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The rates of children's physical activity (PA) have declined over the past several decades in the U.S. While the increased number of women entering the workforce has led to more children than ever before attending childcare centers, studies examining PA have largely focused on school-aged children so far. Currently, there is some knowledge in the existing literature on the amount of PA among preschoolers, but the knowledge is so far very limited. The main purpose of this study was to assess the amount and specific patterns of PA of preschool-aged children in a childcare setting. The second purpose of the study was to examine personal, environmental, and policy factors that have been proposed to influence PA in a childcare setting. A list of 98 five-star childcare centers in Guilford County was compiled and three childcare centers were randomly selected for potential participation in the study (1 agreed to participate). The amount and patterns of children's PA were measured using accelerometers. The multi-level factors related to PA within the childcare setting were assessed using the Environmental Policy Assessment and Observation tool (EPAO), in-depth interviews with the center director and informal interviews with teachers (guided by the Social Cognitive Theory). An Actigraph GT3x accelerometer was placed on each child upon arrival and removed during pickup from the childcare center to measure total PA. Sixty-eight percent of children met the recommendation of at least 60 minutes of moderate-to-vigorous PA a day (MVPA). The childcare center's PA environment was scored at 18.7/20, indicating a very positive PA environment. Using a manual content analysis, several themes emerged from the

interview with the center's director: 1) awareness of PA importance on learning, growth, and health; 2) importance of buy-in from parents and teachers/staff; 3) the need for PA policy to be in place; 4) knowledge of PA recommendations; 5) lack of gym access perceived as a main barrier. The field interviews with teachers generated the following themes: 1) strong awareness of the importance of PA for children's learning, growth and overall health; 2) equipment, space and time perceived as the major facilitators of PA; 3) focus on safety perceived as major barrier to teacher participation in PA with children; 4) low PA among teachers due to lack of time in their schedules; and 5) confusion about current PA recommendations for young children. Most children in the sample met the minimum PA recommendations. Our findings highlight the importance of a positive environment, with childcare staff being aware of the importance of PA for children during the day. Further studies should assess both the PA environment and the social climate related to PA across childcare centers in order to make individualized improvements and thus optimize children's PA across childcare centers.

PATTERNS OF PHYSICAL ACTIVITY AMONG PRESCHOOLERS IN A
CHILDCARE SETTING: A PILOT STUDY

by

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CHAPTER I

INTRODUCTION

Development of excessive adiposity among children may lead to life long health consequences.¹ Although the prevalence of childhood obesity has somewhat stabilized between 2008 and 2011, nearly one third of children and adolescents remain to be overweight or obese nationwide.^{1,2,3} As the rates of obesity have increased, the rates of physical activity (PA) have decreased, suggesting that lower rates of PA are associated with the substantial rise of obesity across many developed countries.^{1,3,4} In fact, research shows that 31% of the world's population is not meeting the PA requirements, which represents a significant increase from the 17% in 2009.⁴ Physical inactivity is not only contributing to increased risk of obesity, but it was also estimated to result in 5.3-5.7 million deaths in 2007 that could have been prevented with sufficient PA.⁵

The rates of PA in recent decades have been influenced by a number of social and economic transitions, such as the use of electronic devices, transportation developments, economic depression and demographic shifts in the workforce.⁶ For instance, the number of women in the workforce has increased by 15% over the past 5 decades, which resulted in the number of children attending childcare centers to nearly double since 1965.^{7,8} Since many young children now spend several hours a day at a childcare center, instead of at home with one of their family members, parents no longer represent the main influence on children's PA. Thus, the parental roles related to children's daily lifestyle habits,

including PA, have largely shifted to teachers, staff and administrators within the childcare center environment.^{9,10}

The physical environment of childcare centers may have an important influence on young children's overall PA level on a daily basis.¹¹⁻¹³ Having adequate play space and equipment encourages children to be physically active. On the other hand, lack of safe outdoor space or limited equipment may significantly diminish children's opportunities to be physically active in a childcare setting.¹¹⁻¹³ Previous research by Ward et al. has also shown that center-wide policies specifically related to PA are related to increased rates of PA among children as well as are a good area for intervention targets.^{14, 15} Finally, it is critical to consider the role of childcare teachers and staff in children's PA patterns in a childcare setting. Just like parents influence their children's behavior at home, childcare teachers and staff play a similar and instrumental role in supporting and encouraging PA among young children. Thus, their knowledge related to PA, their awareness of PA recommendations, the value they put on the importance of PA for children's health and learning, and their own PA may influence the amount and patterns of PA of young children in their classroom.^{17,18} Despite the important potential role childcare teachers play in children's PA behaviors, very few studies to date have examined childcare teachers/staff's perceptions, attitudes and engagement in children's PA in childcare settings.^{9,17}

Research studies and interventions targeting PA among children have largely been focused on older children, ranging from elementary school age to adolescents.¹⁸⁻²⁰ This focus has been justified by the fact that only around 42% of school age children meet the

minimum PA guidelines and the number of children obtaining adequate PA declines with age.²¹ While this is an important area of further research, only small sample, isolated studies have examined the amount and patterns of PA and there is very limited research on the personal and environmental factors that likely influence PA of preschoolers in childcare settings..²²⁻²⁴ Furthermore, almost no qualitative studies have been conducted to better understand the attitudes, knowledge and barriers related to PA from the perspective of teachers, staff, administrators and other adults who teach, guide and care for young children on a daily basis.^{9,17}

Study Objectives

- 1) To determine the daily amount and patterns of PA in a sample of preschool-aged children in a full-day childcare setting.
- 2) To assess the childcare PA environment and examine personal, environmental and policy-level factors that may influence children's PA in a childcare setting.

Definition of Terms

Accelerometers: device that uses a computer and motion sensor to continuously calculate direction and speed of movement

Adiposity: amount of body fat

Anthropometric measures: Used to assess size, shape, and composition of the human body including BMI, waist-to-hip ratio, skin fold test, height, and weight

Body Mass Index (BMI): A measure of height to weight ratio

Childhood Obesity: Obesity among children is determined based on the child's sex-specific BMI-for-age percentile and using the cut off of 95th percentile...

Digital Tanita Scale: device used to calculate weight

EPAO Environmental Policy Assessment & Observation Tool (EPAO): Tool designed to evaluate practices, environmental attributes, and policies of early care and education setting that influences children's nutrition and physical activity

Manual Content Analysis: Analysis without computer techniques for contextualized interpretations of documents/interviews/focus group results

METs (Metabolic equivalents): The ratio of the work metabolic rate to the resting metabolic rate. One MET is defined as 1 cal/kg/hour

Moderate Activity: Requiring moderate amount of effort and noticeable accelerating heart rate, while working at 3-6 metabolic equivalents

Observational system for recording physical activity in children-preschool

(OSRPAC-P): direct observation system for observing children's physical activity and its associated physical and social constructs

Preschool age: 3-5 years old

Stadiometer: device used to measure height that typically consists of a vertical ruler with a sliding horizontal rod or paddle which is adjusted to rest on the top of the head

Star Rating System: a rating system that each childcare center receives in order to note how they compare to the childcare regulations. With 1 being meeting the minimum and 5 being the highest.

Social Cognitive Theory (SCT): Learning theory based on the idea that people learn by observing others. These learned behaviors can be central to one's personality as well as the environment contributing to behaviors.

Vigorous Intensity: large amount of effort and causes rapid breathing and substantial increase in heart rate, while working at greater than 6 metabolic equivalents

Abbreviations

BMI	Body Mass Index
EPAO	Environmental Policy Assessment & Observation Tool
PA	Physical Activity
NASPE.....	National Youth Fitness Survey
MVPA	Moderate to Vigorous Physical Activity
METs.....	Metabolic Equivalents
NAPSACC	Nutrition and Physical Activity Self-assessment for Child Care
OSRPAC-P	Observational System for Recording Physical Activity in Children-Preschool
SCT	Social Cognitive Theory

CHAPTER II

REVIEW OF THE LITERATURE

Physical Activity Recommendations and Childhood Obesity Prevention

Inadequate physical activity (PA) and sedentary lifestyle are recognized as two important correlates of obesity, as these behaviors contribute to excessive adiposity in both children and adults.²⁵ In the state of North Carolina, 15.4% of children ages 2-4 are obese and the state ranks 7th in the obesity rates in this age group in the nation.²⁶ Because obese preschoolers are 5 times more likely to become obese adults,^{27,28,29} optimizing PA among children represent one of the critical components of childhood obesity prevention efforts.³⁰ According to the 2010 Dietary Guidelines for Americans, children aged 2 and older should engage in a minimum of 60 minutes of daily PA at the moderate to vigorous level.^{21, 25} Moderate intensity PA is defined as requiring a moderate amount of effort and noticeable accelerating heart rate, while working at 3-6 metabolic equivalents (METs). Examples of moderate intensity exercise include brisk walking, dancing, and active involvement in games or sports. Vigorous-intensity PA requires a large amount of effort and causes rapid breathing and a substantial increase in heart rate, while working at greater than 6 METs. Examples of vigorous-intensity exercise include running, fast cycling, and competitive sports.³³ The 2015 Dietary Guidelines only specify recommendations for children 6 and older that include 60 minutes a day of physical activity, with the majority coming from aerobic activity, but do not specify intensity.³⁴

Currently, only 54% of children ages 2-6 are meeting the 60 minute a day recommendation.⁴⁶ The National Association for Sport and Physical Education (NASPE) states that preschoolers need 60 minutes a day of structured PA and a minimum of 60 minutes a day and up to several hours of unstructured PA. These recommendations also include a specific guideline related to sedentary behavior, in that preschool-aged children shall not be sedentary for more than 60 minutes per day except while sleeping. Although specific for preschool-aged children, these guidelines do not include recommendations for specific PA intensity levels.³⁵

Physical Activity Among Preschoolers

To date, research studies assessing children's PA has largely focused on school-aged children and adolescents.¹⁸⁻²⁰ Much less is known about PA during preschool years when children begin to develop important dietary and PA habits that track into later years.^{23,39,40} Currently in the literature, more studies are emerging that sample rates and patterns of preschoolers PA, but there is a very limited number of studies that offer either nationally representative data or data from large diverse samples. Findings of previous studies and the accuracy of PA estimates are also somewhat limited by the retrospective and subjective nature of the studies.³⁶⁻³⁸ An exception was the National Youth Fitness Survey (NYFS) in 2012 that provided unique national-level estimates of PA and fitness levels of children aged 3-15 years, with participants wearing accelerometer on the wrist for 7 continuous days at school and at home.^{41, 42} This was the first nationally representative estimate of PA levels that included young children (between ages 3-5).⁴³

The results were intended to be used to develop programs and policies and for development of national reference standards.⁴³ This study collected anthropometric measurements, tests of gross motor development, dietary recall interview, abdominal muscle strength, and PA monitoring with accelerometers in preschool children.⁴¹ Findings for the entire sample showed that only 1 out of 4 children aged 3-15 met the recommended 60 min of daily MVPA. Findings for preschool children specifically were not disclosed from this survey.

To our knowledge, many studies have examined children's PA using subjective measures (i.e., parent-reported questionnaires of the child's PA), but fewer studies have estimated young children's PA using accelerometry.^{12, 38, 44, 46} In a sample of 281 children from 9 childcare centers, children wore accelerometers for 4.4 hours a day for an average of 6.6 days. The accelerometer results showed that children spent 42% of the time sedentary and 2% of the time in MVPA. The activity levels of children varied widely, with boys being more active than girls. The study also found that one of the most important predictors of MVPA was the characteristics of the attended childcare center.¹² These results were not explored in the study, but researchers speculated that this variance can be explained by various policies, procedures, and personnel, and that it should be explored in future research.¹²

Similarly, Finn et al.⁴⁵ found that preschool aged girls participated only 4.5% of the time and boys in 5.2% of the time in vigorous activity. PA levels varied by gender, preterm birth, father's BMI, and child care center, with the childcare center being the strongest determinant of PA and explained 46% of the variability in the study.⁴⁵ The

study did not obtain objective measures of center environment to explain why the childcare center was the strongest determinant, and stated that further investigation into childcare center environments should be studied.⁴⁵

In a study by Shen et al,⁴⁴ observations on 3-5 year old African Americans coupled with accelerometers for one week while at the childcare center for at least 2.3 hours. The researchers found that the children spent the majority of their time while in daycare in sedentary behavior, 56.02 minutes per hour on average. Children spent 3.09 minutes per hour on average in light activity, .89 minutes on average per hour in moderate-to-vigorous activity, and 0 minutes in vigorous activity. Boys and older children had more participation in PA than others. Regardless of demographic characteristics, all children in the sample engaged in very limited MVPA during the measured periods while attending childcare.⁴⁴

A systematic review by Tucker⁴⁶ compared PA results of children aged 2-6 in childcare centers from 39 primary studies, representing 10,316 participants. The studies selected had to conduct measurement in the childcare center, utilize quantitative methodology, contain only a sample of preschoolers, preschoolers had to be free of ailments, and actually report the PA level of the preschoolers. Accelerometers were utilized as the assessment tool of PA in nineteen of the studies (49%) and direct observations were used in thirteen of the studies (33%). Results from the synthesis of these studies showed that 46% of children did not meet the NASPE guidelines of 60 minutes of moderate to vigorous PA per day. The study also found that only 27% of children's outdoor play time was spent in MVPA, even in studies that offered 2 1-hour

outdoor play sessions, equating to 32.5 minutes. Furthermore, gender differences were found in PA, with males being more active than female preschoolers in 16 of the 18 studied that detected differences by gender.⁴⁶

These studies showed that overall children are not meeting their PA recommendations while in preschool. When examining factors that affected PA researchers discovered that many different factors had effect on PA level such as gender, BMI, and the childcare center. The childcare center was the largest predictor of PA,⁴⁵ but no objective measure was taken to figure out why. It is important to determine why the childcare center has such an impact on PA. In order to do this, the childcare center policies, personnel perceptions and attitudes, and daily habits should be explored in an objective measurable manner.

Physical Activity, National Early Childhood Care Trends, and Childcare in North Carolina

Previous research has identified a number of factors that influence children's PA on a daily basis. These factors range from personal characteristics and socio-demographic conditions, to parental modeling and community environment.⁴⁷⁻⁵⁰ It has been well established that children whose parents are physically active are more likely to meet the current PA recommendations.^{17,51,52} Frequent screen time (i.e., TV, video games), limited outdoor play time, unsafe neighborhoods, and living in communities without sidewalks and public transportation represent important factors that have been strongly correlated with children's lower PA levels.^{17, 50, 53-55}

Children's PA levels have also been influenced by additional changes at the societal and family level.^{41, 42} Over the past five decades, the number of women in the workforce has increased by approximately 15%.⁷ It is estimated that the rates of children enrolled in childcare centers nearly doubled since 1965, with 12.5 million (61%) children under the age of 5 years regularly attending some type of a childcare facility.^{10, 55, 58} Given that many children now spend 6-7 hours of their day away from home, it is not surprising that more than half of their total daily PA is accumulated while at school.^{45, 59} Research by the Council on Contemporary Families shows that mothers overestimate the amount of time they spent doing childcare, and by the time babies are 9 months of age, women performed 12 hours less of childcare per week, with the difference being made up in various daycare settings.⁶⁰ Parent's focus on many different factors when selecting a childcare center such as quality, practicality, or preference for a specific type of care arrangement.⁶¹ Certain practical factors that are often considered are cost, hours of availability, and location.⁶¹ Currently, in center-based care, 44.8% of children are enrolled in programs such as privately funded preschools.⁶² Privately funded childcare centers have great discretion pertaining to the facility environment and services offered. All childcare centers must meet basic licensure requirements set forth by the state of North Carolina, but after basic standards are met, it is up to the childcare center to determine to what degree they go above and beyond. Currently, there is a "star system" in place in North Carolina, and the number of stars (ranging 1-5) describes the program standards and staff education level.⁶³ Some examples of environmental factors that change with increasing star rating are size of outdoor space, developed learning

curriculum, and a variety of play materials. Schools who have a higher star rating may have a better environment to foster PA.⁶⁴

The trends in early childhood care have not only shifted the traditional childcare responsibilities of the mother to other members of the family, but also contributed to preschool teachers and staff becoming important role models of lifestyle behaviors for young children.^{65, 66} A few studies introduced a teacher-training component as part of their intervention and found a significant positive change in children's PA.⁶⁷⁻⁷⁰ These components included teacher-guided discussion, teacher pep talk, teacher participation, teacher encouragement, and teacher acknowledgement of PA. When an adult, such as a teacher guided the children in intervention periods, the children's MVPA was increased compared to non-guided nonintervention periods.⁶⁷⁻⁷⁰ Also, when teachers participate with children in activities such as tag, children's movements were more enthusiastic and more vigorous activity was observed.^{71, 72}

Very few studies have examined teachers' and/or school administrators' perceptions related to PA levels of preschool children.^{17, 45} Findings from these isolated studies indicated teachers felt that having enough space in facilities, outdoor time, stimulating materials, or gym time were the most critical factors in getting the children an adequate amount of PA. Teachers also admitted they themselves could be better motivators by participating in activities with the children, and receiving ready-to-use materials was a large aide to teachers. Teachers felt the biggest inhibitory environmental factors in the childcare facilities were competition for resources, lack of staff, and no safe playground areas in their facilities.⁵¹ In another study by Tovar et al.,¹¹ four focus groups

of family child care providers were conducted and factors influencing PA and screen time, awareness of home PA environment, and improvements in PA environment were assessed. Providers reported trying to incorporate learning games that get children moving as well as limiting TV time to 30 minutes per day. They also reported that parents often have a negative influence on children's eating and PA. Examples included cases when childcare providers served healthy options, but children would not eat it because their parents told them not to. Parents may also have many rules about how much outdoor time the children can have as well as allowing free watch of the TV, which further caused complications for teachers. Some resources that were discussed that have made PA easier for teachers are intervention programs with specific guidelines and ideas. The biggest barriers discussed were the sedentary lifestyle of Americans. Teachers feel that electronic games as well as TV really affects the children and their willingness to be active. Teachers also reported that better communication and collaboration with parents in regards to PA would encourage increased PA among children. While these findings are important, studies like this represent isolated and rare examinations of teacher/staff beliefs, attitudes, perceived needs and barriers to successfully encouraging PA among preschool-aged children in childcare settings.¹¹

Physical Activity Environment in a Childcare Setting

In addition to the importance of role modeling of PA by childcare teachers and staff, PA levels of preschoolers may be influenced by the nature of the physical environment and policies implemented in individual centers. Few studies have found that

children who attend childcare centers with clear and comprehensive PA policies and environment have higher PA levels compared to their peers who attend centers without such characteristics.^{12, 13, 73} Thus, the characteristics of the childcare centers may serve as a potential predictor of children's PA level.^{12, 45} As emphasized in a study by Finn et al.,⁴⁵ childcare centers that had adequate space, programming, as well as staffing were better equipped to ensure children obtain the adequate amount and quality of PA during the day. In a study by Foster et al,⁷⁴ researchers studying 29 childcare centers in low-income rural communities from seven states found that most sites have and obey policies that accommodate physical limitations and have a wide variety of age-appropriate outdoor equipment, but even with these policies in place less than half the sites report children getting 60 minutes of PA per day.⁷⁴

The ability to assess the environment of a childcare center is an important and crucial step in determining the level of PA opportunities for children attending the facility. Such assessment tools allow the childcare centers to examine the aspects of their environment and identify areas that need possible improvements. Bower et al.¹³ assessed the childcare environment and children's PA. A two-day assessment of physical and social environmental factors, hypothesized to influence healthy weight in children, was completed across 20 selected childcare centers (3-5 year old classrooms) utilizing the Environmental and Policy Assessment and Observation instrument (EPAO). The EPAO is a validated tool developed by a research team led by Dr. Diane Ward of The University of Chapel Hill and was designed to evaluate the Nutrition and PA Self-Assessment for Child Care (NAP SACC) by quantifying both social and physical environmental findings.

The EPAO is an expansion of the self-assessment component of the NAP SACC program, and was created following an extensive literature review of nutrition and physical activity research, recommendations, and input from experts in the field. The EPAO as well as NAP SAAC have been used across a number of studies, examining nutrition and PA environment in childcare setting.^{13,24,17} Findings showed that children at the centers with better PA environment scores had significantly higher levels of moderate to vigorous activity compared to other children.¹³

Other studies in childcare centers evaluated the PA environment utilizing the Nutrition and PA Self-Assessment for Child Care (NAP SACC).²⁴ NAP SACC is an environmental nutrition and physical activity intervention program designed to be used in childcare centers. The tool was originally tested at 15 treatment and 4 control childcare centers, focusing on 15 key topic areas extracted from literature (6 were related to PA): active play and interactive time, TV use and TV viewing, play environment, supporting PA, PA education for children, parents, and staff, PA policy, fruits and vegetables, fried food and high-fat meats, beverages, menus and variety, meals and snacks, food items outside of regular meals and snacks, supporting healthful eating, nutrition education for children, parents and staff, nutrition policy.²⁴ The EPAO instrument was used in conjunction with the NAP SACC in 84 childcare centers in a study by Ward et al.⁷³ Findings indicated that most childcare centers had a PA policy in place; however, the existing PA did not correspond with the written policy and the study identified several areas of improvement related to PA.⁷³ The EPAO instrument with the NAP SACC program was also used to examine specific environmental characteristics of the childcare

center. McWilliams et al.⁷⁵ designed a set of guidelines to be used by the childcare centers in order to assure adequate PA of children who attended the childcare centers. These recommendations included 8 specific environmental characteristics: 1) active opportunities, 2) fixed play environment, 3) portable play environment, 4) sedentary opportunities, 5) sedentary environment, 6) staff behavior, 7) PA training and education, and 8) PA policies.⁷³ Results of this study showed that only a few of the best-practice PA guidelines were achieved in the sample of 96 childcare centers in North Carolina.⁷⁵

Current Knowledge Related to Children’s Physical Activity in Childcare Settings

Despite the evidence that childcare centers play an important role in young children’s PA, little is known about the amount and patterns of PA patterns among preschoolers in this type of setting. Most previous research in childcare setting have focused on PA from the policy-level perspective.^{13,22,23,38}

A few isolated intervention studies evaluated the effects of altering the environment and teaching strategies on PA levels among young children in childcare settings. The “Hip Hop to Health Jr” study was an obesity prevention trial completed at 18 Head Start centers with a large proportion of African American and Hispanic children aged 3-5.²² The primary outcome measures of this trial were the amount and type of PA that was collected by accelerometer worn by children for 7 days during waking hours and the BMI z-scores of children in intervention and control classes. Accelerometer signals were programmed to 30 times per second and the device must have been worn for 8 hours and at least 4 days for inclusion. Intervention classes received 2 teacher delivered

sessions per week that included 20 minute lesson related to healthy eating and exercise and a 20 minute PA component and the theme was changed each week. The control classes received a general health intervention program.²² Children involved in the intervention program engaged in greater moderate to vigorous PA (MVPA) than children in control classrooms (109.9 vs. 102.5 minutes of MVPA a day, respectively). Teacher trainings that included weekly sessions to educate preschool teachers on how to teach lessons focused on healthy eating and exercise to children were essential components of the program. The control group received lessons on a variety of health topics, such as seatbelt safety and dental health. Immediately following the program, there was no significant difference in BMI z-score among children in treatment and control groups. However, there was a significant difference in BMI z- scores between the treatment and control groups at 1 and 2 year follow up.²⁰ These results suggest that training of classroom teachers at childcare centers to deliver and incorporate interventions into their daily schedule may be an effective way to manage children weight and prevent excessive weigh gain.²²

The “Be Active Kids” study is another example of an intervention program designed for young children attending childcare centers.⁷⁶ The program was implemented in 6 classrooms in three different childcare centers. The lead and assistant teachers of these classrooms received training on the benefits of PA and proper physical activities the children should perform.⁷⁶ The teachers brought home a notebook consisting of the lessons learned at training sessions as well as a list of age appropriate physical activities and materials to incorporate into their lesson plans. The children in these classrooms were

observed by researchers to determine their PA level five times before and after the intervention.⁷⁶ Observation procedures were adapted and followed guidelines from Playcheck and the Observational System for Recording Physical Activity in Children-Preschool (OSRAC-P).⁷⁶ The researchers saw that prior to teacher training moderate/vigorous activity was low only occurring in 12.2% of the observation periods and children engaged in sedentary behavior (25.6%) and light behaviors (61.6%) frequently.⁷⁶ After teacher training and the Be Active Kids implementation, researchers observed activity in the classrooms on 5 different occasions at various times in the day. Researchers saw that light and moderate/vigorous PA increased significantly (16.6% and 64.3% respectively) while sedentary behavior decreased (18.9%). The intervention was particularly effective when activities were teacher directed as opposed to free play.⁷⁶ Both of the interventions discussed above support the notion that adults in young children's environment, such as teachers, are likely to have a major influence on children's PA levels.⁴⁵ Thus, better understanding childcare teacher/staff knowledge, beliefs, attitudes, perceived barriers and needs is much needed in the current literature in order to engage them successfully in shaping preschoolers' PA habits and long-term lifestyle behaviors.

Summary

Fostering an environment that promotes PA in young children is among the top priorities in the fight against childhood obesity.^{25, 28, 29} Childcare centers with teachers and staff play an increasingly important role in this task as significantly more children

spend time in childcare centers than ever before.^{12, 13, 45} Currently, studies suggest that preschoolers acquire a wide range of PA minutes while in childcare, but the time spent in vigorous activities tends to be low while the amount of sedentary time is high.^{13, 75} These two correlates both impact overall health, cardiovascular fitness, and the overall risk for obesity. Studies have also suggested that teachers may play an important role in the level of children's PA and that the childcare environment correlates with PA, yet the reasons for this relationship are not fully explained in the current literature.^{12, 31, 76} While teacher-focused interventions have shown promise in recent research¹³, developing an in-depth understanding of childcare center teachers' knowledge, personal attitudes, and perceived needs and barriers related to PA is critical before further effective and feasible interventions can be developed and successfully implemented in a variety of childcare facilities across the nation. Furthermore, additional factors within the childcare environment need to be investigated further as potential predictors of preschooler's PA.

The main purpose of this study was to determine the daily amount of PA by intensity level, the patterns of PA and sedentary behaviors throughout the day in a sample of preschoolers in a childcare setting. The secondary purpose of this study was to assess features of the childcare centers' PA environment and to examine personal, environmental and policy factors that may influence children's PA in the center.

CHAPTER III
RESEARCH ARTICLE

Abstract

Background: In recent years, a substantially greater proportion of young children attend childcare facilities than ever before. Physical activity (PA), sedentary behaviors and correlates of both have been studied extensively among school-aged children; however, much less is known about correlates of PA among preschoolers. The purpose of this study was to assess the daily amount and patterns of PA and sedentary behaviors of young children in a childcare setting. The second purpose was to examine personal, environmental and policy factors related to PA in childcare setting. **Methods:** The amount and patterns of PA and sedentary behaviors of 3-5 year old preschoolers (n = 27) were measured utilizing accelerometers Actigraph GT3x on 4 consecutive days. The multi-level factors related to PA within the childcare setting were assessed using the Environmental Policy Assessment and Observation tool (EPAO), in-depth interviews with the center director and informal interviews with teachers (guided by the Social Cognitive Theory). **Results:** Sixty-eight percent of the children met the recommendation of at least 60 minutes of moderate-to-vigorous physical activity (MVPA) a day. The center's PA environment was scored at 18.7/20, indicating a very positive PA environment. The interview with the director generated statements centered around the following topics: 1) great awareness of PA importance on learning, growth, and health;

2) importance of buy-in from parents and teachers/staff; 3) the need for PA policy to be in place; 4) knowledge of PA recommendations; 5) lack of gym access perceived as a main barrier. Field Interviews with A manual analysis of the teacher field interviews (n=7) generated the following themes: 1) strong awareness of the importance of PA for children's learning, growth and overall health; 2) equipment, space and time perceived as the major facilitators of PA; 3) focus on safety perceived as major barrier to teacher participation in PA with children; 4) low PA among teachers due to lack of time in their schedules; and 5) confusion about current PA recommendations for young children.

Conclusion: Creating a positive environment for encouraging PA in a childcare setting is critical, including having teachers/staff that realize the role of PA in preschoolers' health, learning and overall wellbeing. Further studies should assess both the physical environment, policies as well as social climate related to PA across childcare centers in order to make individualized recommendations for improvement to optimize children's PA in childcare centers.

Background

Excessive adiposity early in life may lead to life long physical and mental health consequences over time.¹ Although the prevalence of childhood obesity appears to have stabilized somewhat in the U.S. between 2008 and 2011, nearly one third of children and adolescents remain overweight or obese.^{1,2,3} A decreased level of physical activity (PA) and increase in sedentary behaviors have been identified as two of the main correlates of obesity across all age groups.^{4,5,6} These trends are not unique to the U.S, as 31% of the

world's population currently does not meet the PA requirements of 60 minutes a day of physical activity, representing a 14% increase compared to 2009.⁷ While low levels of PA contribute to greater risks of obesity, a sedentary or inactive lifestyle has also contributed to escalating numbers of preventable deaths, with 5.3-5.7 million deaths in 2007 being linked to inadequate PA (not meeting 60 minutes a day).⁷

A large number of studies related to PA levels in pediatric samples have been conducted over the last several decades.^{2,4,5} These studies have utilized survey-based tools as well as objective measures of PA, such as accelerometers.⁴⁻⁶ A strong body of research points to a number of social and economic transitions that have negatively affected children's PA over the past few decades, including the increased use of electronic devices such as tablets and smart phones, changes in transportation usage, and the greater economic hardship of many families since the economic recession in 2008.⁷ Overall, there is a consistent trend of decreasing levels of PA since 1970s, with some studies estimating that only 42% of children during middle childhood meet the minimum PA recommendations and even fewer meet these guidelines as they get older.⁸⁻¹² Much of the previous research on PA, however, utilized samples of school-aged children and/or adolescents.^{14,15} Systematic efforts to better understand PA patterns among preschool-aged children have been scarce, perhaps due to a more urgent need for improving PA level among older children, or difficulties related to access to young populations outside of the public school system. Also, until the use of accelerometry, more objective measures of children's PA were rarely used and studies relied on the use of self- or parent-report observations, or surveys).¹⁶

Because children's lifestyle habits, including PA, begin to shape early in life, advancing the current knowledge on PA patterns among preschoolers is critical for optimizing PA during early childhood and developing future effective obesity prevention programs in the U.S.¹⁷ PA of very young children has likely changed over the past several decades due to a major demographic shift in the U.S. workforce.^{8,19} Since 1965, the number of women in the workforce increased significantly and the rate of children attending childcare centers has doubled over the past several decades.^{8,19} Thus, many preschool-aged children of working parents spend on average of 36 hours per week away from home. More importantly, mothers who used to represent the traditional caretakers of children during preschool years at home are no longer the primary individuals influencing children's lifestyle behaviors throughout the day.¹⁹ In essence, this important role has been, in many cases, transferred to teachers/staff/administrators as they often spend more time with the children during the day than parents themselves.^{12,13} Because parents and children now have less time to spend together during the week than ever before,¹⁰ childcare teachers and staff may play an instrumental role in encouraging PA, shaping children's attitudes about PA, and providing optimal learning environment within the childcare setting.

Current assessment and intervention tools related to lifestyle behaviors in the childcare setting include the Nutrition and Physical Activity Self-assessment for Child Care (NAP SACC) and the Environment and Policy Assessment and Observation (EPAO). The NAP SACC was originally developed as a self-assessment tool for childcare facilities and is also used as an assessment tool in an intervention targeting

improved nutrition and PA policies. This tool allows childcare centers to gauge their current status and select specific areas to require improvements before reassessing.^{10,11} The EPAO is a validated tool developed by a research team led by Dr. Diane Ward of The University of Chapel Hill and was designed to evaluate the Nutrition and PA Self-Assessment for Child Care (NAP SACC) by quantifying both social and physical environmental findings. The EPAO is an expansion of the self-assessment component of the NAP SACC program, and was created following an extensive literature review of nutrition and physical activity research, recommendations, and input from experts in the field. This tool is now validated and used in the research in conjunction with the NAP SACC program as well as on its own. The EPAO as well as NAP SAAC have been used across a number of studies, examining nutrition and PA environment in childcare setting.^{11,12} Previous isolated studies suggest that lack of teachers' knowledge about PA and low priority being placed on PA by the teachers are associated with lower levels of children's PA across the classrooms.¹⁷⁻²⁰ However, very few qualitative studies have examined knowledge, perceptions, attitudes, and perceived needs and barriers related to PA of childcare teachers/staff and administrators.^{19,20}

In addition to the influence of childcare teachers/staff, the overall childcare environment may influence children's PA levels while attending childcare.¹⁷⁻²⁰ Ranging from features of the physical environment, such as adequate play space and PA equipment, to specific policies supporting PA, childcare climate may encourage or discourage children to be physically active throughout the day.¹⁷⁻²⁰ A number of research studies aimed at policies related to PA in childcare settings have been conducted across

North Carolina and other states.²⁹⁻³¹ Findings indicate that children at childcare centers that utilize established PA environment and policy assessment tools, such as the EPAO and NAP SAAC, have greater levels of PA compared to children without such policies.^{9-12,17, 26-28}

Currently, little is known about PA and sedentary patterns of preschoolers attending childcare facilities throughout the day.^{12,17,21} While teacher-focused interventions have shown promise in recent research,^{10,13} developing an in-depth understanding of directors'/teachers' knowledge, personal attitudes, needs and perceived barriers related to PA is critical before effective and feasible interventions can be developed and successfully implemented in a variety of childcare facilities. The main purpose of this study was to determine the daily amount of PA and sedentary patterns in a sample of preschool-aged children in a 5-star childcare setting. The secondary purpose of this study was to assess features of the childcare center's PA environment by examining personal, environmental and policy factors related to children's PA in this setting.

Methods

Design, Setting, and Participants

The exploratory study was conducted in an urban area in the Southeastern part of the U.S. between January and February of 2016. Data for this study were collected utilizing a direct measurement of children's PA, direct observations of the childcare center environment by the PI, an in-depth interview with the childcare director, and field interviews with teachers and/or teaching staff. During the initial selection of the

childcare centers, a list of all 5-star childcare centers in the area was created (n=98). The PI randomly selected three centers and contacted the center directors by phone to make the initial contact. The study's purpose and details were explained to them in order to secure their approval for participation in the study. From the three centers, one director provided her permission for the center to participate in the study. The director was asked to provide an informed consent form for the center's participation and briefly inform the teachers and staff about the study during a staff meeting. The PI then visited the center to inform the teachers/staff about the study details and to recruit teachers/staff for field interviews. The PI also obtained their support for recruiting parents for their child's participation. The inclusion criteria for children eligible to participate in the study were as follows: 1) being 3-5 years old, 2) free of any condition/disability that hinders normal participation in PA 3) being enrolled in one of the participating classrooms, Parents of children who met the inclusion criteria were informed about the study through flyers posted at the center and also sent home with their children. The PI also attended the center during pick up times on a mutually agreed upon day in order to recruit parents (for their child's participation) in person. A written parental consent form for the child to participate in the study and the study purpose description were sent home in a form of a letter/flyer with each child. Once parental written informed consent was received from all interested parents, data collection of PA was scheduled in the respective classrooms (children whose parents signed the written informed consent only). Teachers and teaching assistants/staff were recruited to participate in field interviews by direct personal contact with the PI in the center. The University's Institutional Review Board reviewed and

approved all recruitment material, consent forms, scripts, and the overall study protocol before any data collection occurred.

The center that agreed to participate in this study was a North Carolina preschool with a 5 star rating designation. To receive a 5-star rating, a childcare facility must go above the standard requirements and regulations related to the staff education as well as program standards. Staff education includes requirements that expect the center's administrator and lead teachers to complete their credential requirements. Extra "points" may be earned if the administrator has a Level III NC administration credential, 75% of lead teachers have at least an associates degree in Early Childhood Education???? and 50% of teachers have completed their NC Early Childhood Credentials. Program standards also ensure that the operating and personnel policies are completed, the number of activity areas are increased from minimum requirements in classrooms, the classrooms have a higher square footage per classroom than minimum requirements, the staff/child ratios are reduced from maximum requirement, and the center meets specific scores on an environment rating scale assessment.⁵³

Because the center participating in the current study had a 5-star rating, the director had advanced education in administration, with the majority of teachers having at least an Associate's Degree in childhood education. Also, the current NC Childcare Regulations state that teacher/child ratio for 3 year olds must be 1:15 and for 4 year olds 1:20. The center was a privately funded preschool facility, thus, attendance cost rates were not determined using the federal regulations, likely resulting in the socio-economic status of the enrolled families to be higher compared to other preschool centers in the

area, including federally funded Head Start centers. The center had multiple fenced playground areas, with jungle gyms, a bike path, tricycles, wagons and other play equipment available to children.

Physical Activity and Sedentary Patterns: Accelerometer Measurements

The Actigraph GT3X+ accelerometer is currently the most utilized motion sensor in pediatric populations with strong evidence of good reproducibility across studies.^{25,29} Height and weight of each child was measured using a portable stadiometer for height (Seca 213) and a digital Tanita scale for weight (TANITA, model WB-8000RW) by a trained researcher (PI). The measurement principle guidelines developed by the Center for Disease Control and Prevention (CDC) were used in the current study.³⁹ The measurements were taken in a private area of the classroom away from other children and teachers to ensure privacy and confidentiality during the measurements. The height and weight measurements were required for setting up the accelerometer units for each child. The accelerometers were set to measure PA in the 15-second epoch setting, which is the most commonly utilized time interval for preschool-aged populations.^{25,35} Using the 15-second epoch vs. a 1-minute sampling interval ensures that short intermittent bursts of activity, which are common in young children will not be missed.³⁵ In order to collect a sufficient range of PA data, each child wore the accelerometer on four separate days of the week while attending the childcare center. The trained researcher secured the accelerometer unit on children's non-dominant hip on each morning of the scheduled data collection days. The unit was secured on the hip as soon as the child arrived to school

(ranged from 7-9 am). The exact wear time was recorded in a daily chart by the PI and/or the classroom teacher. The teacher was instructed to remove the accelerometers at the end of each data collection day right before the children left the center (recording the end wear time in the daily chart). A full-day observation of the participating children on one of the PA data collection days was also completed by the PI, with detailed field notes related to PA being taken throughout the day (e.g., timing and duration of snack times, outdoor play time, rest time). The field notes as well as the daily wear charts were utilized to validate subjects' PA data for each day before the final data analyses were conducted.

Physical Activity Environment in Childcare: EPAO

Evaluation of the physical environmental factors, teacher behaviors and policies that have been shown to influence PA behaviors of children in childcare centers was conducted utilizing the EPAO.¹² The PA component of the EPAO consists of eight subscales derived from key PA areas that were identified during the development of the NAP SACC program.^{11,12} These eight subscales include: 1) Active Opportunities; 2) Sedentary Opportunities; 3) Sedentary Environment; 4) Portable Play Environment; 5) Fixed Play Environment; 6) Staff Behaviors; 7) Physical Activity Training and Education; and 8) PA Policy.¹² The eight subscale items included in the EPAO were marked by the PI during direct observation on the printed document and scored by number of times occurred. One classroom was randomly selected from the three participating classrooms of 3-5 year old children and observations were made on a single

day. The PI was trained during a half-day workshop that included a review of the EPAO items, scoring criteria, and lessons on observational techniques.³⁶ The EPAO observation began before children arrived in the morning and ended after every child had left the classroom for the day. Data from the observation was collected in a tally format continuously during the observation period. As part of the EPAO completion, the PI thoroughly examined lesson plans, parent and staff handbooks, PA training documents and curriculum, and written PA policy documents of the childcare center.³⁶

Attitudes and Perceptions Related to Physical Activity: Interviews with Childcare Center Director and Teachers/Staff

An in-depth interview with the center's director and field interviews with teachers/staff were completed to assess their perceptions, attitudes, barriers and perceived needs related to children's PA within the childcare setting.⁴⁴ The Social Cognitive Theory (SCT) and its constructs were utilized to develop the interview scripts in order to better understand individuals' self-efficacy for encouraging children's PA in childcare setting (i.e. ensuring there is adequate PA time allowed) at the personal/cognitive and environmental level.⁴⁴ SCT, a research and education theory, represents that an individuals knowledge on a subject or learning can be directly related to observing others through social interactions, experiences, and outside media. The three constructs of the SCT were used to explore aspects of the childcare center that affect children's PA within a childcare setting. Examples of the aspects explored via SCT constructs included teacher perceptions and attitudes about PA, teacher PA modeling, the environmental

conditions, and policies. The interview script aimed to determine how outside influences model or affect children's PA. For example, good modeling and supportive environments may prompt the children to engage in physical activity. The personal construct was explored through questions asking about teacher/director's attitudes, perceptions and knowledge related to PA, the behavioral construct was explored by questions asking about ways the teachers/director/center encouraged PA, and the environmental construct was explored by asking about the aspects of the childcare environment that might influence PA. The interview script was reviewed by two researchers experienced in qualitative research, PA, and SCT.⁴¹⁻⁴³

The in-depth interview with the director was voice recorded for later analysis. The PI was trained in interviewing technique prior to data collection. The director's perceptions of the center's PA environment, the perceived role of the center in children's health, concerns, barriers, perceptions of current PA levels, motivations for increasing PA of preschoolers, and input on PA policies at the centers were explored in the interview with the childcare center director using open ended questions. First, a series of open-ended questions explored the role the director felt she/he had in ensuring preschoolers got adequate PA (e.g. "What are your feelings on PA needing to be accomplished in school vs. at home? What role do you feel you have as a childcare director, if any, for children in your classroom in terms of getting enough PA during the day? What are some things you do in order to ensure that the children are getting PA while at childcare?"). In the next set of open-ended questions, director behaviors that enhanced/deterred PA were explored (i.e. "What do you find is the most important way to get your children physically active?").

In addition, field interviews with teachers/teaching assistants were completed, utilizing the same questions when appropriate and asking additional question relevant to the director's administrative role in the center. The interviews with teachers mostly took place during outside time or indoor free time when the individuals had time to answer the questions. Because voice recording was not feasible in this setting, detailed field notes were taken by the PI and used in the final analyses.⁴⁷

Data Analysis

Amount and Patterns of Physical Activity and Sedentary Behaviors

For each child, a minimum of three days of valid wear time data was included in the final analyses. Actilife software (version 6.12.0) was used to generate descriptive statistics related to PA and sedentary behaviors in the sample. First, data were coded based on the individual PA levels that were determined by age-specific count cutoffs corresponding to: 1) sedentary: 0-99 counts per minute (CPM); 2) Light (LPA): 800-1679 CPM; 3) Moderate (MPA): 1680-3367 CPM; 4) Vigorous (VPA): >3368 CPM; 5) Moderate-Vigorous (MVPA): >1680 CPM.²⁵ Descriptive statistics were generated to describe the sample in terms of the amount of PA (in minutes) at each level of intensity (i.e., means, standard deviations (SD), frequencies of different levels of PA, percentages of time spent in different levels of PA, and the number and length of sedentary bouts during the day). The PA data was also analyzed by every hour of wear time to examine patterns of PA and sedentary bouts throughout the day (i.e. intensity of PA that occurs during outdoor play time versus indoor). The hourly breakdown of PA and sedentary

bouts data allowed for identification of time periods with the highest and lowest amount of MVPA during the day. Lastly, the results were compared to the current PA recommendation guidelines, developed by the CDC and the NAPSE. The number of children in the sample meeting each recommendation was determined. All statistical tests were considered significant at $p < 0.05$. The Statistical Package for Social Sciences (version 23 for Windows SPSS Inc. Chicago, IL) was used for the quantitative statistical analyses.

Assessment of the Childcare Environment Related to Physical Activity

The EPAO instrument is an expansion of the NAP SACC program created to quantify both social and environmental factors that are thought to affect dietary and PA behaviors of children in childcare.¹² Responses for all of the EPAO items were converted to a three-point scale and summed to generate subscale score and an overall EPAO score (0=least favorable,1= somewhat favorable,2=most favorable). Sedentary Opportunities and Sedentary Environment subscales were reverse scored, indicating that a higher value represented a less favorable score for positive PA environment (0=most favorable,1=somewhat favorable,2=least favorable). An example of least favorable responses, indicated by a score of “0,” to sedentary opportunities items was a “yes” to the following questions: “Is a TV present in the room?” For the purposes of this study, seven out of eight subscales were used in the final analyses, excluding the fixed play environment subscale. The new state childcare regulations eliminated most of the fixed play equipment inquired about in the EPAO (I.e. see-saw and merry-go-round) and thus, this

subscale was not applicable and would have skewed study findings.³⁷ The total PA environment score from EPAO was calculated as an average of all subscale scores (ranging from 0-20). Based on the EPAO score, the center was then categorized as having a high or low PA environment score utilizing a median split of the total PA subscale score.³⁴

Teacher/Staff/Director Perceptions, Attitudes Related to Physical Activity

The in-depth interview with the director was audio-recorded, transcribed verbatim and manually analyzed immediately following the interview for preliminary analysis.⁴⁴ Individual codes were developed from the data itself, with efforts to minimize preconceived themes from the literature, and statements were summarized from her answers. Asking the same series of questions and by taking detailed field notes and analyzing themes manually the PI did field interviews with teachers/staff. Manual content analysis was used in the case of the field interviews due to the lack of a transcript, only interviewing one person at a time, and the small sample size. Field notes were examined for objective inferences about the subjects feelings to the questions framed from the SCT. The information collected was organized by question, and then key terms from the research questions were determined from the answers to get an overall theme from the group of teachers/staff interviewed.^{47,48} Using the SCT constructs allowed for exploring the cognitive, behavioral and environmental factors related to PA.⁴⁶⁻⁴⁸

Results

Physical Activity and Sedentary Patterns

PA data using the accelerometers was collected from a total of 28 children. Twenty-seven children provided a minimum of 3 days of PA data during the study, and were used for analysis. The sample's characteristics related to PA are presented in Table 1. In the sample, accelerometers were worn on average for 3.7 days and a total of 8.19 hours per day. Children on average had 396 min/day minutes spent sedentary. Children spent 110 min/day in some type of movement (light, moderate, vigorous) (Table 1). Approximately 40 min/day spent in LPA, 44/day in MPA, and 26 min/day in VPA. Approximately 70 minutes per day were spent at the MVPA level (Table 1). Sedentary bouts are summarized in Table 2. Sedentary bouts were recorded for two children in the sample (≥ 60 minutes of inactivity occurring at one time), with the bouts occurring outside the nap and/or eating time.

The proportion of children's PA by intensity level is presented in Figure 1. 78% of the total wear time was spent in sedentary activities while 8% was spent in light, 9% was spent in moderate, and 5% was spent in vigorous. The hourly breakdown of MVPA measured per hour during the day is presented in Figure 2. The greatest amount of activities at the MVPA level were acquired by children between 11 am-12 pm (16.3 minutes), followed by the time period between 8 am- 9 am (10.4 minutes). The time period with the least amount of MVPA was between 2 pm and 3 pm (7 minutes), which corresponded with scheduled resting time periods for all children. Another time period with the lowest MVPA was detected between 5 pm and 6 pm, with only 1 minute/hour.

The PA activity patterns on the individual days are presented in Figure 3. Children acquired the greatest relative amount of sedentary, LPA and MPA on Thursday, while they accumulated the most amount of VPA on Monday. However, the differences between the days were not statistically significant.

The amount of PA accumulated by the children in the sample was compared to the 2010 Dietary Guidelines PA recommendation (Figure 4). More than two thirds of the children achieved the ≥ 60 minutes of MVPA, while 32% obtained less PA than recommended.¹⁵ Figure 5 compares the amount of PA achieved by the children to the NASPE recommendations. A little over half of the sample (54%) achieved the recommendation of 120 minutes of PA a day.¹⁶

Assessment of Childcare Environment Related to PA

The results of the EPAO assessment via direct observation by the PI are presented in Figure 6. Fixed play equipment was excluded from the final analysis in order to provide an accurate reflection of the current state childcare laws related to playground equipment.⁴⁰ The childcare center received an overall score of 18.7 out of 20. The center received the maximal scores in the following subscales: Active play, Sedentary environment, Portable play environment, Staff behaviors-PA, and PA policy subscales. The lowest score was received on the sedentary behaviors subscale (a score of 13.3 out of 20). This is still above the median split, which classifies it as a “good” score, but is much lower than the scores for other categories in this center.

Teacher/ Staff Interviews

The findings of the content analysis related to the three SCT constructs explored during the interviews (n=7) are presented in Table 3. Representative quotes for each of the identified theme are also included in Table 3. Themes indicated 1) strong awareness of the importance of PA for children's learning, growth and overall health; 2) equipment, space and time perceived as the major facilitators of PA; 3) focus on safety perceived as major barrier to teacher participation in PA with children; 4) low PA among teachers due to lack of time in their schedules; and 5) confusion about current PA recommendations for young children.

Director Interview

The content analysis of the interview transcript with the childcare center director yielded 5 major findings: 1) awareness of PA importance on learning, growth, and health; 2) importance of buy-in from parents and teachers/staff; 3) the need for PA policy to be in place; 4) knowledge of PA recommendations; 5) lack of gym access perceived as a main barrier. The director was highly aware of PA being essential for children's learning and health throughout the day as well as at home. She expressed that not accomplishing children's PA goals while at school was nonnegotiable at her childcare center, and parents had to agree to this before sending their child to that center. She also felt that her main role in promoting PA was to make sure that policies and procedures were in place to facilitate active learning and that she played an important role in monitoring these policies/procedures to ensure they were being followed. The director was very

knowledgeable on current PA recommendations, being able to cite the recommendation and which organization made this recommendation. She also discussed weather and access to a gym as the main barriers.

Discussion

The purposes of this study were to determine the amount and patterns of PA in a childcare setting as well as to assess the childcare center environment and examine personal, environmental, and policy factors influencing PA of preschoolers. This was accomplished by using both qualitative and quantitative methodologies, including objective measurements of PA via accelerometers, direct observations of childcare environment using the EPAO instrument as well as qualitative interviews with teachers and director to gain deeper insights into PA-related perceptions, attitudes and perceived barriers of individuals working with preschoolers. Because directors/teachers' perceptions and attitudes and characteristics of childcare environment related to PA have not been investigated in depth in previous research, the findings of the current study help fill the current literature on preschoolers' PA within childcare setting .^{16,19,20,43}

Previous studies examining PA among preschool-aged children vary dramatically in terms of the sample characteristics, size and/or methodologies used by the researchers. However, the findings of the present study can be contrasted with at least some of the previous investigations. For instance, a study of young children enrolled in Head Start classrooms by Shen et al. (2012)¹⁸ found that children in their sample spent no time in VPA, 1 minute per hour in MPA, 3 minute per hour in LPA, and 56 minutes per hour in

sedentary activities. Children in the present study spent a greater amount of time in all PA intensity levels (5 min in LPA, 2 min in MPA and 2 min at VPA). Children in the current study also spent relatively less time in sedentary activities (48 min vs. 56 min per hour). The different type of the childcare environment or daily schedule may explain the differences in the amount of children's PA between the two studies, due to the fact that a Head Start enrollment is determined by family income in relation to the poverty threshold and thus enrolls children from low-income families. These sites may have different resources, staff characteristics, and the children may live in different home environments that influence their PA levels and other health-related behaviors. Overall, looking at comparison to PA recommendations, Tucker et al.²⁷ found that 46% of studies reported children did not meet 60 minutes per day, thus even more not meeting the NASPE guidelines of 120 minutes per day.²⁷ The present study found that 68% met the CDC recommendation.

Children in the current study were most active in terms of MVPA between 11am-12pm and 8-9 am. These were both outside times on the daily schedule. Dowda et al.,⁴⁹ also found that children were most active when outdoors and that children spent 27% of their outdoor time in MVPA. They discovered that having multiple outside periods further enhanced the number of children meeting the recommendations.⁴⁹ Our findings indicate that building multiple outside play time periods into preschoolers' daily schedule contributes to greater overall PA. More importantly, it promotes the higher intensity PA that is often difficult to accumulate by children throughout the day. The importance of children having multiple opportunities to play outside have been shown in previous

studies, indicating that children with such outside play times tend to accumulate more PA than those who have only one or no outside time during the school day.⁴⁴ Also, our study shows that the majority of children's physical activity occurs in the morning. This was also demonstrated in a study by Hesketh et al.,⁵⁰ when comparing patterns of children's physical activity. More research is needed on this topic, but it is thought that children have more opportunity for physical activity before daily activities such as lunch, nap time, and pick up are started. Due to current childcare regulations in North Carolina, in order for teachers and centers to be able to achieve both educational and PA mandates, the schedule must be carefully arranged, which often leaves outside time to be achieved in the morning.^{40,50} This also implicates children that may not come to school until 9 AM, with those having less of an opportunity for outdoor play, thus decreasing chances at meeting PA requirements.⁵⁰

The environment has also been one factor studied in research and shown to correlate with physical activity levels in the childcare center.¹⁷⁻²⁰ The physical activity of this study's center was extremely supportive scoring a perfect score in the sedentary environment and portable play equipment subscales. This was also demonstrated in observation by seeing the children playing with tricycles, wagons, climbing on structures, as well as not having any televisions or media devices in the classrooms.

The center continued to excel in categories of active play and staff behaviors, but only had middle level scores in sedentary behaviors. These subscales focus on the emotional environment, where teacher and child behavior dictate scoring. In this center there were teacher led group activities and multiple occasions of observed "praise" for

PA, but despite this, children were still observed sitting still for extended periods of time. Results of these subscales were consistently higher at this center than reported in the research.^{12,17} Research also shows that centers with high EPAO scores typically have children that obtain more PA in general as well as more MVPA, further enhancing health benefits.¹²

Another section of the EPAO as well as important correlate of PA in childcare centers is the policies that are put into place and the training and education that teachers receive. This center scored high in PA training and education as well as PA policies. This was again demonstrated through the priorities of the director, written policies that were observed, and amount of education/training that teachers receive. Studies demonstrated that with adequate policies and teacher training children were likely to meet their physical activity recommendations, which was also demonstrated in this study.¹⁷⁻²⁰ In contrast, Foster et al.,⁵² found that even sites with strong policies, variety of equipment, and space, less than half of students achieved 60 minutes per day of PA. Collectively, these results suggest that environment plays a role in preschooler's PA, but may not be the only important factor.

A few intervention studies suggest that teachers' involvement in daily PA among preschoolers is also a critical factor for effective promotion of PA in childcare settings.^{11,37} The support and knowledge of teachers about the benefits of PA plays a large part in the amount of PA achieved by preschoolers while in the childcare center.^{11,37} Teachers in the current study had a good concept of the health benefits both cardiovascular as well as the neurological benefits of physical activity and felt a strong

importance of incorporating PA into their day. There are limited focus groups with teachers in the literature, but the small results have shown similar findings with a general understanding of the importance and wanting to incorporate it in their learning day.^{19, 20} Teachers were confused when asked about current physical activity recommendations. Current recommendations in the US have varying amounts ranging from 60-120, as well as varying intensity levels.^{14,15} Other countries have one set of recommendations, and even though still vague about the recommended intensity level, may be easier to understand for teachers.⁵¹ Further research is warranted to specify not only the recommended amount but also the recommended levels of PA, make these guidelines consistent and incorporate them into PA educational tools for childcare teachers. Teachers also felt that they had minimal barriers with supportive parents, space, and resources. Some of the main complaints were lack of access to a gym in the case of bad weather, and concern about adequately watching out for safety of the children if they were to participate in PA with other children. Literature has shown that on bad weather days without an adequate back up plan teachers feel PA is compromised.^{11, 34} In contrast, the literature has also shown that teachers face large barriers such as a competition for resources, negative influence from parents (i.e. rules about outdoor play, eating habits), that teachers feel they need support from policy/administration, proper equipment, and space.^{19,20} An explanation as to why teachers in the present study did not find similar barriers could be that current policies in place strongly state what is expected from parents and children each day in regards to PA, as well as the financial level of this preschool not providing a barrier or competition for resources. Also, another barrier

shown in the literature, which was also found in this study is concern for safety and ability to watch the whole class when teachers participate in PA with small groups. The child to teacher ratio was lower in this center with only around 15 students per two teachers compared to the North Carolina standards. This allowed teachers more opportunities to engage or participate with students. Even with this lower number of children, teachers still felt the ability to engage with children was diminished due to having to watch children and concern for their safety, and leads to future research needed on ways to diminish this barrier, especially focusing on centers that may have higher teacher:child ratios.⁴⁰

The director is another important influence on children's PA. The director is the one that is in charge of determining the policies/procedures and training that teachers receive. The director in this study reflected similar themes, as did teachers. One of the main differences was an understanding of the PA recommendations that the center enforced. The director had a deep understanding of current policies and practices that were in the child care center and it was demonstrated in the interview that she tried to instill these practices in her staff, teachers, and parents through education and training. The director felt similar barriers, as did teachers in not having access to a gym in order to get proper PA on bad weather days. As stated earlier, this is one of the main barriers reported in the literature.^{11, 34} The staff (both director, teachers/staff) at this observed childcare center had advanced education, with the majority having a minimum of an associates degree with some having masters degrees in childcare related fields. Due to this, staff at this center may have a background already understanding health benefits of

PA, knowledge about recommendations, and knowledge and strategies known to effectively increase PA. This is an advantage for PA levels of this center and may not be representative of the current norm in childcare.

The current study has several strengths as well as limitations that should be noted. This study both quantitative and qualitative methodologies that strengthened the findings of the study. The objective PA measurements via accelerometers were further supplemented with PI's direct environmental observation and field interviews with director/teachers.^{19,20} Very few studies exist on patterns of PA as well as an assessment of environment and teacher knowledge and perception and therefore, the findings of our study advance the current literature in this area. The ability to successfully recruit and retain participants for a period of 4 days of data collection represents another major strength of the study. Twenty-eight preschoolers were recruited from three different classrooms and only one of the twenty-eight children did not have enough data to be considered in analysis, resulting in twenty-seven subjects. A limitation of this study is the fact that only one childcare center director provided permission to participate in the study, thus the findings are not generalizable to other childcare centers. In addition, the center had a 5-star rating and thus may not compare to centers with less than 5-star rating in terms of policies and state childcare requirements. Also, this center was one of a higher income location, which means that centers in other locations may not have as many resources, as qualified staff, parent's who have higher education, or a director that is invested in PA as this one was. Another limitation is that instead of focus groups that were originally planned for teachers, field interviews had to be conducted due to teacher

time constrictions. Due to childcare center hours as well as a shortage of personnel, it was not feasible to get all of the teachers from the 3 classrooms together in order to complete a focus group. Finally, our findings reflect the patterns of PA and sedentary behaviors of 3-5 year old children as well as the environment and teacher PA perception, knowledge, and barriers within the respective center that participated in the current study. Because childcare centers have unique environments and policies, it is important to conduct future research to broaden the sample size, estimate children's PA and assess the cognitive, behavioral and environmental factors that influence young children's PA across different types of childcare facilities.

Conclusions and Implications

Our study suggests several target foci for PA interventions that are needed in the full day childcare setting. Because of the high PA observed in this center as well as the high score on the EPAO and positive remarks from teachers, it is important to direct future interventions in the direction of modifying childcare PA environment, improving teachers' knowledge of PA guidelines for children and encouraging PA among teachers themselves. Although our findings cannot be generalized to a broader population of childcare centers, our study highlights key variables that influence PA levels of preschoolers in the childcare environment.

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Tables and Figures

Table 1. Time Spent in Varying Intensity Levels by Children

Time Spent in Varying Intensity Levels by Children					
	N	Minimum	Maximum	Mean	Std. Deviation
Total wear days	27	3	4	3.81	.396
Total Sedentary Minutes	27	685.02	1818.08	1469.31	304.47
Total Light PA	27	43.90	310.32	153.65	67.95
Total Moderate PA	27	43.87	298.13	169.95	74.10
Total Vigorous PA	27	0	183.57	101.82	42.79
Total MVPA ^c	27	73.75	448.95	268.56	111.03
Total PA ^d	27	1235.30	10009.86	5096.39	2292.66

a. PA=Physical Activity

b. Average wear time was 8.19 hours per day

c. Values expressed in minutes per week

d. MVPA= Moderate, Vigorous, Physical Activity

e. Total Physical Activity=Light, Moderate, Vigorous, Physical Activity

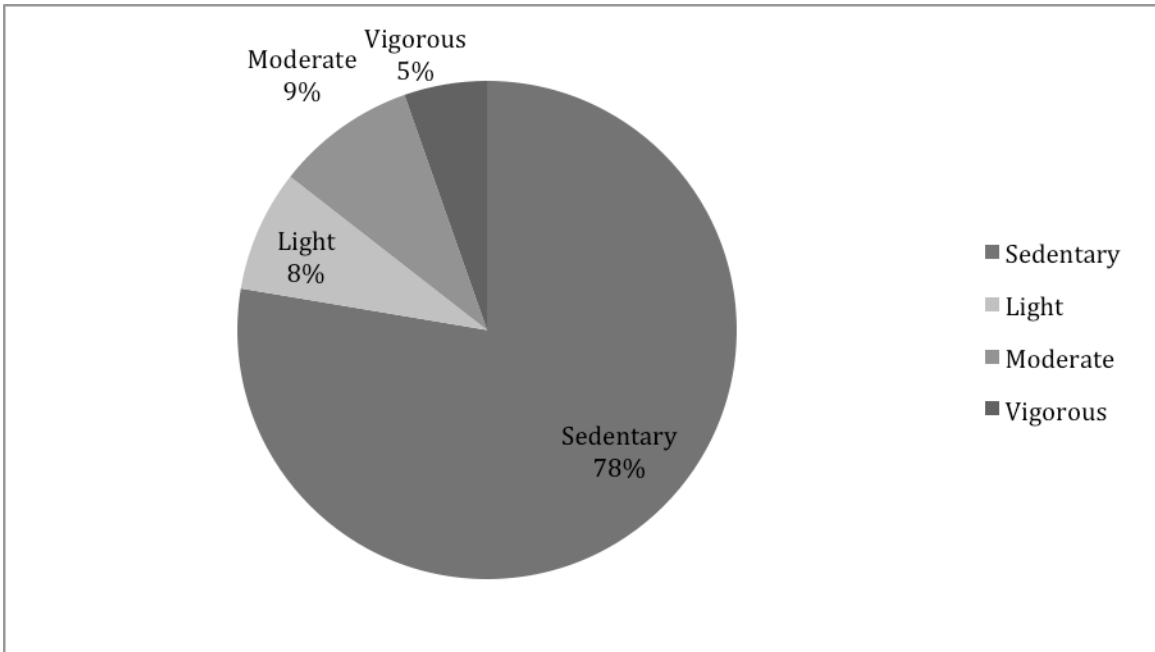
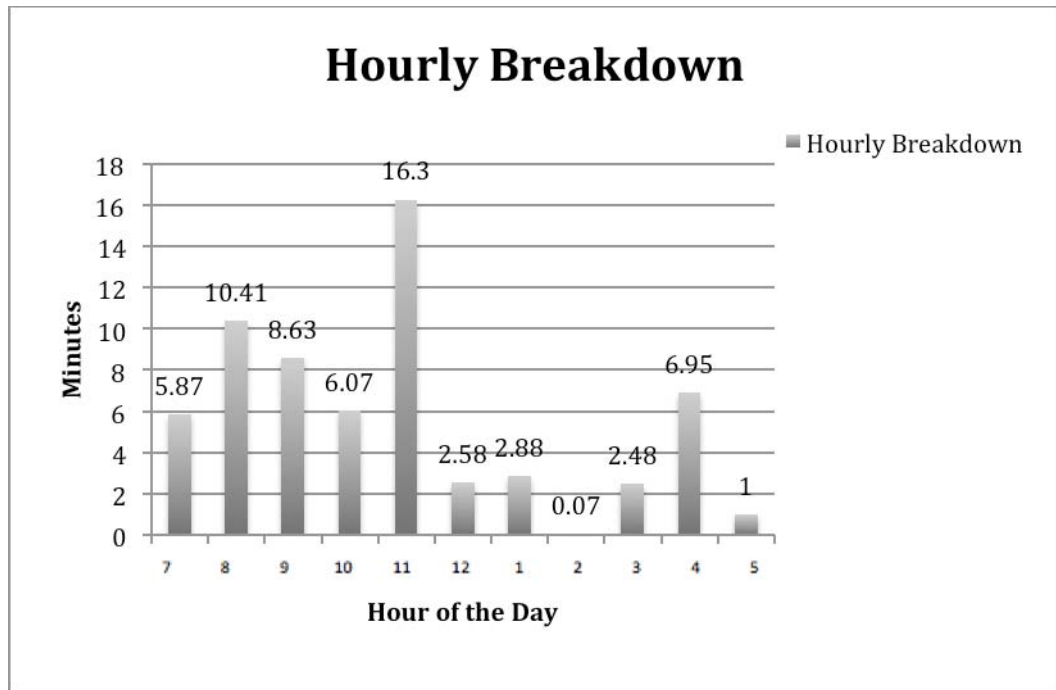
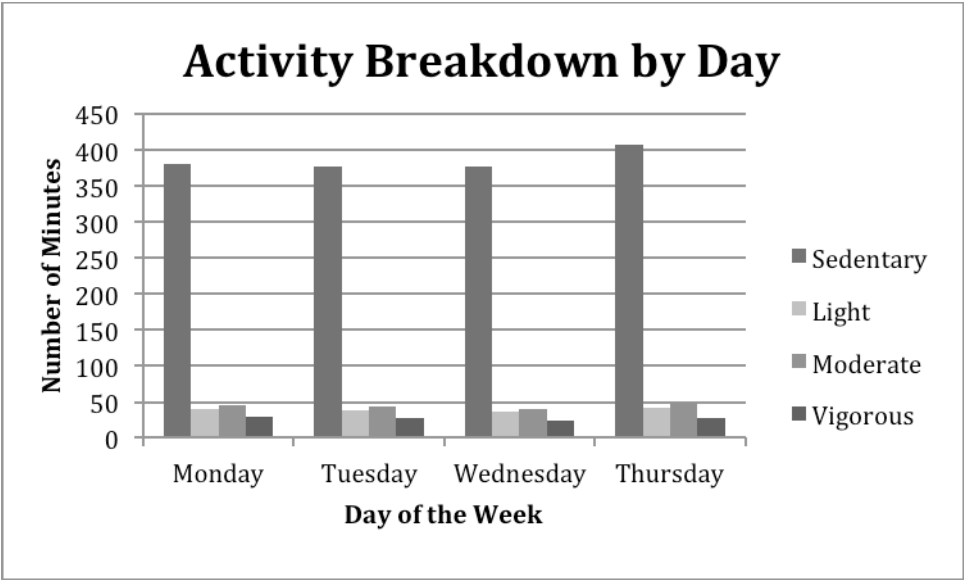


Figure 1. Proportion of Time Spent in Each Level of Activity Over 4 Days



a. MVPA= Moderate-to-vigorous physical activity

Figure 2. Average Breakdown of MVPA (in minutes) by Hour of the Day



^a Physical Activity results were not significant

Figure 3. Total Physical Activity by Intensity Level by Day of the Week

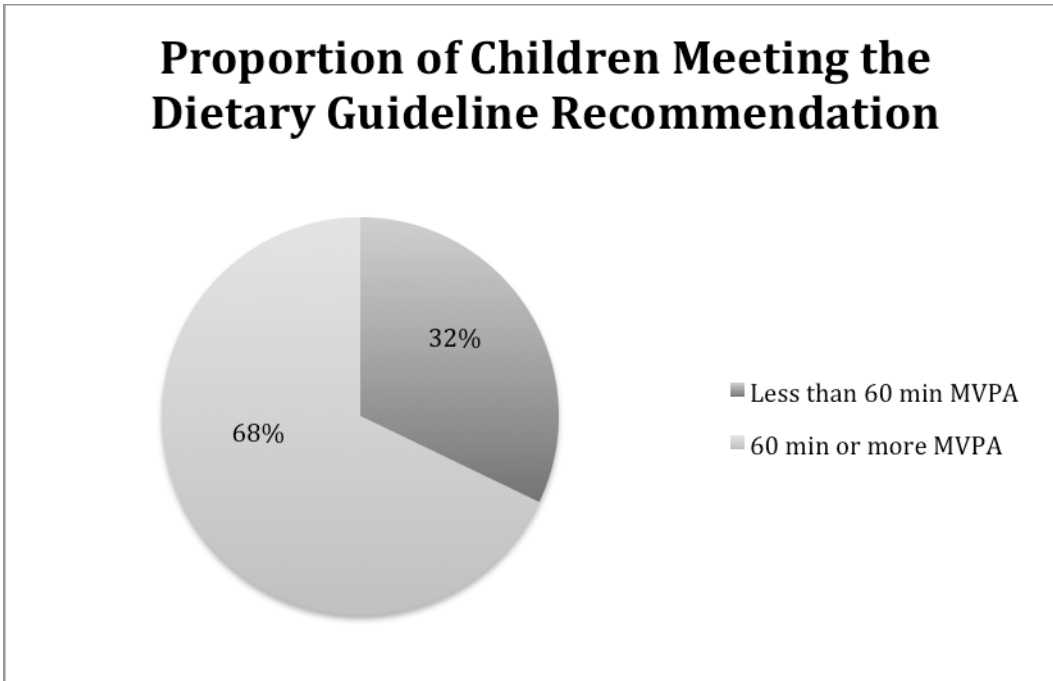
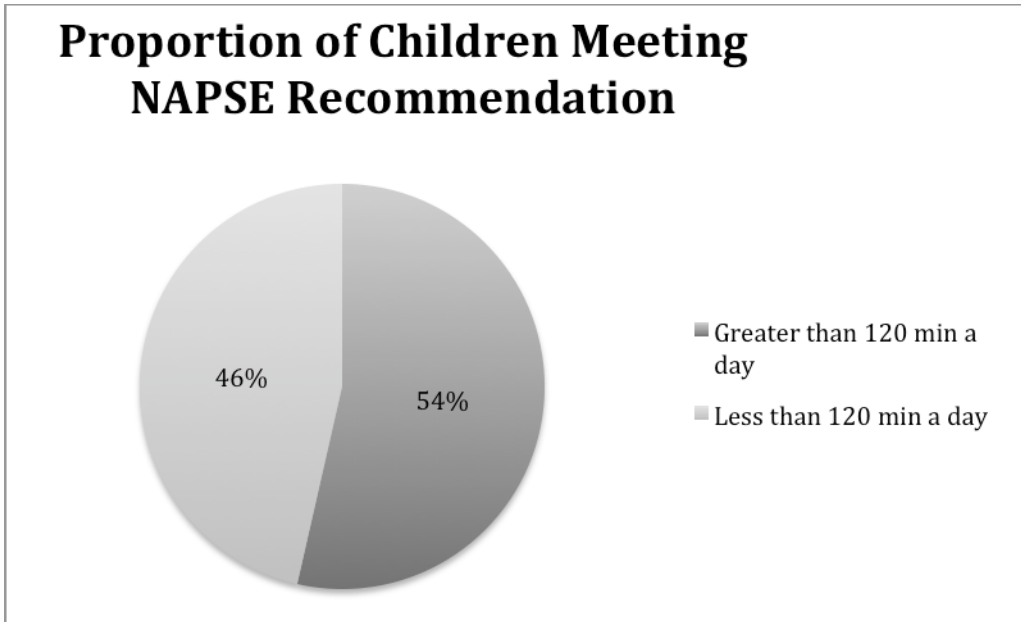


Figure 4. Proportion of Children Meeting the Dietary Guidelines Recommendation of 60-Minutes a Day of Physical Activity



^a. NASPE= National Association of Sport and Physical Education

Figure 5. Proportion of Children Meeting NAPSE Recommendation of 120-Minutes of Physical Activity Per Day

Table 2. Sedentary Bouts Observed

Child	# Sedentary Bouts	Length (Minutes)
1	2	122 minutes 67 minutes
2	2	121 minutes 67 minutes

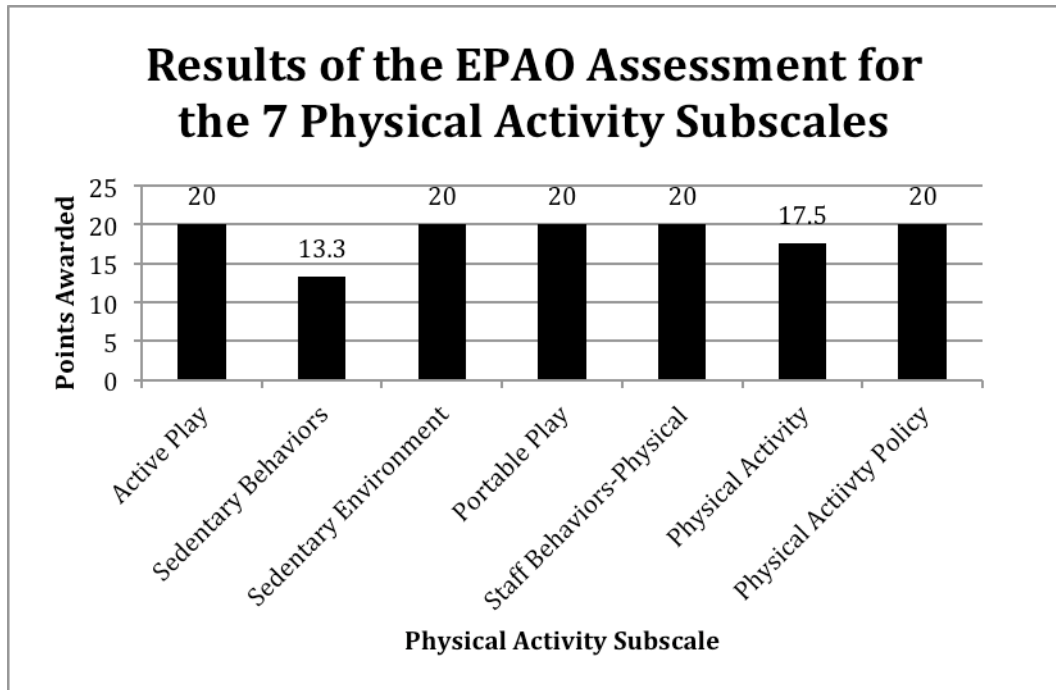


Figure 6. Results of the EPAO Assessment for the 7 Physical Activity Subscales

Table 3. Themes and Representative Quotes Related to Physical Activity that Emerged During Field Interviews

Identified Themes	Selected Responses
Importance of buy-in from parents, teachers/staff	<p>“We play a role in setting a good example for the kids.”</p> <p>“We practice using encouraging words in order to not deter them from trying something new.”</p> <p>“I think teachers promote activity among the children”</p> <p>“Our teachers are trained to incorporate PA in the learning day and in the classroom as well.”</p> <p>“They don’t come to us knowing what our goals are always, they feel sedentary learning is more important. So until they can get in and get training and mentored in the direction we go is the biggest hurdle.”</p>
Awareness of PA importance on learning, growth, and health	<p>“...It is the best way for them to learn”</p> <p>“...Students getting physical activity early in the day and throughout the day provides for less disruptions in the classroom and more focus.”</p> <p>“They are still developing social and life skills, which at this age is just as important to teach them as their alphabet, and physical activity really helps with this.”</p> <p>“It is essential throughout the day”</p> <p>“Critical to early learning and development”</p> <p>“They will stick with habits that they learn now”</p> <p>“It is important- my generation just went out and played and came in when the sun went down for dinner. You did not see childhood obesity as a problem in my generation”</p>

Table 3. Themes and Representative Quotes Related to Physical Activity that Emerged During Field Interviews (continued)

<p>The need for PA policy to be in place</p>	<p>“Policies and procedures kind of drive what our goals are so children receive a minimum of 120 minutes of physical activity a day” “Staff should be trained and equipped” “We have a physical activity curriculum. We use Be Active Kids to promote PA. We use Diane Kraft who has a great training module for teachers.</p>
<p>Major facilitators of PA</p>	<p>“I check lesson plans and make sure they are following the daily schedule” “Giving them the proper equipment as well as giving adequate time to be active” “Using encouraging words to keep them moving outside and always thinking of new activities to do” “I think that we play a role in setting a good example and using encouraging words”</p>
<p>Lack of Physical Activity in Personal Life</p>	<p>“I know I am not active enough”^a “I want to make a change but lack motivation for myself” “I try and be active with the kids walking the paths of the playground or playing games, but when I get home I am so exhausted I don’t do much.” “Now that I am older, I do not have as good of metabolism and am less active and have been getting bigger” “I do fear of getting diabetes now that I am not physically active and am overweight”</p>

Table 3. Themes and Representative Quotes Related to Physical Activity that Emerged During Field Interviews (continued)

<p>Knowledge of PA recommendations</p>	<p>“Here we get at least 120 minutes of outdoor play so I assume in a day they need more than that.” “They just need a lot every day...otherwise they are wild!” “I know its 60 minutes a day”^a “we strive to have a minimum of 120 minutes of PA, but I don’t think that should exclude them having a chunk of time in the evening at home as well. So I think a minimum of 2 and it would be ideal to have 3.”</p>
<p>Main barriers including lack of gym space and safety</p>	<p>”If I could add anything it would be a gym” “We could really use more access to the gym” “More tricycles would always be nice” “Storage and budget” “Sometimes you will have a child, specifically an asthmatic child or a child that’s not well, the parent wont want them outside during that period. So we always have to battle what’s in the best interest of the child. So if they have a doctors note we defer to the doctor’s otherwise the policy is they are going outdoors.” “Sometimes we walk around or play a game with a few, but have to watch the whole group” “Usually have to stand in a corner at outside time so that I can keep an eye on everyone. It is important that everyone stay safe. If we are doing group play it is easier to participate”</p>

^a Indicates that this was the most popular response and the majority of teachers said this

CHAPTER IV

EPILOGUE

Throughout my undergraduate career at North Carolina State University (NCSU) I focused largely on sports dietetics and athletics. I was getting a feeling this was not the pathway that I wanted to follow, and my senior year I discovered pediatrics and became very intrigued in the toddler-preschool age. Upon my acceptance to UNCG for graduate school, I began looking for a mentor to perform research with and that had interests aligned with mine. I discovered Dr. Lenka Shriver and after reading many of her publications discovered that I could combine my love for sports dietetics/PA and pediatrics. Dr. Shriver was already working on a larger study focusing on feeding practices related to fruit and vegetable consumption, and I thought that the addition of studying PA in a preschool population would really give a full circle picture. After a preliminary literature review, it became apparent that there is a gap in the current literature when examining patterns of PA in preschoolers as well as looking at the environment of the center where they are enrolled, as well as teacher perception of PA in that center. The majority of intervention studies I saw would focus on teacher education and modifying the curriculum to increase PA, but I felt they never really looked at the reasons PA was low in the first place. I proposed to conduct a study with a 5-star

childcare center in which I would collect quantitative data by accelerometer and environmental assessment qualitative data teacher/director interviews.

Overall, the current study did find that PA levels are being reached for a majority of the children in a school that has a positive environment and one with teachers/a director that feels PA is important to have in the school day. As evident in the literature, PA was achieved in highest rates during outside times, which was also true of the results discovered in this study.⁷⁵ Previous intervention studies have also discovered that when environmental aspects of the childcare center were improved, so did rates of PA.^{9,11,13,21} This was shown in the current study by having a high environmental score as well as the majority of children reaching their recommendation. Previous literature suggests that many teachers feel PA is important, but have barriers such as equipment, time, weather, or parental interference.¹⁴ Lastly, teachers in this study did not feel hindered by any barriers; therefore this could have helped with more children achieving adequate PA levels. This is all of practical importance for developing future interventions with preschool children's PA. It is necessary to examine environment, teacher motivation, and policies in place in order to get an idea of what is affecting PA rates. Obese preschoolers are 5 times more likely to become obese adults and live with life long healthcare complications. Until effective interventions can be put into place at this age level, children will continue to suffer from this epidemic.

My involvement with community nutrition research has really opened my eyes to a whole new world. Community research is very unique, complex, and takes many players in order to accomplish one goal. I have learned valuable skills and feel fortunate

to have made connections in a community that one day I hope to work in. I have learned that in community nutrition work, one has to be flexible, creative, and quick to make important decisions. Often times, I made plans that I knew would go flawlessly, only to have to rework the entire project once again because one step did not work. This experience has helped me grow as a scholar, researcher, and individual. I feel that community nutrition not only teaches one how to develop research skills, but also teaches important life lessons and character. I am thankful for the experiences this project has given me as well as the connections I have made through this process. I feel my thesis research has really enriched my experience in the masters program and has prepared me well for becoming a registered dietitian practicing in the community setting.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL



OFFICE OF RESEARCH INTEGRITY
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To: Morgan Jones
Nutrition
Nutrition

From: UNCG IRB

A handwritten signature in cursive script, appearing to read "Anne Wedem".

Authorized signature on behalf of IRB

Approval Date: 11/23/2015
Expiration Date of Approval: 11/22/2016

RE: Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)
Submission Type: Initial
Expedited Category: 4.Noninvasive clinical data,6.Voice/image research recordings,7.Surveys/interviews/focus groups,5.Existing or non-research data
Study #: 15-0498
Study Title: Preschoolers' Patterns of Physical Activity in a Childcare Center Environment: A Pilot Study

This submission has been approved by the IRB for the period indicated. It has been determined that the risk involved in this research is no more than minimal.

Study Description:

The purpose of this study is to determine the daily physical activity patterns of 3-5 year old children attending childcare centers (a minimum of 2 centers will be asked to participate), assess the physical activity and policy environment of the centers, and examine personal factors related to teachers and staff that may influence children's physical activity in the childcare center setting. Parents of 3-5 year old children in a convenient sample of 2-6 childcare centers in Guilford county will be asked to provide parental permission for their children to participate in the study. Accelerometers will be used to determine the amount of physical activity that children obtain on 4 selected days while attending their respective childcare center. The accelerometers will be fastened on children's hip on each morning of data collection (approximately 7-9 am) and removed before the child leaves the facility (approximately 4-6 pm). While the participating children are wearing the accelerometers on the selected days, the PI will take field notes and will assess the physical activity environment of the childcare facility using the Environmental and Policy Assessment Observation tool (EPAO). The EPAO examines personal, environmental, and policy factors that may influence physical activity in childcare settings. Additionally, 1-2 focus groups with childcare teachers/ staff will be conducted by the PI to examine personal factors related to teachers and staff that may influence the children's physical activity in the childcare center setting such as perceived role, barriers, resources available, and knowledge. Finally, the childcare directors (n=2) will be asked to complete a 1-hour long interview with the PI to obtain their perspective on physical activity in the childcare center by exploring their personal factors such as knowledge, perceived barriers and concerns such as policy or ratings related to children's physical activity in their centers. The question route will be nearly identical for both teachers (focus groups) and childcare directors (interviews).

Regulatory and other findings:

- This research, which involves children, meets criteria at 45 CFR 46.404 (research involving no greater than minimal risk). Permission of one parent or guardian is sufficient.
- If your study is contingent upon approval from another site (additional recruitment sites), you will need to submit a modification at the time you receive that approval.

Investigator's Responsibilities

page 1 of 2

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator's responsibility to submit for renewal and obtain approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.

Signed letters, along with stamped copies of consent forms and other recruitment materials will be scanned to you in a separate email. **Stamped consent forms must be used unless the IRB has given you approval to waive this requirement.** Please notify the ORI office immediately if you have an issue with the stamped consents forms.

You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented (use the modification application available at <http://integrity.uncg.edu/institutional-review-board/>). Should any adverse event or unanticipated problem involving risks to subjects or others occur it must be reported immediately to the IRB using the "Unanticipated Problem-Adverse Event Form" at the same website.

Please be aware that valid human subjects training and signed statements of confidentiality for all members of research team need to be kept on file with the lead investigator. Please note that you will also need to remain in compliance with the university "Access To and Retention of Research Data" Policy which can be found http://policy.uncg.edu/research_data/.

CC:
Lenka Shriver, Nutrition

APPENDIX B
PARENTAL CONSENT FORM

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

CONSENT FOR A MINOR TO ACT AS A HUMAN PARTICIPANT: LONG FORM

Project Title: Preschoolers' Patterns of Physical Activity in a Childcare Center Environment: A Pilot Study

Principal Investigator and Faculty Advisor (if Faculty Advisor is applicable): Principal Investigator: Morgan Jones; Faculty Advisor: Lenka Shriver, PhD

Participant's Name: _____

What are some general things you should know about research studies?

Your child is being asked to take part in a research study. Your child's participation in the study is voluntary. You may choose for your child not to join, or you may withdraw your consent for him/her to be in the study, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. There may not be any direct benefit to your child for being in the research study. There also may be risks to being in research studies. If you choose for your child not to be in the study or you choose for your child to leave the study before it is done, it will not affect your relationship or your child's relationship with the researcher or the University of North Carolina at Greensboro.

Details about this study are discussed in this consent form. It is important that you understand this information so that you can make an informed choice about your child being in this research study.

You will be given a copy of this consent form. If you have any questions about this study at any time, you should ask the researchers named in this consent form. Their contact information is below.

What is the study about?

Your child's participation in this project is voluntary. We would like to invite your child to be a part of a research project that will help assess how and when children are physically active while they are in the childcare center.

Why are you asking my child?

You and your child is being asked to participate because your child is 3-5 years old and attends one of the eligible classrooms from one of the childcare centers where directors approved the center's participation in the study.

What will you ask my child to do if I agree to let him or her be in the study?

Your child will be asked to wear an accelerometer, which is a small device that will determine the percentage of time your child spends at different intensities of physical activity during the day, while at childcare, on 4 separate days. Your child will wear this device for approximately 6-8 hours/per observed day while in his/her regular childcare center (it will be put on upon arrival to childcare and taken off right before the child leaves childcare that day). The small device will be secured on a black flexible belt with a small buckle and fastened around your child's waist (under or over clothes based on the child's preference). Height and weight of your child will also

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Valid from:
11/23/15 to 11/22/16

be measured by the principal investigator in order to set the device up specifically for your child (current height and weight is needed to do so). The weight and height will be measured in a private location in the childcare center (or a corner of the classroom) to maximize privacy and confidentiality. A portable medical scale and a stadiometer (very similar to equipment used in pediatrician offices) will be used to measure your child's height and weight. A stadiometer is a piece of medical equipment used for measuring human height. It is usually constructed out of a ruler and a sliding horizontal headpiece, which is adjusted to rest on top of the head. Furthermore, your child as well as their overall school and classroom environment will be observed by the principal investigator to note trends or habits that may be affecting physical activity during the day on 4 separate days.

What are the dangers to my child?

If your child finds that the accelerometer is uncomfortable, the elastic band may be adjusted in order to make it larger or smaller for optimal comfort. Also, the child may wear this over their clothing so that the accelerometer is not touching or rubbing the skin. If the child expresses desire to no longer wear the accelerometer, they will be allowed to remove it.

The Institutional Review Board at the University of North Carolina at Greensboro has determined that participation in this study poses minimal risk to participants.

If you have questions, want more information or have suggestions, please contact Morgan Jones who may be reached at 919-810-9333 or mjones2@uncg.edu or Lenka Shriver 405-762-9746

If you have any concerns about your rights, how you are being treated, concerns or complaints about this project or benefits or risks associated with being in this study please contact the Office of Research Integrity at UNCG toll-free at (855)-251-2351.

Are there any benefits to society as a result of my child taking part in this research?

This study may benefit society by providing a further understanding of the environmental factors that may affect physical activity levels and give better direction for nutrition educators when designing future intervention studies. Also, physical activity data will give further understanding to how much physical activity is achieved while at school in preschool aged children and help nutrition educators determine a pattern of physical activity.

Are there any benefits to *my child* as a result of participation in this research study?

There are no direct benefits to participants in this study.

Will my child get paid for being in the study? Will it cost me anything for my kid to be in this study?

There are no costs to you or payments to you or your child as a result of participation in this study.

How will my child's information be kept confidential?

All collected observational environmental data and personal identifiers will be stored in a locked file cabinet in the PI's faculty advisor's office or laboratory (311 Stone Bld. or 307 Stone Bld.). All accelerometer physical activity data will be immediately de-identified and stored on a

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computer under password protection. The master list of names with participant numbers will be stored separately on a password protected laptop in the UNCG box so that files can be shared with mentor. Participants will not be mentioned by name with data are disseminated. "All information obtained in this study is strictly confidential unless disclosure is required by law."

What if my child wants to leave the study or I want him/her to leave the study?

You have the right to refuse to allow your child to participate or to withdraw him or her at any time, without penalty. If your child does withdraw, it will not affect you or your child in any way. If you or your child chooses to withdraw, you may request that any data, which has been collected be destroyed unless it is in a de-identifiable state. The investigators also have the right to stop your child's participation at any time. This could be because your child has had an unexpected reaction, has failed to follow instructions, or because the entire study has been stopped. Choosing not to participate or withdrawing from the study will in no way affect your relationship with or your child's relationship with your child's teacher of the preschool from which your child was recruited from.

What about new information/changes in the study?

If significant new information relating to the study becomes available which may relate to your willingness allow your child to continue to participate, this information will be provided to you.

Voluntary Consent by Participant:

By signing this consent form, you are agreeing that you have read it or it has been read to you, you fully understand the contents of this document and consent to your child taking part in this study. All of your questions concerning this study have been answered. By signing this form, you are agreeing that you are the legal parent or guardian of the child who wishes to participate in this study described to you by _____

Participant's Parent/Legal Guardian's Signature

Date: _____

APPENDIX C

TEACHER/DIRECTOR CONSENT FORM

UNIVERSITY OF NORTH CAROLINA AT GREENSBORO

CONSENT TO ACT AS A HUMAN PARTICIPANT

Project Title: Preschoolers' Patterns of Physical Activity in a Childcare Center Environment: a Pilot Study

Principal Investigator and Faculty Advisor (if applicable): Principal Investigator: Morgan Jones; Faculty Advisor: Lenka H. Shriver (PhD) from the Department of Nutrition

Participant's Name: _____

What are some general things you should know about research studies?

You are being asked to take part in a research study. Your participation in the study is voluntary. You may choose not to join, or you may withdraw your consent to be in the study, for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. There may not be any direct benefit to you for being in the research study. There also may be risks to being in research studies. If you choose not to be in the study or leave the study before it is done, it will not affect your relationship with the researcher or the University of North Carolina at Greensboro. Details about this study are discussed in this consent form. It is important that you understand this information so that you can make an informed choice about being in this research study.

You will be given a copy of this consent form. If you have any questions about this study at any time, you should ask the researchers named in this consent form. Their contact information is below.

What is the study about?

Your participation is voluntary. We would like to invite you to be a part of a research project that will tell us more information about perceived barriers, knowledge, and attitudes to children physical activity while in the childcare center.

Why are you asking me?

You are being asked to participate because you are a teacher/teacher assistant of 3-5 year old children in a childcare center at one of the selected centers whose directors provided permission for this study to be carried in. You are eligible to participate in this study if you are the main teacher or teaching assistant in a 3-5 year old classroom, or if you are a director at one of the selected childcare centers.

What will you ask me to do if I agree to be in the study?

If you are a teacher or teaching assistant, you will be asked to participate in a 1-1.5 hour long discussion (focus group) with fellow teachers at your childcare center. If you are a childcare center director, you will be asked to participate in a 1-1.5 hour one-on-one interview with the primary investigator. Regardless of being a teacher/assistant or director, you will be asked questions pertaining to your feelings, attitudes and barriers related to children's physical activity while in childcare. You will also be asked questions pertaining to how you feel you as a teacher/director play a role in the child's physical activity and knowledge that you have in regards to their physical activity. The focus group setting will foster healthy discussion about the topics and everyone's opinions and thoughts will be heard. If you are a teacher/teaching assistant, you will also be asked to allow the principal investigator into your classroom to observe your daily schedule and activities as well as collect physical activity data using accelerometers on the children who have parental consent for the study participation. Observational data also collected will

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Valid from:
11/23/15 to 11/22/16

be lesson plans, parent and staff handbooks, physical activity training documents and curriculum, and written physical activity policy documents. Accelerometers are small devices that collect physical activity per second during the day. They are placed on a flexible belt and worn around the waist by children for 6-8 hours/day on 4 separate days. They will be placed around the children's waist upon their arrival to daycare and removed right before their departure that day. Prior to placing the device on the child on the first day of data collection, the child's height and weight will be measure by the primary investigator so the units can be individualized for each child. A portable scale and a stadiometer will be used to measure height and weight in a private part of the classroom (e.g., office) or another location of the childcare center (i.e., based on the director's accommodation). A stadiometer is a piece of medical equipment used for measuring human height. It is usually constructed out of a ruler and a sliding horizontal headpiece, which is adjusted to rest on top of the head. The accelerometers cause minimal or no distractions for normal activities of the children during the day.

Is there any audio/video recording?

The focus groups/interviews will be audio-recorded for quality control as well as in order to transcribe data. Because your voice will be potentially identifiable by those who may hear the tape, your confidentiality for things you say on the tape cannot be guaranteed although the researcher will ensure confidentiality and safe storage of the tapes tape as described below.

What are the risks to me?

If any of the questions from focus groups or interviews make you uncomfortable, you may choose to not respond.

"The Institutional Review Board at the University of North Carolina at Greensboro has determined that participation in this study poses minimal risk to participants."

If you have questions, want more information or have suggestions, please contact Morgan Jones who may be reached at 919-810-9333 or mejones2@uncg.edu or Lenka Shriver 405-762-9746

If you have any concerns about your rights, how you are being treated, concerns or complaints about this project or benefits or risks associated with being in this study please contact the Office of Research Integrity at UNCG toll-free at (855)-251-2351.

Are there any benefits to society as a result of me taking part in this research?

Your responses are important because they will help nutrition educators as well as policy makers better understand what barriers teachers are facing in the classroom and help them discover ways to overcome them. Also, your perceived role in physical activity will allow nutrition educators insight into how best design interventions in order to fit teacher needs and scheduling demands. Physical activity data will be used in order to determine barriers that you as teachers face as well as discover a pattern of physical activity among preschool children while at school.

Are there any benefits to me for taking part in this research study?

There are no direct benefits to participants in this study.

Will I get paid for being in the study? Will it cost me anything?

There are no costs to you or payments made for participating in this study.

How will you keep my information confidential?

All identifiable information such as name will be kept in a locked file cabinet inside of a locked office on UNCG campus. Information will be immediately deidentified and a participant number will be assigned to you. Audio recordings will be downloaded immediately following the focus group and kept on a

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Valid from:

11/23/15 to 11/22/16

password protected computer. Once information is transcribed to an electronic form, all data will be kept on a password-protected computer. The master list of names connecting you to participant number will be kept on a password protected UNCG laptop in the UNCG box so that files can be shared with mentor. You will not be mentioned by name with data are disseminated. All information obtained in this study is strictly confidential unless disclosure is required by law.

What if I want to leave the study?

"You have the right to refuse to participate or to withdraw at any time, without penalty. If you do withdraw, it will not affect you in any way. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is in a de-identifiable state. The investigators also have the right to stop your participation at any time. This could be because you have had an unexpected reaction, or have failed to follow instructions, or because the entire study has been stopped."

What about new information/changes in the study?

"If significant new information relating to the study becomes available which may relate to your willingness to continue to participate, this information will be provided to you."

Voluntary Consent by Participant:

By signing this consent form you are agreeing that you read, or it has been read to you, and you fully understand the contents of this document and are openly willing consent to take part in this study. All of your questions concerning this study have been answered. By signing this form, you are agreeing that you are 18 years of age or older and are agreeing to participate, or have the individual specified above as a participant participate, in this study described to you by _____

Signature: _____ Date: _____

APPENDIX D

RECRUITMENT FLYER

We invite your child participate in a research study about children's physical activity patterns while in childcare.

Your child can participate if they are 3-5 years old and attend one of the participating childcare centers.



Please call Morgan Jones (UNCG) at (919) 810-9333

Your child will be asked to wear an accelerometer, which is a small device that will determine the percentage of time your child spends at different intensities of physical activity during the day, while at childcare, on 4 separate days. The small device will be secured on a black flexible belt with a small buckle and fastened around your child's waist (under or over clothes based on the child's preference). Height and weight of your child will also be measured in order to set the device up specifically for your child.

Thank you for your consideration!

Morgan Jones & Lenka Shriver, PhD

Department of Nutrition, UNCG

Phone: (919) 810-9333

Email: mejones2@uncg.edu

Approved IRB
11/23/15

APPENDIX E
INTERVIEW GUIDE

Focus Group/Interview Script

(focus groups with teachers/teaching assistants; interviews with childcare center directors)

Questions relating to teacher role in child's physical activity- personal/cognitive construct

1. What types of physical activity is most popular among children in your classroom/childcare center? [ice breaker question]
2. What are your feelings on physical activity needing to be accomplished in school vs at home?
3. What role do you feel you have as a teacher/childcare director, if any, for children in your classroom in terms of getting enough physical activity during the day?
4. What are some things that you do in order to ensure that the children are getting physical activity while at school?
5. How important do you feel physical activity is for these young children?
6. How important do you feel that adequate physical activity plays into preventing chronic disease at this age?
7. How much activity do you think children at this age (3-5 years) should get on a daily or weekly basis?
 - a. How much activity do you think is feasible for children to get while they are in the classroom?
8. How can you tell if children are physically active at a moderate or vigorous intensity?
9. How do you feel about your own physical activity level? Would you like to change anything about how physically active you are personally?
 - a. Follow up questions: Why or why not?
 - b. In what ways do you see physical activity promoting your health or wellbeing?

Questions relating to teacher/director behavior in order to enhance child physical activity- behavior construct

1. What are some examples of physical activity that you do with children in your class/center?
2. What do you find is the most important way to get your children physically active?
3. What do you do on days when you can't take the children in your classroom/center outside?

4. What do you (or your teachers) typically do while children are physically active or are doing active play?
5. What typically prevents you/your teachers from getting children moving around and active?

Questions relating to barriers teachers/childcare center director feel that they are facing to ensuring adequate physical activity- environmental

1. What are some of the things that you feel hinder you from providing the children with physical activity opportunities in your classroom/center?
2. What are some of the things that the school (or you as the director) could provide that would make this (physical activity) easier?
3. Are there specific barriers that currently exist at your schools that make it difficult for children to get enough physical activity?
4. What type of support (or lack of support) do you feel you get from parents in terms of physical activity and/or health? What kinds of support would you like to see parents provide for you in terms of physical activity for children in your classroom/center?
5. What are some reasons children and/or parents give you for not wanting to do physical activity, if any?
6. If you could change anything in your childcare center/classroom to increase physical activity, what would you like to change and how would that help?

APPENDIX F

EPAO PHYSICAL ACTIVITY SECTION

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EPAO Observation

30. Did staff sit with children during lunch?

yes → 30a. Did staff consume the same food as children? → yes no
 no

31. Did staff eat and/or drink less healthy foods in front of children?

yes → 31a. How many meals? 1 2 3 4 5 other →
 no
 did not observe staff eating

32. Did staff talk with children about healthy foods?

yes → 32a. How many separate times did you observe staff talking to children about healthy foods? 1 2 3 4 5 other →
 no

33. Was any **formal** nutrition education for children observed?

yes no

Physical Activity - Child Behaviors

34. How many minutes of total active play time was observed (includes indoor, outdoor, structured and unstructured)?

minutes

35. Was structured physical activity observed?

no
 yes ↓

35a. How many occasions? 1 2 3 4 5 other ↓

35b. Total minutes of structured PA observed:
minutes

35c. Was the structured PA optional for children? yes no

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EPAO Observation

36. Did you observe any outdoor active play?

yes → 36a. How many times/day? 1 2 3 4 5 other →

no → 36b. Was it due to weather (too hot, too cold, rain/snow)?

yes no unsure

37. How many total minutes of outdoor active play (structured and unstructured) was observed?

minutes

38. Was drinking water for children available outdoors?

yes no no outdoor time observed → 38a. Did you see a drinking fountain yes no located in the outdoor play area?

39. While outdoors, did you witness teachers prompting children to drink water?

yes no no outdoor time observed

Sedentary Activities - Child

40. Did you observe children seated for more than 30 minutes at a time (excluding nap and meal times)?

yes → 40a. How many times/day? 1 2 3 4 5 other →

no

40b. How many total minutes of seated activity (majority of the class seated) was observed?

minutes

EPAO Observation

41. Was a TV present in the room? yes no

42. Was TV viewing observed?

yes → 42a. Total minutes TV was on: minutes

no

42b. Was it on during meals? yes → 42b_1. If yes, how many meals? no 1 2 3 or more

42c. Was the TV used only for viewing educational programs? yes no

43. Was a VCR/DVD present in the room? yes no

44. Was there a video game system present in the room? yes no

45. Was a computer present in the room for use by children? yes no

46. Was video game or computer game playing observed?

yes → 46a. Total number of minutes computer/video game playing was observed: minutes

no

46b. Was it being used for educational purposes only? yes no

46c. How many total children participated in computer/video game playing during the entire day? # of children

EPAO OBSERVATION

PHYSICAL ACTIVITY - STAFF BEHAVIORS

47. Did you observe restricting active play as punishment?

yes → 47a. How many times/day? 1 2 3 4 5 other →

no

48. Did staff join in active play?

yes → 48a. How many times/day? 1 2 3 4 5 other →

no

49. How many positive statements were made about physical activity (e.g., Good throw!, Running is fun!, I like the way you threw that ball!)?

1 2 3 4 5 other →

50. Did staff provide prompts to **increase** physical activity (e.g., Can you jump higher?, Can you hop on one foot?)?

yes → 50a. How many times/day? 1 2 3 4 5 other →

no

51. Did staff provide prompts to **decrease** physical activity (e.g., Slow down!, Give it a rest! Don't climb on the slide!)?

yes → 51a. How many times/day? 1 2 3 4 5 other →

no

52. Were any **formal** physical education lessons for children observed? yes no

53. Were any extra-curricular (special) physical activity programs provided to children on a fee basis (e.g., Tumbling Tots, Tumble Bus)?

yes → 53a. Were any active alternatives provided for those children that did not participate? → yes no

no

EPAO OBSERVATION

Center ENVIRONMENT

54. Where were soda and other vending machines located?

- in entrance or front
 in public areas, but not the entrance →
 out of sight of parents and kids
 no vending machines on site
- 54a. Did they contain only healthy options (e.g., water, milk, 100% fruit juice, granola bars, pretzels, nuts)? →
- yes
 no

Please indicate where these pieces of physical activity equipment (both fixed and portable) were located:

55. Fixed Play Equipment	indoors only	outdoors only	both indoors & outdoors	not present
a. balancing surfaces (balance beams, boards, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. basketball hoop	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. climbing structures (jungle gyms, ladders, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. merry-go-round	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. pool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. sandbox	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. see-saw	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. slides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. swinging equipment (swings, rope, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. tricycle track	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. tunnels	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

EPAO OBSERVATION

56. Portable Play Equipment

	indoors only	outdoors only	both indoors & outdoors	not present
a. ball play equipment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. climbing structures (ladders, jungle gyms, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. floor play equipment (tumbling mats, carpet squares, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. jumping play equipment (jump ropes, hula hoops)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. parachute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. push/pull toys (wagon, scooters, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. riding toys (tricycles, cars, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. rocking & twisting toys (rocking horse, sit-n-spin, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. sand/water play toys (buckets, scoops, shovels, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
j. slides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
k. twirling play equipment (ribbons, scarves, batons, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

57. Was outdoor running space . . .

- unobstructed with plenty of space for group games (tag, red rover, etc.)
 some obstruction, but space was adequate for individual play (running, skipping, etc.)
 plenty of space for play, but obstructed with play equipment
 little running space or completely obstructed

58. Did staff limit or restrict outdoor play area in a way that substantially affect active play (more than 1/3 of total play space or equipment)?

- yes → 57a. How many outdoor play occasions? 1 2 3 4 5 other →
- no

EPAO Observation

59. Was indoor play space suitable for . . .

- quiet play (classroom is small and not a lot of room for movement)
- limited movement/some active play (able to translocate by walking, skipping, hopping, jumping, etc.)
- all activities (easily able to perform all gross motor activities)

60. Were any posters, pictures or displayed books about **physical activity** present in the observation room?

- yes → 60a. How many were present? 1 2 3 4 5 other
- no

61. Were any posters, pictures or displayed books about **nutrition** present in the observation room?

- yes → 61a. How many were present? 1 2 3 4 5 other
- no

Play Environment

20. Did you review any documentation of safety checks?

- yes → a. If yes, frequency of checks:
- no
- only when installed
- once a week
- once a year
- other →
- once a month

Center Physical Activity Policy

21. Does the center have written policy on physical activity?

- yes → a. If yes, what areas of NAP SACC are covered? *[Mark all that apply.]*
- no
- no documents received from center
- Active play and inactive time
- Supporting PA
- TV use and TV viewing
- PA education
- Play environment

Section 4: Training & Curriculum Review

Nutrition Education For Children, Parents and Staff

22. Does the center provide nutrition training for staff?

- yes → a. If yes, how often?
- no
- no documents received from center
- 2 times/year or more
- 1 time/year
- less than 1 time/year
- b. If yes, what was the content of the trainings?

23. Does the center have a documented nutrition curriculum for kids?

yes → a. If yes, what was the content of the curriculum?

no

24. Does the center have documentation of parent nutrition education/workshop materials?

yes → a. If yes, what was the content of the education workshops?

no

Physical Activity Education For Children, Parents and Staff

25. Does the center provide physical activity training for staff?

yes → a. If yes, how often?

no

2 times/year or more 1 time/year less than 1 time/year

no documents
received from
center

b. If yes, what was the content of the trainings?

26. Does the center have a documented physical activity curriculum for kids?

yes → a. If yes, what was the content of the curriculum?

no

27. Does the center have documentation of physical activity education/workshop materials?

yes → a. If yes, what was the content of the workshops?

no

Please use the following citation when referencing this instrument:

Ball SC, Benjamin SE, Hales DP, Marks J, McWilliams CP, Ward DS. 2005. The Environment and Policy Assessment and Observation (EPAO) child care nutrition and physical activity instrument. Center for Health Promotion and Disease Prevention, University of North Carolina at Chapel Hill.

Please use the following citation when referencing instrument protocol and interobserver agreement:

Ward DS, Hales D, Haverly K, Marks J, Benjamin SE, Ball SC, Trost S. An instrument to assess the obesogenic environment of child care centers. *Am J Health Behavior*. 2008 Jul-Aug;32(4):380-6.