data recorded before, between, and after the two 20-minute play sessions. There were a few non-play times that occurred during the 20-minute play sessions. These included participants who needed bathroom breaks and one incident of falling. To determine non-play times, a stopwatch was started at the time the accelerometer started collecting data. During the play sessions the stopwatch was used to denote what was being done and at what time and when the 20 minutes ended. These stopwatch times were converted to computer time which the accelerometer used to determine the initialization time. The converted computer times were used to determine what data to cut for each participant.

Once the data files were cleaned, only the data files from the preschool-aged children were used for data analysis. The outcome variable was total physical activity counts over the 20-minute period. To calculate this outcome variable, the 1-second activity counts were summed for each condition. This created a total activity count for the preschool-age child when playing with mother and older sibling.

## **Statistical Analysis**

While 28 families completed the study, one family was excluded from the data analysis due to insufficient accelerometer data. Thus, for all data analyses the total sample size used was 27 families and 81 participants total. Mean, standard deviation and percentage were calculated for demographic factors. A paired t-test was used to analyze any differences in the preschool-aged child's physical activity counts when they played with the mother compared to older sibling. A paired t-test was also used to analyze any differences in enjoyment ratings when playing with older sibling and when playing with mom. Statistical significance was set at  $p < .05$ . Effect sizes (Cohen's  $d$ ) were calculated, and the values were interpreted as follows:  $>0.8$  was a large,  $0.5$  was a medium, and  $< 0.2$  was a small effect (Cohen, 1998).

## RESULTS

### Demographics

There were 46 families who showed interest in the study. Of those 46 families, 11 of them did not respond to follow up emails or texts, five of the families did not have a child between the ages of three to five years old, one family only had one child, and one family had a pregnant mom therefore they did not participate in the study. Therefore, the sample included 28 families comprised of 84 participants in total.

Table 1 displays the demographic information for the pre-school aged child, older child, and mother. There was a similar number of male and female preschool-aged children and among the older siblings 67% of them were females. For the younger and older siblings 85% of the children were White. The average age of the preschool-aged child was  $3.56 \pm .8$  years. The average age of the older child was  $6.01 \pm 1.4$  years. The average age of mothers was  $37.15 \pm 3.7$  years. All the mothers who participated in the study were married and had a household income over \$50,000. There were 24 mothers (89%) who had 2-3 children total, and 3 mothers (11%) had 4 or more children.

The mother's had an average BMI of  $25.14 \pm 7.01$  kg/m<sup>2</sup>. The older siblings had an average BMI of  $15.47 \pm 3.5$  kg/m<sup>2</sup> and the average BMI z-score for older siblings was  $.19 \pm 1.04$  with an average BMI percentile of  $42.89 \pm 34.47$ . The preschool-aged children had an average BMI of  $15.98 \pm 3.4$  kg/m<sup>2</sup>, the BMI z-score was  $-.02 \pm 1.24$  with an average percentile of  $51.89 \pm 28.6$ . The BMI percentiles for the children are in the normal weight range.

**Table 1**

*Participant Demographics*

| Variable                    |                                 | N  | %    |
|-----------------------------|---------------------------------|----|------|
| <b>Preschool-Aged Child</b> |                                 |    |      |
| <b>Sex</b>                  | <b>Female</b>                   | 13 | 48   |
|                             | <b>Male</b>                     | 14 | 52   |
| <b>Race</b>                 | <b>Black</b>                    | 1  | 4    |
|                             | <b>White</b>                    | 23 | 85   |
|                             | <b>Asian</b>                    | 2  | 7    |
|                             | <b>Other</b>                    | 1  | 4    |
| <b>Ethnicity</b>            | <b>Non-Hispanic</b>             | 26 | 96.3 |
|                             | <b>Hispanic</b>                 | 1  | 4.7  |
| <b>Older Child</b>          |                                 |    |      |
| <b>Sex</b>                  | <b>Female</b>                   | 18 | 66.6 |
|                             | <b>Male</b>                     | 9  | 33.3 |
| <b>Race</b>                 | <b>Black</b>                    | 1  | 4    |
|                             | <b>White</b>                    | 23 | 85   |
|                             | <b>Asian</b>                    | 2  | 7    |
|                             | <b>Other</b>                    | 1  | 4    |
| <b>Ethnicity</b>            | <b>Non-Hispanic</b>             | 26 | 96.3 |
|                             | <b>Hispanic</b>                 | 1  | 3.7  |
| <b>Mother</b>               |                                 |    |      |
| <b>Race</b>                 | <b>Black</b>                    | 1  | 4    |
|                             | <b>White</b>                    | 23 | 85   |
|                             | <b>Asian</b>                    | 3  | 11   |
|                             | <b>Other</b>                    | 0  | 0    |
| <b>Ethnicity</b>            | <b>Non-Hispanic</b>             | 26 | 96.3 |
|                             | <b>Hispanic</b>                 | 1  | 3.7  |
| <b>Education</b>            | <b>HS Diploma/GED</b>           | 1  | 4    |
|                             | <b>Attended College</b>         | 2  | 7    |
|                             | <b>Earned Bachelor's Degree</b> | 10 | 37   |
|                             | <b>Earned Master's Degree</b>   | 14 | 52   |
|                             | <b>Work for a Living</b>        |    |      |
|                             | <b>Yes</b>                      | 21 | 77.8 |

|           |                                    |    |      |
|-----------|------------------------------------|----|------|
|           | No                                 | 6  | 22.2 |
|           | Hours Worked                       |    |      |
|           | Part-Time                          | 6  | 28.6 |
|           | Full-Time                          | 15 | 71.4 |
| City Size |                                    |    |      |
|           | Large city (>100,000 people)       | 2  | 7    |
|           | Medium city (30,000-100,00 people) | 23 | 86   |
|           | Rural city (<30,000 people)        | 2  | 7    |

## Physical Activity

When examining the amount of physical activity the preschool-aged children had when playing with the older sibling, they averaged  $54,530.81 \pm 20,791.38$  counts per second. When the preschool-aged child played with the mother, the average counts per second for the child was  $47,071.22 \pm 19,653.04$ . No statistically significant difference was observed in the amount of physical activity for the preschool-aged child when playing with either their older sibling or their mother ( $t = 1.3$ ;  $p = .21$ ). The effect size calculated was .4 which means there was close to a medium effect. Therefore, the older siblings were able to produce slightly higher total counts from the preschool-aged children than mom.

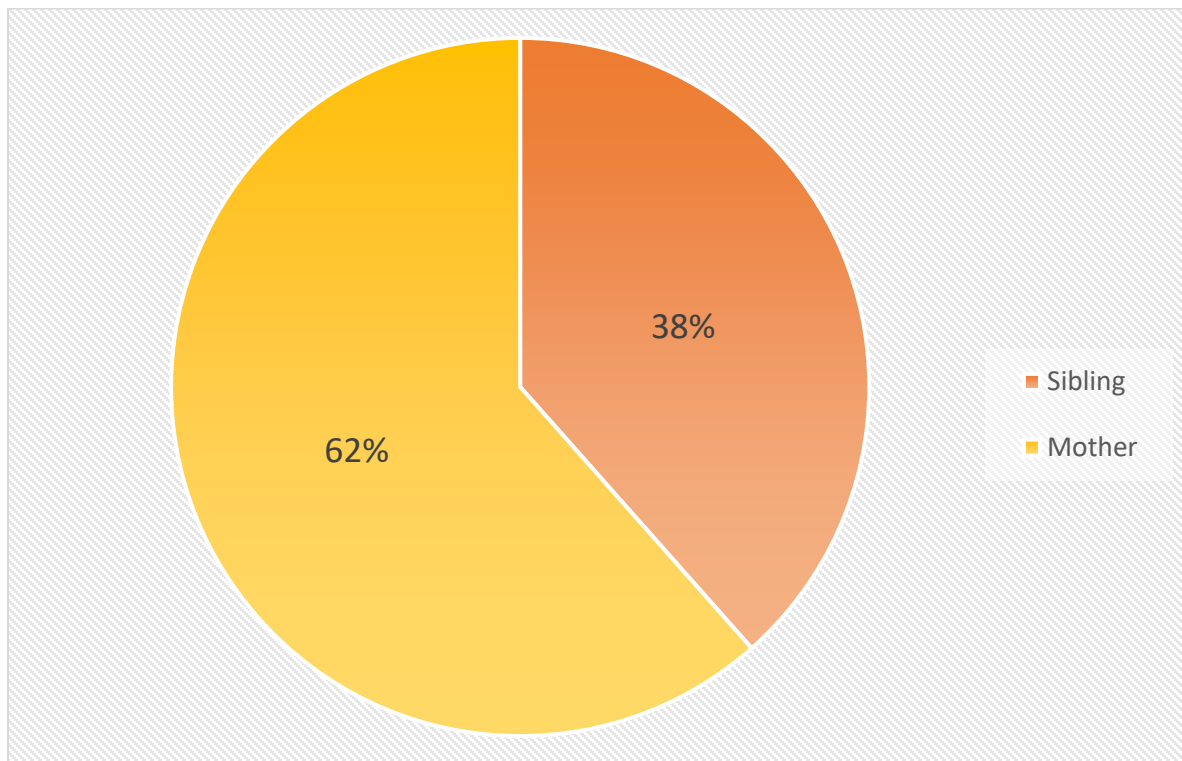
## Enjoyment

Enjoyment of co-participation during the 20-minute sessions was measured using a smiley face Likert scale labeled 1-5 with 1 being “did not enjoy” and 5 being “enjoyed the most”. Due to missing data for 1 participant, responses from 26 preschool-aged children were used to analyze the enjoyment data. The preschool-aged children’s average enjoyment rating when playing with their sibling was  $4.88 \pm .86$ . When playing with their mother, the preschool-aged children’s average enjoyment was  $4.76 \pm .52$ . There was no statistical difference between the preschool-aged child’s rating of enjoyment of co-participation between either the mother or older sibling ( $t=.5$ ;  $p=.31$ ). The effect size for enjoyment is .2. Thus, there was a small difference between how much the preschool-aged child enjoyed playing with their sibling compared to

mom. As demonstrated in Figure 6, 61.54% (n = 16) of the preschool-aged children said they enjoyed playing with their mother more than playing with their older sibling, whereas 38.46% (n = 10) of the preschool-aged children said they enjoyed playing with their older sibling more than playing with their mother.

**Figure 6**

*Preschooler Choice of playmate with Physical Activity Co-Participation*



## **DISCUSSION**

### **Purpose and Major Findings**

The purpose of this study was to investigate the effect playing with either a mother or older sibling had on a preschooler's physical activity levels. An additional point of interest in the study was to investigate the preschooler's enjoyment of physical activity co-participation. This study found that mothers and older siblings have the same impact on preschoolers' total physical activity levels. It was also found that while the preschoolers rated the enjoyment of playing with an older sibling and mom the same; however, when asked who they liked playing with the most, a higher percentage of preschoolers picked mom compared to their older sibling.

### **Relation to Past Literature**

This study found that the preschooler's physical activity levels are similar when playing with either their mother or older sibling. This finding expands past research as the effects of mothers and siblings on preschooler's physical activity has been studied independently of each other. Previous research has shown that mothers (Hesketh et al., 2014; Rebold et al., 2016; Dlugonski et al., 2017) and siblings (Edwards et al., 2015; Hesketh et al., 2017; Kracht and Sisson, 2018) positively influence a preschooler's physical activity levels. While previous investigations have underscored the importance of mothers and siblings, few examined the impact of physical activity co-participation in an experimental setting. Rebold et al. (2016) examined physical activity co-participation and reported slightly higher, but comparable levels of physical activity counts than what was reported in the current study. One reason for this difference in physical activity counts between studies is most likely due to longer play session in the Rebold et al. (2016) study. Their play sessions were conducted for 30 minutes in comparison to 20 minutes in the current study.

Moreover, the current study's findings expand on the limited research that has examined the impact a sibling has on a preschooler's physical activity levels. Most studies have examined the importance of a sibling versus only children (Kratch & Sisson, 2018; Kratch et al., 2019), and none have examined this question through co-participation of physical activity. To illustrate this point, a meta-analysis by Kracht & Sisson (2018) showed that compared to only children those with a sibling and especially preschoolers with an older sibling participated in more physical activity over the day.

To the best of our knowledge only one study compared the effect of two different people on a child's physical activity level. Koback et al. (2021) compared older children's ( $8.2 \pm 1.7$  years) total physical activity levels when playing alone, playing with a parent, and playing with a peer. One of their key findings was that there was no difference in the amount of a child's physical activity levels when playing with either a peer or parent ( $t=.76$ ,  $p=.45$ ). Studies conducted by Koback et al. (2021) and Rebold et al. (2016) both found that children engaged in higher amounts of physical activity when playing with another person than when playing alone. The results from Rebold et al. (2016), Koback et al. (2021) and the current study all highlight that playing with someone is critical for a child's physical activity engagement; they will do more than when playing alone. Further, who the other person they are playing with does not appear to matter.

In older children and adults, enjoyment of physical activity is an important aspect for people to engage in physical activity (Piercy et al., 2018). Among younger children physical activity co-participation has been identified as an important way to help them engage in physical activity (Hesketh et al., 2014; Rebold et al., 2016; Dlugonski et al., 2017). While the amount of physical activity that is obtained during co-participation has been studied, what is currently unknown is how the preschool-aged child perceives enjoyment of physical activity co-participation. The current study found that the level of enjoyment was similar when the



preschool-aged child played with either their mother or older sibling. Further, a higher percentage of preschoolers said they enjoyed playing with their mother more compared to playing with their older sibling. While these findings are novel among the preschool-aged child, they are similar to a finding in older children. Kobak et al. (2021) reported the amount of a child's "liking"/enjoyment was similar when playing with either parent or peer ( $t = 1.33$ ,  $p = .20$ ); however, more children stated they preferred to play with a peer (60%), over a parent (35%), but would rather play with a parent than play alone (5%) ( $p \leq .01$ ). While the current study and the study by Kobak et al. (2021) both reported no difference in enjoyment of playing with different people, there was a difference in who the child preferred to play with. In the current study the children stated they enjoyed playing with mom more than their sibling, but in the Kobak et al. (2021) they enjoyed playing with a peer more than with their mother. One reason for why the preschoolers in the current study chose mom over a sibling could be because they were getting one-on-one time with mom. The children in the Kobak et al. (2021) were older ( $8.2 \pm 1.7$  years) and playing with peer is becoming more desirable than playing with mom. Even though a growing body evidence is starting to show that preschoolers may experience more enjoyment of physical activity when another person is playing with them, additional research is needed as most of the past research measured enjoyment from the parent's perspective instead of from the preschooler. Thus, a better understanding about the role of enjoyment of physical activity co-participation as a determinate to increase the preschool-aged child's physical activity level is needed.

## **Strengths**

This study has many strengths which were built off past research. For example, mothers and siblings' impact on preschooler's physical activity has been studied independently of each other. One strength of this study is that both mothers and older siblings were included in the same study which enabled a direct comparison of the impact each family member had on the

same preschoolers' physical activity. Another strength was that the order of conditions, who played with the preschooler – mother or sibling – were counterbalanced to ensure there was no order effect. Additionally, the accelerometer data was set at a 1 second epoch. This is a strength because movement patterns of preschool-aged children are short and irregular in length (Bailey et al., 1995), thus the accelerometer was able to measure all physical activity that was occurring. A final strength of the study was that enjoyment of co-participation was asked directly to the preschooler. Previous research has investigated enjoyment of physical activity in general or the parent's perception of their preschooler's enjoyment. This study directly examined the enjoyment of co-participation and from the preschooler's perception.

## **Limitations**

This study has some limitations that could be used to direct future research. One limitation involves the measurement of preschooler's enjoyment. Using the smiley face Likert scale did attract most of the preschool-age children's attention and they were able to point to an answer when prompted. However, the preschool-aged children may not have fully comprehended the question they were being asked. It was observed that when administering this questionnaire, the directions had to be asked more than once for some of the younger children (3 years). Another limitation was that the main outcome variable measured total physical activity counts. Physical activity was not broken down into light, moderate, and vigorous intensities. If the time spent in the different intensities were calculated it might show differences in the impact that a mother or older sibling could have on the preschooler's physical activity levels that are not apparent with total physical activity. Yet another limitation is that having mothers play with their child in a controlled environment while being watched by researchers could have changed how they interacted with the child. Finally, another possible limitation could be the lack of a condition where the preschool-aged child played alone. However, past studies have consistently reported that playing with someone generated more

physical activity than playing alone (Barkley et al., 2014; Koback et al., 2021; Rebold et al., 2016; Sanders et al., 2014), so it is unlikely that in the current study a different finding would have been present if the alone condition was present.

### **Practical Applications/Future Research**

The results from this study can be applied to many real-life situations. Both the mother and older sibling produce the same amount of physical activity from the preschooler. Therefore, there are two family members that can help contribute to increasing physical activity levels in a preschooler. Further, if you take into consideration the results of the preschooler's enjoyment, the mother may have more influence over the preschooler's physical activity considering a higher percentage of participants enjoyed playing with mom over the older sibling. These findings highlight the importance multiple family members have on a young child's physical activity levels. As a result of these findings physical activity co-participation among multiple family members should be encouraged within a family.

While this study enhances the understanding of physical activity co-participation in the preschool age group, additional research is still necessary. For example, it is unknown if playing with different family members helps the preschool-aged child engage in more moderate to vigorous physical activity. Breaking the play sessions into different physical activity intensities to see if more time was spent in light, moderate, or vigorous intensity might show different results than total physical activity. Another aspect to consider for future research is the father's role as we do not know much about how they interact with preschoolers. In addition, an avenue that may be explored is if the sex of the older sibling and younger sibling to see if there are any differences among the different pairings. In addition to these pairings, the age difference between siblings could be investigated further to see if it potentially may influence preschooler physical activity levels. Lastly, another way to expand on this study would be to include activities that are more applicable to the home environment.

## **Conclusion**

In conclusion, mothers and older siblings both positively impact a preschoolers' physical activity levels during co-participation. The current findings expand on the existing literature stating that co-participation has been associated with higher levels of physical activity in preschoolers. Additionally, preschoolers may enjoy physical activity co-participation with their mother more than their older sibling. This finding contributes to the small amount of past research by further exploring enjoyment of co-participation from the preschooler's perspective. The results from this study underscore the importance different determinates (family and enjoyment) have on preschooler's physical activity.

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## **APPENDIX A: Informed Consent**

### **Informed Consent to Participate in Research**

Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: Exploring the contributions of parents and siblings to young children's physical activity levels

Principal Investigator: Katrina DuBose

Institution, Department or Division: Department of Kinesiology

Address: 174 Minges, Mailstop 559, Department of Kinesiology, East Carolina University, Greenville, NC 27858 Telephone #: 328-1599

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Researchers at East Carolina University (ECU) study issues related to society, health problems, environmental problems, behavior problems and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

#### **Why am I and my children being invited to take part in this research?**

The purpose of this research is to find out how older siblings and mothers influence children aged 3-5 years physical activity amounts. Your children are being invited to take part in this research because the younger child is between 35 months and the older child is no more than 4 years older than the younger child. The decision for your children to take part in this research will also depend upon whether your children want to participate. By doing this research, we hope to better understand the role different family members have on young children's physical activity levels.

The purpose of this research is to find out how mothers and older siblings influence children aged 3-5 years physical activity amounts. It is completely up to you to partake in this study. You are being invited to take part in this research because you are 19 years or older and you have 2 children between the years 3-9 years old. The decision to take part in this research is yours to make. The decision for your children to take part in this research will also depend upon whether your children want to participate. By doing this research, we hope to better understand the role different family members have on young children's physical activity levels.

If you volunteer to take part in this research, you will be one of about 90 people to do so.

#### **Are there reasons I and my children should not take part in this research?**

If you are under the age of 19 years or do not have 2 children between the ages of 3-9 years. Another reason not to participate is if your 2 children are more than 4 years apart in age or do not have a child between 2-5 years old.

**What other choices do I and my children have if I do not take part in this research?** You can choose not to participate.

**Where is the research going to take place and how long will it last?**

The research will be conducted at the Activity Promotion Laboratory (Room 101) located in Minges Coliseum. You and your children will need to come 1 time during the study. The total amount of time you and your children will be asked to volunteer for this study is 60 minutes.

*Consent Version # or Date: 9-7-22\_\_\_\_\_*

**What will I and my children be asked**

**to do?** You will be asked to do the following:

- For children between the ages of 3-5, we will measure their height and weight. He/she will be asked to play for 2 20-minute sessions. One session will be playing with their older sibling and the other session will be playing with you. A rest break (~5 minutes) will be given in between the 2 sessions. During the play sessions there will be a variety of activities to choose from. The activities include options like, crawling through a tunnel, jumping, playing catch with a ball, playing basketball, reading, coloring, etc. Your child will wear an activity monitor around his/her waist during the 2 sessions. After both conditions are finished, we will ask your child questions about how they liked the two play sessions.
- For the older child, we will measure their height and weight. He/she will be asked to play with their younger sibling for 20 minutes. He/she will also wear an activity monitor around their waist.
- For the mother, you will complete consent document, demographics and family physical activity questionnaires, we will measure your height and weight, and you will play with your youngest child for 20 minutes. During this play session you will wear an activity monitor around your waist.

We would like to take some pictures of the different family members during the 2 play sessions. Only the principal investigator and research staff will have access to the pictures. These pictures could be used by the principal investigator for scientific presentations or could be used to highlight research activities done at East Carolina University or could be used for marketing future studies. Your and your children's names will not be associated with any pictures and the pictures will be kept on a password protected pirate drive on the principal investigator's computer for a minimum of 3 years. When it is time to destroy the pictures they will be deleted from the pirate drive. You may remain in the study even if you chose not to allow us to take pictures. Please let us know if you will allow us to take pictures of you and your children during the play sessions.

\_\_\_\_\_ Yes, I will allow you to take pictures of my children and myself

\_\_\_\_\_ No, I will NOT allow you to take pictures of my children and myself

In the future we might want to do additional research with your family. Please let us know if we can contact you about future research studies that we might do about physical activity and families. By allowing us to contact you this does not mean you are agreeing to participate in any future study.

\_\_\_\_\_ Yes, I will allow you contact me about future research

opportunities \_\_\_\_\_ No, I will NOT allow you to contact me about

future research opportunities

### **What might I and my children experience if we take part in the research?**

Other people who have taken part in this type of research have no more risk than what you would experience in your everyday life. While you and your children are completing the physical activity sessions, you may feel out of breath or your heart beating faster, you might begin to sweat, or start to get tired. These responses are normal and go away with time. Other people who have participated in this type of research have experienced having fun with their child and between sibling and felt closer to family members. By participating in this research study, you may also experience these benefits.

### **Will I or my children be paid for taking part in this research?**

We will not be able to pay you for the time you volunteer while being in this study. However, the youngest child will receive a ball and the older sibling will get to pick a toy from a prize box for participating.

### **Will it cost me to take part in this research?**

It will not cost you any money to be part of the research.

### **Who will know that I took part in this research and learn personal information about me and my children?**

ECU and the people and organizations listed below may know that you took part in this research and may see information about you that is normally kept private. With your permission, these people may use your private information to do this research:

- The sponsors of this study.
- Any agency of the federal, state, or local government that regulates human research. This includes the Department of Health and Human Services (DHHS), the North Carolina Department of Health, and the Office for Human Research Protections.
- The University & Medical Center Institutional Review Board (UMCIRB) and its staff have responsibility for overseeing your welfare during this research and may need to see research records that identify you.

**How will you keep the information you collect about me and my children secure? How long will you keep it?**

Only the investigators and personnel associated with this study will have access to the data obtained. No identifying information will be released. An ID will be assigned to you and your children and only the primary investigator and key research personnel will have access to the code and your name. Data will be secured in a locked filing cabinet in the primary investigator's laboratory. These measures will protect the identity of you and your children. The data will be kept for 7 years. Any data that is presented in papers or at conferences will be done so as group data with no identification of individual adults or children.

**What if I decide I and my children don't want to continue in this research?**

You and your children can stop at any time after it has already started. There will be no consequences if you and your children stop and you and your children will not be criticized. You will not lose any benefits that you normally receive.

**Who should I contact if I have questions?**

The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator, Katrina DuBose at 252-328-1599 (between Monday – Friday, 8:00AM-5:00PM).

If you have questions about your rights as someone taking part in research, you may call the University & Medical Center Institutional Review Board (UMCIRB) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director for Human Research Protections, at 252-744-2914.

**Is there anything else I should know?**

Identifiers might be removed from the identifiable private information or identifiable biospecimens and, after such removal, the information or biospecimens could be used for future research studies or distributed to another investigator for future research studies without additional informed consent from you or your Legally Authorized Representative (LAR). However, there still may be a chance that someone could figure out the information is about you.

**I have decided I want to take part in this research. What should I do now?**

The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.
- I know that I and my child can stop taking part in this study at any time.
- By signing this informed consent form, I and my child are not giving up any of my rights. ☐ I have been given a copy of this consent document, and it is mine to keep.

**Parent Participant's Name (PRINT)**

**Signature**

**Date**

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**Younger Child Participant's Name (PRINT)**

“By initialing in the following places, the parent/guardian and investigator indicate their opinion that the patient is too young or otherwise not able to give consent/assent.”

\_\_\_\_ Parent/Guardian

\_\_\_\_ Investigator

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**Older Child Participant's Name (PRINT)**

“By initialing in the following places, the parent/guardian and investigator indicate their opinion that the patient is too young or otherwise not able to give consent/assent.”

\_\_\_\_ Parent/Guardian

\_\_\_\_ Investigator

**Person Obtaining Informed Consent:** I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above, and answered all of the person's questions about the research.

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**Person Obtaining Consent (PRINT)**

**Signature**

**Date**

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**Principal Investigator (PRINT)**

**Signature**

**Date**

**(If other than person obtaining informed consent)**

**Verbal Assent was given by the child aged 7-9 years** \_\_\_\_\_

**Date:** \_\_\_\_\_

## APPENDIX B: Demographic Information Questionnaire

### Demographic Information

I would like to ask you about your and your children's family background. Some questions will use terms like younger and older child. When these terms the questions are asking about the 2 children involved in this study and not any other child you might have.

1. How old is your younger child? \_\_\_\_\_ years [SMPA0201]
2. What is your younger child's birth date? \_\_\_\_\_/\_\_\_\_\_/\_\_\_\_\_ [SMPA0202]
3. What is your younger child's biological sex? (check one) [SMPA0203]  
  
\_\_\_\_ 1. Female      \_\_\_\_ 2. Male
4. What is your younger child's race? (check one) [SMPA0204]  
  
\_\_\_\_ 1. Black/African American      \_\_\_\_ 2. White      \_\_\_\_ 3. Asian  
  
\_\_\_\_ 4. Native American      \_\_\_\_ 5. Other
5. What is your younger child's ethnicity? (check one) [SMPA0205]  
  
\_\_\_\_ 1. Non-Hispanic      \_\_\_\_ 2. Hispanic
6. How old is your older child? \_\_\_\_\_ years [SMPA0206]

7. What is your older child's birth date? \_\_\_\_/\_\_\_\_/\_\_\_\_ [SMPA0207]

8. What is your older child's biological sex? (check one) [SMPA0208]

\_\_\_\_ 1. Female      \_\_\_\_ 2. Male

9. What is your older child's race? (check one) [SMPA0209]

\_\_\_\_ 1. Black/African American      \_\_\_\_ 2. White      \_\_\_\_ 3. Asian

\_\_\_\_ 4. Native American      \_\_\_\_ 5. Other

10. What is your older child's ethnicity? (check one) [SMPA0210]

\_\_\_\_ 1. Non-Hispanic      \_\_\_\_ 2. Hispanic

11. How old are you? \_\_\_\_ years [SMPA0211]

12. What is your biological sex? (check one) [SMPA0212]

\_\_\_\_ 1. Female      \_\_\_\_ 2. Male

13. What is your race/ethnicity? (check one) [SMPA0213]

\_\_\_\_ 1. Black/African American      \_\_\_\_ 2. White      \_\_\_\_ 3. Asian

\_\_\_\_ 4. Native American      \_\_\_\_ 5. Other



14. What is your ethnicity? (check one) [SMPA0214]

\_\_\_\_ 1. Non-Hispanic      \_\_\_\_ 2. Hispanic

15. Which best reflects your highest level of education? (check one) [SMPA0215]

\_\_\_\_ 1. Did not complete high school  
\_\_\_\_ 2. Graduated from high school or earned GED  
\_\_\_\_ 3. Attended college or vocational school  
\_\_\_\_ 4. Earned a college degree (Bachelor's)  
\_\_\_\_ 5. Earned a graduate degree (Masters, Doctoral, Professional)  
\_\_\_\_ 7. Don't know/refused

16. Do you work for a living? [SMPA0216]

\_\_\_\_ 1. No (go to question 18)  
\_\_\_\_ 2. Yes  
\_\_\_\_ 7. Don't know/ Refused

17. Which best describes the hours you work? [SMPA0217]

\_\_\_\_ 1. Part time      \_\_\_\_ 2. Full time      \_\_\_\_ 7. Don't know/ Refused

18. Which best describes your marital status? (check one) [SMPA0218]

\_\_\_\_ 1. Married  
\_\_\_\_ 2. Living as married

- \_\_\_ 3. Widowed
- \_\_\_ 4. Divorced
- \_\_\_ 5. Never married/single
- \_\_\_ 6. Separated
- \_\_\_ 7. Don't know/refused

Which best describes the place you live? (check one) [SMPA0219]

- \_\_\_ 1. Large city [>100,000 people; like Raleigh, NC]
- \_\_\_ 2. Medium city [30,000-100,000 people; like Goldsboro or Greenville, NC]
- \_\_\_ 3. Rural city [<30,000 people; like Havelock or New Burn, NC]
- \_\_\_ 4. Small city [<1,000 people; like Black Creek or Bath, NC]
- \_\_\_ 5. In the country, no city
- \_\_\_ 7. Don't know/refused

19. Which best describes your household income in the past year? (check one) [SMPA0220]

- \_\_\_ 1. < \$15,999
- \_\_\_ 2. \$16,000 to \$24,999
- \_\_\_ 3. \$25,000 to \$34,999
- \_\_\_ 4. \$35,000 to \$49,999
- \_\_\_ 5. \$50,000 to \$74,999
- \_\_\_ 6. \$75,000 and greater
- \_\_\_ 7. Don't know/refused

21. Does your younger child attend either preschool or daycare? [SMPA0221]

- \_\_\_ 1. No (go to question 23)

\_\_\_ 2. Yes

\_\_\_ 7. Don't know/ Refused

22. On average how long is your younger child in preschool or daycare per day? [SMPA0222]

\_\_\_\_\_ hours

23. Does your younger child attend elementary school (kindergarten)? [SMPA0223]

\_\_\_ 1. No (go to question 26)

\_\_\_ 2. Yes

\_\_\_ 7. Don't know/ Refused

24. Does your younger child attend an after-school program? [SMPA0224]

\_\_\_ 1. No (go to question 26)

\_\_\_ 2. Yes

\_\_\_ 7. Don't know/ Refused

25. On average how long is your younger child in the after-school program per day?  
[SMPA0225]

\_\_\_\_\_ hours

26. Does your older child attend either preschool or daycare? [SMPA0226]

\_\_\_ 1. No (go to question 28)

\_\_\_ 2. Yes

\_\_\_ 7. Don't know/ Refused

27. On average how long is your older child in preschool or daycare per day? [SMPA0227]

\_\_\_\_\_ hours

28. Does your child older child attend elementary school? [SMPA0228]

\_\_\_ 1. No (go to question 31)

\_\_\_ 2. Yes

\_\_\_ 7. Don't know/ Refused

29. Does your older child attend an after-school program? [SMPA0229]

\_\_\_ 1. No (go to question 31)

\_\_\_ 2. Yes

\_\_\_ 7. Don't know/ Refused

30. On average how long is your older child in the after-school program per day? [SMPA0230]

\_\_\_\_\_ hours

31. How many children to you have (include the children participating in this study)?  
[SMPA0231]

\_\_\_\_\_ number

32. What is the age and biological sex for each child (*do not* include children participating in this study)? [SMPA0232]

Child #1: \_\_\_\_\_ age [SMPA0232A] Sex: \_\_\_\_\_ 1. Female \_\_\_\_\_ 2. Male  
[SMPA0232B]

Child #2: \_\_\_\_\_ age [SMPA0232C] Sex: \_\_\_\_\_ 1. Female \_\_\_\_\_ 2. Male  
[SMPA0232D]

Child #3: \_\_\_\_\_ age [SMPA0232E] Sex: \_\_\_\_\_ 1. Female \_\_\_\_\_ 2. Male  
[SMPA0232F]

Child #4: \_\_\_\_\_ age [SMPA0232G] Sex: \_\_\_\_\_ 1. Female \_\_\_\_\_ 2. Male  
[SMPA0232H]

Child #5: \_\_\_\_\_ age [SMPA0232I] Sex: \_\_\_\_\_ 1. Female \_\_\_\_\_ 2. Male  
[SMPA0232J]

## APPENDIX C: Anthropometrics Data Collection Form

### Anthropometrics Data Collection Form

Mom ID: \_\_\_\_\_M

**Height** (to the nearest 0.5 cm)

HT1: \_\_\_\_\_ cm [SMPA0301]      HT2: \_\_\_\_\_ cm [SMPA0302]

**Weight** (to the nearest 0.1 kg)

WT1: \_\_\_\_\_ kg [SMPA0303]      WT2: \_\_\_\_\_ kg [SMPA0304]

Younger Child ID: \_\_\_\_\_Y

**Height** (to the nearest 0.5 cm)

HT1: \_\_\_\_\_ cm [SMPA0301]      HT2: \_\_\_\_\_ cm [SMPA0302]

**Weight** (to the nearest 0.1 kg)

WT1: \_\_\_\_\_ kg [SMPA0303]      WT2: \_\_\_\_\_ kg [SMPA0304]

Older Child ID: \_\_\_\_\_ O

**Height** (to the nearest 0.5 cm)

HT1: \_\_\_\_\_ cm [SMPA0301]      HT2: \_\_\_\_\_ cm [SMPA0302]

**Weight** (to the nearest 0.1 kg)

WT1: \_\_\_\_\_ kg [SMPA0303]      WT2: \_\_\_\_\_ kg [SMPA0304]

## APPENDIX D: Direct Observation Form

### Direct Observation of Dyad PA

10. Play session observing [SMPA0501]

\_\_\_\_ 1. Session #1      \_\_\_\_ 2. Session #2

11. Condition observing [SMPA0502]

\_\_\_\_ 1. Younger Child-Older Child      \_\_\_\_ 2. Younger Child-Mom

During the play session record the following information

| Activity Option                         | Recording number |
|-----------------------------------------|------------------|
| Obstacle course #1 – tunnel             | 1                |
| Obstacle course #2 – ladder/polly spots | 2                |
| Obstacle course #3 – wedge              | 3                |
| Soccer                                  | 4                |
| Playing catch                           | 5                |
| Running race                            | 6                |
| Sedentary Activities                    | 7                |

12. Activity 1 type: \_\_\_\_\_ [SMPA0503]

13. Who initiated play? [SMPA0504]



\_\_\_\_ 1. Younger Child \_\_\_\_ 2. Older Child \_\_\_\_ 3. Mom

14. Activity 1 duration: \_\_\_\_\_ min \_\_\_\_\_ seconds [SMPA0504]

15. Activity 2 type: \_\_\_\_\_ [SMPA0506]

16. Who initiated play? [SMPA0508]

\_\_\_\_ 1. Younger Child \_\_\_\_ 2. Older Child \_\_\_\_ 3. Mom

17. Activity 2 duration: \_\_\_\_\_ min \_\_\_\_\_ seconds [SMPA0507]

18. Activity 3 type: \_\_\_\_\_ [SMPA0509]

19. Who initiated play? [SMPA0508]

\_\_\_\_ 1. Younger Child \_\_\_\_ 2. Older Child \_\_\_\_ 3. Mom

20. Activity 3 duration: \_\_\_\_\_ min \_\_\_\_\_ seconds [SMPA0510]

21. Activity 4 type: \_\_\_\_\_ [SMPA0512]

22. Who initiated play? [SMPA0508]

\_\_\_\_ 1. Younger Child \_\_\_\_ 2. Older Child \_\_\_\_ 3. Mom

23. Activity 4 duration: \_\_\_\_\_ min \_\_\_\_\_ seconds [SMPA0513]

24. Activity 5 type: \_\_\_\_\_ [SMPA0515]

25. Who initiated play? [SMPA0508]

\_\_\_\_\_ 1. Younger Child \_\_\_\_\_ 2. Older Child \_\_\_\_\_ 3. Mom

26. Activity 5 duration: \_\_\_\_\_ min \_\_\_\_\_ seconds [SMPA0516]

27. Activity 6 type: \_\_\_\_\_ [SMPA0518]

28. Who initiated play? [SMPA0508]

\_\_\_\_\_ 1. Younger Child \_\_\_\_\_ 2. Older Child \_\_\_\_\_ 3. Mom

29. Activity 6 duration: \_\_\_\_\_ min \_\_\_\_\_ seconds [SMPA0519]

30. Activity 7 type: \_\_\_\_\_ [SMPA0521]

31. Who initiated play? [SMPA0508]

\_\_\_\_\_ 1. Younger Child \_\_\_\_\_ 2. Older Child \_\_\_\_\_ 3. Mom

32. Activity 7 duration: \_\_\_\_\_ min \_\_\_\_\_ seconds [SMPA0522]

33. Activity 8 type: \_\_\_\_\_ [SMPA0524]

34. Who initiated play? [SMPA0508]

\_\_\_\_\_ 1. Younger Child \_\_\_\_\_ 2. Older Child \_\_\_\_\_ 3. Mom

35. Activity 8 duration: \_\_\_\_\_ min \_\_\_\_\_ seconds [SMPA0525]

36. Who initiated play? [SMPA0526]

\_\_\_\_\_ 1. Younger Child \_\_\_\_\_ 2. Older Child \_\_\_\_\_ 3. Mom

37. Activity 9 type: \_\_\_\_\_ [SMPA0527]

38. Who initiated play? [SMPA0508]

\_\_\_\_\_ 1. Younger Child \_\_\_\_\_ 2. Older Child \_\_\_\_\_ 3. Mom

39. Activity 9 duration: \_\_\_\_\_ min \_\_\_\_\_ seconds [SMPA0528]

## APPENDIX E: Child Enjoyment Data Collection Form

### Child Enjoyment Data Collection Form

1. Play session #1 [SMPA0601]

\_\_\_\_\_ 1. Session #1      \_\_\_\_\_ 2. Session #2

2. Condition [SMPA0602]

\_\_\_\_\_ 1. Younger Child-Older Child      \_\_\_\_\_ 2. Younger Child-Mom

3. Rate how much you enjoyed playing with \_\_\_\_\_ [SMPA0603]

Rating: \_\_\_\_\_

4. Play session #2 [SMPA0604]

\_\_\_\_\_ 1. Session #1      \_\_\_\_\_ 2. Session #2

5. Condition [SMPA0605]

\_\_\_\_\_ 1. Younger Child-Older Child      \_\_\_\_\_ 2. Younger Child-Mom

6. Rate how much you enjoyed playing with \_\_\_\_\_ [SMPA0606]

Rating: \_\_\_\_\_

***Ask this question after both play sessions have been completed***

7. Who did you enjoy playing with the most? [SMPA0607]

\_\_\_\_\_ 1. Sibling      \_\_\_\_\_ 2. Mom



